

**Fermi 1 NRC Docket No. 50-16  
NRC License No. DPR-9**

**Attachment 1 to  
NRC-12-0012**

**“Updated Fermi 1 Groundwater Monitoring Data”**

**Updated Table of Analytical Results**

**Update of Table in Attachment 1 of Reference 2**

UPDATED RADIONUCLIDE ANALYTICAL RESULTS  
SITE CONCEPTUAL MODEL  
DETROIT EDISON - FERMI ENERGY CENTER  
NEWPORT, MICHIGAN

Well ID		Background #1 (Located near NTC) (GW-3)	Background #1 (Located near NTC) (GW-3)	Background #1 (Located near NTC) (GW-3)	Background #1 (Located near NTC) (GW-3)	Background #1 (Located near NTC) (GW-3)	Background #1 (Located near NTC) (GW-3)	Background #1 (Located near NTC) (GW-3)	Background #1 (Located near NTC) (GW-3)	Background #1 (Located near NTC) (GW-3)	Background #1 (Located near NTC) (GW-3)	Background #1 (Located near NTC) (GW-3)	Background #1 (Located near NTC) (GW-3)	Background #1 (Located near NTC) (GW-3)	Background #1 (Located near NTC) (GW-3)
Date Sampled		July-2004	October-2004	February-2005	September-2005	February-2006	June-2006	December-2006	June-2007	December-2007	March-2008	March-2009	May-2010	November-2010	October-2011
Date Analyzed															
Parameter	Units														
H-3	µCi/cc	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.82E-07* <1.12E-06	<3.80E-07	<4.30E-07	<4.30E-07	<4.40E-07	<4.20E-07	<1.11E-06	<1.17E-06	<1.10E-06
Na-22	µCi/cc	<8.3260E-09	<1.1768E-08	<1.1929E-08	<1.0235E-08	<9.3854E-09	<3.99E-09* Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	<6.46E-09	<6.14E-09	<6.89E-09
Co-60	µCi/cc	<1.2821E-08	<1.1915E-08	<1.0760E-08	<1.1448E-08	<1.3298E-08	<4.60E-09* <6.10E-09	<5.80E-09	<2.80E-09	<5.20E-09	<7.90E-09	<7.90E-09	<7.72E-09	<5.27E-09	<6.75E-09
Cs-137	µCi/cc	<8.9032E-09	<9.7535E-09	<8.9682E-09	<9.6380E-09	<1.0172E-08	<3.67E-09* <4.90E-09	<5.70E-09	<2.70E-09	<5.10E-09	<6.30E-09	<7.40E-09	<6.86E-09	<6.60E-09	<6.61E-09
Sr-90	pCi/L						<2.35E-09*								
Tc-99	pCi/L						<3.35E-08*								

Well ID		Background #2 (Located off Pointe Aux Peaux Road) (GW-2)	Background #2 (Located off Pointe Aux Peaux Road) (GW-2)	Background #2 (Located off Pointe Aux Peaux Road) (GW-2)	Background #2 (Located off Pointe Aux Peaux Road) (GW-2)	Background #2 (Located off Pointe Aux Peaux Road) (GW-2)	Background #2 (Located off Pointe Aux Peaux Road) (GW-2)	Background #2 (Located off Pointe Aux Peaux Road) (GW-2)	Background #2 (Located off Pointe Aux Peaux Road) (GW-2)	Background #2 (Located off Pointe Aux Peaux Road) (GW-2)	Background #2 (Located off Pointe Aux Peaux Road) (GW-2)	Background #2 (Located off Pointe Aux Peaux Road) (GW-2)	Background #2 (Located off Pointe Aux Peaux Road) (GW-2)	Background #2 (Located off Pointe Aux Peaux Road) (GW-2)	Background #2 (Located off Pointe Aux Peaux Road) (GW-2)
Date Sampled		July-2004	October-2004	February-2005	September-2005	February-2006	June-2006	December-2006	June-2007	December-2007	March-2008	March-2009	June-2011	November-2010	October-2011
Date Analyzed															
Parameter	Units														
H-3	µCi/cc	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.85E-07* <1.12E-06	<3.80E-07	<4.30E-07	<4.30E-07	<4.40E-07	<4.30E-07	<1.21E-06	<1.17E-06	<1.14E-06
Na-22	µCi/cc	<1.1094E-08	<1.1222E-08	<1.2313E-08	<1.2188E-08	<1.2171E-08	<3.71E-09* Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	<7.98E-09	<7.04E-09	<7.74E-09
Co-60	µCi/cc	<1.2236E-08	<1.3355E-08	<1.3897E-08	<1.2301E-08	<1.1514E-08	<3.36E-09* <5.20E-09	<4.60E-09	<4.40E-09	<6.40E-09	<7.10E-09	<8.60E-09	<8.77E-09	<6.98E-09	<1.00E-08
Cs-137	µCi/cc	<9.4135E-09	<8.8800E-09	<7.9696E-09	<9.4438E-09	<8.9271E-09	<3.58E-09* <5.20E-09	<4.30E-09	<4.10E-09	<4.70E-09	<6.80E-09	<6.60E-09	<7.03E-09	<5.86E-09	<7.05E-09
Sr-90	pCi/L						<2.34E-09*						NA	NA	NA
Tc-99	pCi/L						<3.23E-08*						NA	NA	NA

Well ID		Background #3 (Located by Firing Range) (GW-4)	Background #3 (Located by Firing Range) (GW-4)	Background #3 (Located by Firing Range) (GW-4)	Background #3 (Located by Firing Range) (GW-4)	Background #3 (Located by Firing Range) (GW-4)	Background #3 (Located by Firing Range) (GW-4)	Background #3 (Located by Firing Range) (GW-4)	Background #3 (Located by Firing Range) (GW-4)	Background #3 (Located by Firing Range) (GW-4)	Background #3 (Located by Firing Range) (GW-4)	Background #3 (Located by Firing Range) (GW-4)	Background #3 (Located by Firing Range) (GW-4)	Background #3 (Located by Firing Range) (GW-4)	Background #3 (Located by Firing Range) (GW-4)
Date Sampled		July-2004	October-2004	February-2005	September-2005	February-2006	June-2006	December-2006	June-2007	December-2007	March-2008	March-2009	November-2010	June-2011	October-2011
Date Analyzed															
Parameter	Units														
H-3	µCi/cc	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.85E-07* <1.12E-06	<3.80E-07	<4.20E-07	<4.30E-07	<4.40E-07	<4.30E-07	<1.18E-06	<1.08E-06	<1.14E-06
Na-22	µCi/cc	<9.8033E-09	<1.0131E-08	<1.0784E-08	<1.0392E-08	<1.0508E-08	<3.79E-09* Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	<5.19E-09	<6.26E-09	<6.63E-09
Co-60	µCi/cc	<1.1228E-08	<1.2311E-08	<1.2352E-08	<1.2468E-08	<1.4441E-08	<3.48E-09* <4.50E-09	<4.50E-09	<2.70E-09	<4.70E-09	<7.70E-09	<8.10E-09	<8.02E-09	<7.37E-09	<9.80E-09
Cs-137	µCi/cc	<1.0670E-08	<8.7213E-09	<7.5394E-09	<8.1238E-09	<1.1569E-08	<3.45E-09* <5.80E-09	<4.80E-09	<2.70E-09	<3.80E-09	<7.10E-09	<7.40E-09	<6.60E-09	<7.45E-09	<7.33E-09
Sr-90	pCi/L						<2.11E-09*								
Tc-99	pCi/L						<2.97E-08*								

Well ID		Background # (GW-1)	Background # (GW-1)
Sample ID			
Date Sampled		May-2010	October-2011
Date Analyzed			
Parameter	Units		
H-3	µCi/cc	<1.11E-06	<1.13E-06
Na-22	µCi/cc	<8.94E-09	<7.73E-09
Co-60	µCi/cc	<7.82E-09	<9.40E-09
Cs-137	µCi/cc	<7.82E-09	<6.52E-09
Sr-90	pCi/L		
Tc-99	pCi/L		

Notes:

NA = Not analyzed

\* = Results reported from General Engineering Laboratories, LLC (GEL)

< = Sample activity was below the minimum detectable activity (MDA) for the analysis



UPDATED RADIONUCLIDE ANALYTICAL RESULTS  
SITE CONCEPTUAL MODEL  
DETROIT EDISON - FERMI ENERGY CENTER  
NEWPORT, MICHIGAN

Well ID		EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S
Sample ID														EFT-1/S010510				
Date Sampled		April-2004	July-2004	October-2004	February-2005	September-2005	February-2006	June-2006	December-2006	July-2007	April-2008	March-2009	September-2009	January-2010	May-2010	October-2010	June-2011	October-2011
Date Analyzed														February-10				
Parameter	Units													GEL Results				
H-3	µCi/cc	<1.20E-06	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.13E-06	<1.12E-06*	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.11E-06	<1.18E-06	<1.29E-06	<1.14E-06
Na-22	µCi/cc	<1.0086E-08	<8.4390E-09	<9.9837E-09	<1.0751E-08	<7.8844E-09	<9.1733E-09	<1.1822E-08	<9.5580E-09	<5.5124E-09	<5.3526E-09	<1.1822E-08	<7.9078E-09	NA	<8.11E-09	<7.6214E-09	<5.85E-09	<8.67E-09
Co-60	µCi/cc	<1.1063E-08	<1.2497E-08	<1.1037E-08	<1.2852E-08	<1.0587E-08	<1.0667E-08	<2.21E-09*	<1.3478E-08	<6.6331E-09	<9.3011E-09	<9.2103E-09	<8.5598E-09	NA	<9.05E-09	<7.2055E-09	<8.99E-09	<8.46E-09
Cs-137	µCi/cc	<9.7608E-09	<9.1448E-09	<8.4271E-09	<1.1096E-08	<1.0902E-08	<9.6622E-09	<2.32E-09*	<9.7049E-09	<7.9235E-09	<8.1314E-09	<8.5046E-09	<7.9151E-09	NA	<6.17E-09	<6.5733E-09	<6.27E-09	<6.83E-09
Sr-90	pCi/L							<1.84E-09*						NA	NA	NA	NA	NA
Tc-99	pCi/L							<2.95E-08*									NA	NA

Well ID		EFT-1I	EFT-1I	EFT-1I	EFT-1I	EFT-1I
Sample ID		EFT-1/I011410				
Date Sampled		January-2010	May-2010	October-2010	October-2011	October-2011
Date Analyzed		February-10				
Parameter	Units	GEL Results			Duplicate	
H-3	µCi/cc	NA	<1.11E-06	<1.18E-06	<1.14E-06	<1.14E-06
Na-22	µCi/cc	NA	<8.35E-09	<5.7501E-09	<7.45E-09	<9.12E-09
Co-60	µCi/cc	NA	<7.55E-09	<8.2428E-09	<9.59E-09	<8.44E-09
Cs-137	µCi/cc	NA	<6.74E-09	<7.3531E-09	<6.91E-09	<8.05E-09
Sr-90	pCi/L	<1.96E-09*	NA	NA	NA	NA
Tc-99	pCi/L					

Well ID		EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D
Sample ID														EFT-1/D010510				
Date Sampled		April-2004	July-2004	February-2005	September-2005	February-2006	June-2006	December-2006	July-2007	July-2007	April-2008	March-2009	September-2009	January-2010	May-2010	October-2010	June-2011	October-2011
Date Analyzed														February-10				
Parameter	Units									Duplicate				GEL Results				
H-3	µCi/cc	<1.20E-06	<1.41E-06	<1.08E-06	<1.25E-06	<1.18E-06	<4.87E-07*	<1.12E-06	<1.19E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.16E-06	<1.18E-06	<1.29E-06	<1.13E-06
Na-22	µCi/cc	<1.0320E-08	<7.8619E-09	<9.0777E-09	<1.1321E-08	<1.2143E-08	<2.80E-09*	<1.4078E-08	<9.3654E-09	<1.0331E-08	<8.2444E-09	<6.7178E-09	<7.2134E-09	NA	<6.15E-09	<5.3068E-09	<5.78E-09	<6.86E-09
Co-60	µCi/cc	<1.3046E-08	<1.2810E-08	<1.2278E-08	<1.3402E-08	<1.4276E-08	<2.93E-09*	<8.2906E-09	<1.2187E-08	<9.3008E-09	<9.9910E-09	<9.6580E-09	<1.0387E-08	NA	<8.39E-09	<6.9431E-09	<9.92E-09	<8.41E-09
Cs-137	µCi/cc	<9.5493E-09	<9.4406E-09	<9.9089E-09	<1.0879E-08	<1.0171E-08	<2.80E-09*	<8.9010E-09	<9.3495E-09	<8.2578E-09	<8.4241E-09	<7.8385E-09	<8.1651E-09	NA	<6.79E-09	<6.1747E-09	<7.10E-09	<6.51E-09
Sr-90	pCi/L						<1.60E-09*							NA	NA	NA	NA	NA
Tc-99	pCi/L						<3.03E-08*										NA	NA

Well ID		EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S
Sample ID																		
Date Sampled		April-2004	July-2004	October-2004	February-2005	September-2005	February-2006	June-2006	December-2006	July-2007	April-2008	March-2009	September-2009	June-2010	November-2010	June-2011	October-2011	
Date Analyzed													October-09	September-10				
Parameter	Units																	
H-3	µCi/cc	<1.20E-06	<1.41E-06	<1.22E-06		<1.25E-06		<4.87E-07*	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	<1.16E-06		<6.47E-07	<1.14E-06	
Na-22	µCi/cc	<1.0497E-08	<1.0178E-08	<9.1869E-09		<9.6864E-09		<2.05E-09*	<1.1379E-08	<4.7855E-09	<7.4184E-09	<1.0288E-08	<6.4658E-09	<7.4678E-09	<7.89E-09		<7.86E-09	<7.29E-09
Co-60	µCi/cc	<1.3569E-08	<1.1138E-08	<8.6360E-09	DRY	<1.1308E-08	DRY	<1.1956E-08	<9.5573E-09	<1.0316E-08	<1.0201E-08	<8.6624E-09	<9.4332E-09	<7.34E-09	DRY	<7.20E-09	<8.15E-09	
Cs-137	µCi/cc	<8.6460E-09	<8.1003E-09	<9.2891E-09		<6.1138E-09		<1.93E-09*	<5.2764E-09	<9.5321E-09	<6.7670E-09	<6.9924E-09	<7.3340E-09	<9.0637E-09	<7.45E-09		<7.02E-09	<6.87E-09
Sr-90	pCi/L							<1.83E-09*							NA		NA	NA
Tc-99	pCi/L							<3.03E-08*									NA	NA

Notes:  
NA = Not analyzed

\* = Results reported from General Engineering Laboratories, LLC (GEL)  
< = Sample activity was below the minimum detectable activity (MDA) for the analysis

UPDATED RADIONUCLIDE ANALYTICAL RESULTS  
SITE CONCEPTUAL MODEL  
DETROIT EDISON - FERM ENERGY CENTER  
NEWPORT, MICHIGAN

Well ID		EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D		
Sample ID																				EFT-2/D010410		
Date Sampled		April-2004	April-2004	July-2004	October-2004	November-2004	February-2005	September-2005	February-2006	February-2006	June-2006	December-2006	July-2007	April-2008	March-2009	September-2009	January-2010	June-2010	November-2010	June-2011	October-2011	
Date Analyzed																						
Parameter	Units		Duplicate							Duplicate											GEL Results	
H-3	µCi/cc	<1.20E-06	<1.20E-06	<1.41E-06	<1.22E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.13E-06	<1.13E-06	<4.85E-07*	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.11E-06	<1.18E-06	<6.47E-07	<1.13E-06	
Na-22	µCi/cc	<9.6289E-09	<1.0458E-08	<9.4942E-09	<1.1906E-08	<9.4260E-09	<9.7954E-09	<1.0476E-08	<1.0568E-08	<1.0342E-08	<2.09E-09*	<1.5904E-08	<1.0902E-08	<1.1650E-08	<7.8808E-09	<9.9496E-09	<9.6978E-09	NA	<7.997E-09	<7.9453E-09	<7.73E-09	<7.44E-09
Co-60	µCi/cc	<1.1704E-08	<1.0397E-08	<1.4079E-08	<1.5042E-08	<1.1037E-08	<1.0389E-08	<1.3085E-08	<1.0851E-08	<1.4306E-08	<1.88E-09*	<1.1447E-08	<1.2098E-08	<1.0316E-08	<9.7815E-09	<1.1696E-08	<8.9898E-09	NA	<8.62E-09	<6.3489E-09	<7.69E-09	<7.95E-09
Cs-137	µCi/cc	<9.3513E-09	<6.7600E-09	<1.0681E-08	<8.8931E-09	<9.6981E-09	<9.6680E-09	<8.0124E-09	<9.9376E-09	<1.0540E-08	<1.72E-09*	<7.3761E-09	<8.5369E-09	<9.0380E-09	<8.3196E-09	<7.3076E-09	<7.9751E-09	NA	<7.09E-09	<7.1904E-09	<7.17E-09	<7.04E-09
Sr-90	pCi/L										<1.79E-09*						NA	NA	NA	NA	NA	
Tc-99	pCi/L										<3.00E-08*									NA	NA	

Well ID		EFT-4S	EFT-4S	EFT-4S	EFT-4S	EFT-4S	EFT-4S	EFT-4S	EFT-4S	EFT-4S	EFT-4S	EFT-4S	EFT-4S	EFT-4S	EFT-4S	EFT-4S	EFT-4S	EFT-4S	EFT-4S	
Sample ID																				
Date Sampled		April-2004	July-2004	October-2004	February-2005	September-2005	February-2006	June-2006	December-2006	July-2007	April-2008	March-2009	September-2009	December-2009	January-2010	May-2010	October-2010	June-2011	October-2011	
Date Analyzed															Sample not received by GEL					
Parameter	Units																			
H-3	µCi/cc	<1.20E-06	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.13E-06	<4.85E-07*	<1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA		<1.26E-09	<1.18E-06	<1.08E-06	<1.14E-06
Na-22	µCi/cc	<1.0841E-08	<7.8101E-09	<1.0145E-08	<9.7689E-09	<1.2322E-08	<1.0315E-08	<3.98E-09*	<1.0011E-08	<7.4412E-09	<8.4466E-09	<1.0389E-08	<9.6679E-09	<7.6616E-09	NA		<6.04E-09	<7.7934E-09	<6.84E-09	<7.13E-09
Co-60	µCi/cc	<1.2678E-08	<1.3461E-08	<1.0208E-08	<1.0391E-08	<1.5519E-08	<1.1380E-08	<4.29E-09*	<1.2594E-08	<1.0900E-08	<8.9259E-09	<8.2588E-09	<1.0954E-08	<9.2386E-09	NA	NA	<7.60E-09	<8.0303E-09	<7.62E-09	<9.13E-09
Cs-137	µCi/cc	<9.8021E-09	<8.1678E-09	<9.1254E-09	<9.6594E-09	<1.0487E-08	<1.2591E-08	<3.67E-09*	<8.9335E-09	<8.4829E-09	<8.8195E-09	<8.2304E-09	<8.6006E-09	<9.0753E-09	NA		<5.67E-09	<6.6482E-09	<7.17E-09	<7.28E-09
Sr-90	pCi/L							<1.63E-09*						NA			NA	NA	NA	NA
Tc-99	pCi/L							<2.98E-08*												

Well ID		EFT-4D	EFT-4D	EFT-4D	EFT-4D	EFT-4D	EFT-4D	EFT-4D	EFT-4D	EFT-4D	EFT-4D	EFT-4D	EFT-4D	EFT-4D	EFT-4D	EFT-4D	EFT-4D	EFT-4D	EFT-4D		
Sample ID																				EFT-4/D122909	
Date Sampled		April-2004	July-2004	October-2004	February-2005	September-2005	February-2006	June-2006	June-2006	December-2006	July-2007	April-2008	March-2009	September-2009	December-2009	May-2010	October-2010	June-2011	October-2011		
Date Analyzed																				February-10	
Parameter	Units								Duplicate											GEL Results	
H-3	µCi/cc	<1.20E-06	<1.37E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.85E-07*	<4.84E-07*	<1.12E-06	<1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.11E-06	<1.17E-06	<1.08E-06	<1.14E-06
Na-22	µCi/cc	<1.0169E-08	<8.3089E-09	<1.1935E-08	<9.3931E-09	<9.8371E-09	<1.1508E-08	<3.50E-09*	<3.56E-09*	<1.3470E-08	<1.0393E-08	<8.9950E-09	<8.9316E-09	<9.1459E-09	<6.9588E-09	<8.7548E-09	NA	<6.54E-09	<5.8939E-09	<6.76E-09	<9.49E-09
Co-60	µCi/cc	<1.1981E-08	<1.1611E-08	<1.0259E-08	<1.2979E-08	<1.2998E-08	<1.2268E-08	<3.68E-09*	<3.72E-09*	<1.2313E-08	<1.0128E-08	<8.3117E-09	<8.8466E-09	<1.0023E-08	<9.6977E-09	<9.8457E-09	NA	<7.62E-09	<6.9027E-09	<8.74E-09	<8.20E-09
Cs-137	µCi/cc	<8.6459E-09	<7.3827E-09	<6.9107E-09	<1.0868E-08	<1.0589E-08	<1.0005E-08	<3.35E-09*	<3.55E-09*	<9.4605E-09	<6.1486E-09	<9.2439E-09	<8.4863E-09	<8.7263E-09	<8.8013E-09	<7.0717E-09	NA	<6.70E-09	<6.07E-09	<5.76E-09	<4.98E-09
Sr-90	pCi/L							<1.60E-09*	<1.49E-09*								NA	NA	NA	NA	
Tc-99	pCi/L							<3.00E-08*	<3.06E-08*												

Notes:

NA = Not analyzed

\* = Results reported from General Engineering Laboratories, LLC (GEL)

< = Sample activity was below the minimum detectable activity (MDA) for the analysis

UPDATED RADIONUCLIDE ANALYTICAL RESULTS  
SITE CONCEPTUAL MODEL  
DETROIT EDISON - FERMIL ENERGY CENTER  
NEWPORT, MICHIGAN

Well ID		EFT-5S	EFT-5S	EFT-5S	EFT-5S	EFT-5S	EFT-5S	EFT-5S	EFT-5S	EFT-5S	EFT-5S	EFT-5S	EFT-5S	EFT-5S	EFT-5S	EFT-5S	EFT-5S	EFT-5S	
Sample ID															EFT-5/S122909				
Date Sampled		April-2004	July-2004	October-2004	February-2005	September-2005	February-2006	June-2006	December-2006	July-2007	April-2008	March-2009	September-2009	December-2009	May-2010	October-2010	June-2011	October-2011	
Date Analyzed														February-10					
Parameter	Units														GEL Results				
H-3	µCi/cc	<1.20E-06	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.92E-07*	<1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.11E-06	<1.18E-06	<1.08E-06	<1.14E-06
Na-22	µCi/cc	<1.2267E-08	<1.0527E-08	<1.0156E-08	<1.0087E-08	<1.1347E-08	<1.3134E-08	<1.84E-09*	<1.1425E-08	<1.1072E-08	<9.7962E-09	<8.8609E-09	<7.9452E-09	<9.2133E-09	NA	<6.02E-09	<7.2582E-09	<6.14E-09	<6.56E-09
Co-60	µCi/cc	<1.0968E-08	<1.1448E-08	<1.0691E-08	<1.4063E-08	<9.2084E-09	<1.2518E-08	<1.98E-09*	<1.1150E-08	<1.0052E-08	<9.1024E-09	<9.0657E-09	<9.5254E-09	<6.1753E-09	NA	<1.00E-08	<6.7473E-09	<7.18E-09	<8.95E-09
Cs-137	µCi/cc	<9.9056E-09	<7.0427E-09	<9.5432E-09	<8.8377E-09	<8.4928E-09	<1.0614E-08	<1.87E-09*	<7.0719E-09	<7.2689E-09	<8.3949E-09	<8.5134E-09	<1.0150E-08	<7.8685E-09	NA	<7.41E-09	<6.6547E-09	<8.17E-09	<8.09E-09
Sr-90	pCi/L							<1.65E-09*						<1.96E-09*	NA	NA	NA	NA	NA
Tc-99	pCi/L							<3.01E-08*											

Well ID		EFT-5D	EFT-5D	EFT-5D	EFT-5D	EFT-5D	EFT-5D	EFT-5D	EFT-5D	EFT-5D	EFT-5C	EFT-5D	EFT-5D	EFT-5D	EFT-5D	EFT-5D	EFT-5D	EFT-5D	EFT-5D	
Sample ID															EFT-5/D122909					
Date Sampled		April-2004	July-2004	October-2004	February-2005	February-2005	September-2005	February-2006	June-2006	December-2006	July-2007	April-2008	March-2009	September-2009	December-2009	May-2010	October-2010	June-2011	October-2011	
Date Analyzed															February-10					
Parameter	Units					Duplicate									GEL Results					
H-3	µCi/cc	<1.20E-06	<1.41E-06	<1.22E-06	<1.08E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.93E-07*	<1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.16E-06	<1.32E-06	<1.08E-06	<1.20E-06
Na-22	µCi/cc	<7.9238E-09	<1.0875E-08	<1.2568E-08	<1.0362E-08	<7.7359E-09	<1.1353E-08	<1.0687E-08	<2.40E-09*	<1.1295E-08	<1.0634E-08	<9.6624E-09	<1.0031E-08	<7.5168E-09	<9.1260E-09	NA	<8.79E-09	<6.4167E-09	<6.39E-09	<8.66E-09
Co-60	µCi/cc	<1.1440E-08	<1.0748E-08	<1.2334E-08	<1.2107E-08	<1.1624E-08	<1.2502E-08	<1.2956E-08	<2.34E-09*	<1.1046E-08	<9.7632E-09	<1.2708E-08	<9.6523E-09	<9.6361E-09	<7.2827E-09	NA	<8.45E-09	<7.4735E-09	<9.00E-09	<6.82E-09
Cs-137	µCi/cc	<9.9193E-09	<8.4313E-09	<9.5826E-09	<1.1570E-08	<9.9670E-09	<1.0344E-08	<1.0007E-08	<2.14E-09*	<9.5759E-09	<8.3723E-09	<8.2371E-09	<8.0682E-09	<8.6436E-09	<7.9105E-09	NA	<6.145E-09	<7.042E-09	<6.59E-09	<7.07E-09
Sr-90	pCi/L								<1.78E-09*						<1.96E-09*	NA	NA	NA	NA	
Tc-99	pCi/L								<3.01E-08*											

Well ID		EFT-6S	EFT-6S	EFT-6S	EFT-6S	EFT-6S	EFT-6S	EFT-6S	EFT-6S	EFT-6S	EFT-6S	EFT-6S	EFT-6S	EFT-6S	EFT-6S	EFT-6S	EFT-6S	EFT-6S	
Sample ID															EFT-6/S122909				
Date Sampled		July-2004	October-2004	February-2005	September-2005	February-2006	June-2006	December-2006	July-2007	April-2008	March-2009	August-2009	December-2009	May-2010	October-2010	June-2011	October-2011		
Date Analyzed															February-10				
Parameter	Units														GEL Results				
H-3	µCi/cc	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.84E-07*	<1.12E-06	<1.12E-06	<1.19E-06	<1.10E-06	<1.12E-06	<1.20E-06	NA	<1.11E-06	<1.18E-06	<1.21E-06	<1.14E-06	
Na-22	µCi/cc	<1.2405E-08	<9.2077E-09	<1.1005E-08	<1.2600E-08	<1.2452E-08	<4.37E-09*	<1.2169E-08	<1.1646E-08	<7.7428E-09	<8.0792E-09	<8.884E-09	<8.3924E-09	NA	<8.82E-09	<7.1409E-09	<7.15E-09	<7.40E-09	
Co-60	µCi/cc	<1.3624E-08	<1.1987E-08	<1.2262E-08	<9.7660E-09	<1.3875E-08	<3.78E-09*	<1.1451E-08	<1.2410E-08	<7.1885E-09	<9.6521E-09	<9.9537E-09	<8.1703E-09	NA	<9.00E-09	<6.9941E-09	<7.55E-09	<1.16E-08	
Cs-137	µCi/cc	<9.5382E-09	<9.3034E-09	<9.6692E-09	<9.9529E-09	<8.5905E-09	<3.46E-09*	<7.5852E-09	<8.1559E-09	<6.5449E-09	<7.9383E-09	<9.0845E-09	<7.0120E-09	NA	<7.61E-09	<6.7494E-09	<6.64E-09	<7.17E-09	
Sr-90	pCi/L						<1.74E-09*							NA	NA	NA	NA	NA	NA
Tc-99	pCi/L						<3.03E-08*										NA	NA	NA

Well ID		EFT-6D	EFT-6D	EFT-6D	EFT-6D	EFT-6D	EFT-6D	EFT-6D	EFT-6D	EFT-6D	EFT-6D	EFT-6D	EFT-6D	EFT-6D	EFT-6D	EFT-6D	EFT-6D	EFT-6D	EFT-6D	EFT-6D		
Sample ID																EFT-6/D122909						
Date Sampled		July-2004	July-2004	October-2004	October-2004	February-2005	September-2005	September-2005	February-2006	June-2006	December-2006	July-2007	April-2008	March-2009	March-2009	August-2009	December-2009	May-2010	October-2010	June-2011	October-2011	
Date Analyzed																				February-10		
Parameter	Units		Duplicate			Duplicate		Duplicate								Duplicate					GEL Results	
H-3	µCi/cc	<1.41E-06	<1.41E-06	<1.22E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.25E-06	<1.13E-06	<4.85E-07*	<1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.12E-06	<1.20E-06	NA	<1.10E-06	<1.18E-06	<1.08E-06	<1.14E-06
Na-22	µCi/cc	<1.0323E-08	<8.3389E-09	<7.3284E-09	<1.0716E-08	<8.9670E-09	<9.0835E-09	<1.0728E-08	<1.2956E-08	<1.97E-09*	<1.0050E-08	<1.0978E-08	<6.9531E-09	<7.3800E-09	<9.2786E-09	<8.8553E-09	<8.1058E-09	NA	<7.24E-09	<7.4746E-09	<5.83E-09	<7.21E-09
Co-60	µCi/cc	<1.4667E-08	<1.3759E-08	<1.1373E-08	<1.4557E-08	<1.1331E-08	<1.4880E-08	<1.1991E-08	<1.3876E-08	<2.13E-09*	<1.1469E-08	<9.1155E-09	<9.1083E-09	<1.1316E-08	<8.1625E-09	<7.5742E-09	<8.9149E-09	NA	<7.50E-09	<7.5143E-09	<6.05E-09	<1.11E-08
Cs-137	µCi/cc	<7.7276E-09	<9.3965E-09	<8.4927E-09	<1.0527E-08	<8.9498E-09	<9.9425E-09	<9.2431E-09	<1.1844E-08	<1.83E-09*	<7.2416E-09	<1.0272E-08	<9.5955E-09	<7.0228E-09	<7.8757E-09	<8.6477E-09	<7.8617E-09	NA	<7.43E-09	<6.2297E-09	<6.30E-09	<6.45E-09
Sr-90	pCi/L									<1.75E-09*								NA	NA	NA	NA	NA
Tc-99	pCi/L									<3.03E-08*												

Notes:

NA = Not analyzed

\* = Results reported from General Engineering Laboratories, LLC (GEL)

< = Sample activity was below the minimum detectable activity (MDA) for the analysis

UPDATED RADIONUCLIDE ANALYTICAL RESULTS  
SITE CONCEPTUAL MODEL  
DETROIT EDISON - FERMI ENERGY CENTER  
NEWPORT, MICHIGAN

Well ID		EFT-7S	EFT-7S	EFT-7S	EFT-7S	EFT-7S	EFT-7S	EFT-7S	EFT-7S	EFT-7S	EFT-7S	EFT-7S	EFT-7S	EFT-7S	EFT-7S	EFT-7S	EFT-7S	EFT-7S	
Sample ID															EFT-7/S010410				
Date Sampled		April-2004	July-2004	October-2004	February-2005	September-2005	February-2006	June-2006	December-2006	July-2007	January-2008	March-2009	September-2009	January-2010	June-2010	November-2010	June-2011	October-2011	
Date Analyzed														February-10					
Parameter	Units														GEL Results				
H-3	µCi/cc	<1.20E-06	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<6.88E-07*	<1.12E-06	<1.12E-06	<1.19E-06	<1.14E-06	Not Sampled due to radioactive waste shipment.	<1.20E-06	NA	<1.11E-06	<1.18E-06	<1.08E-06	<1.14E-06
Na-22	µCi/cc	<1.0688E-08	<6.3803E-09	<1.0185E-08	<9.6176E-09	<1.0723E-08	<1.1291E-08	<1.97E-09*	<9.7765E-09	<9.1456E-09	<7.4899E-09	<8.6995E-09		<7.5472E-09	NA	<9.46E-09	<5.9172E-09	<5.69E-09	<8.25E-09
Co-60	µCi/cc	<1.3601E-08	<1.2139E-08	<1.1196E-08	<1.3703E-08	<1.1250E-08	<1.3566E-08	<2.01E-09*	<1.1678E-08	<8.6767E-09	<9.1024E-09	<7.7048E-09		<1.1047E-08	NA	<7.02E-09	<6.5052E-09	<8.94E-09	<8.59E-09
Cs-137	µCi/cc	<7.7272E-09	<9.8698E-09	<1.0263E-08	<8.3787E-09	<1.1287E-08	<9.8752E-09	<1.87E-09*	<8.8174E-09	<7.7653E-09	<9.1347E-09	<8.9034E-09		<6.6524E-09	NA	<7.74E-09	<7.2305E-09	<5.77E-09	<7.04E-09
Sr-90	pCi/L							<1.76E-09*						NA	NA	NA	NA	NA	
Tc-99	pCi/L							<3.10E-08*											

Well ID		EFT-8S	EFT-8S	EFT-8S	EFT-8S	EFT-8S	EFT-8S	EFT-8S	EFT-8S	EFT-8S	EFT-8S	EFT-8S	EFT-8S	EFT-8S	EFT-8SNew	EFT-8SNew	EFT-8SNew	EFT-8SNew	
Sample ID															EFT-8/S010110				
Date Sampled		July-2004	October-2004	February-2005	September-2005	February-2006	June-2006	December-2006	July-2007	April-2008	March-2009	September-2009 (Old Well)	June-2010 (Old Well)	October-2010 (Old Well)	January-2010	October-2010	June-2011	October-2011	
Date Analyzed															February-10				
Parameter	Units														GEL Results				
H-3	µCi/cc	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	DRY - No sample	<4.83E-07*	<1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	1.11E-06	DRY - No sample	NA	<1.17E-06	<1.21E-06	<1.14E-06
Na-22	µCi/cc	<7.6018E-09	<8.4427E-09	<1.1498E-08	<1.0235E-08		<1.68E-09* Not Reported	<1.1224E-08	<1.0725E-08	<7.5504E-09	<8.4483E-09	<8.1074E-09	<8.717E-09	NA		<5.0109E-09	<8.29E-09	<6.92E-09	
Co-60	µCi/cc	<9.3478E-09	<1.4382E-08	<1.1870E-08	<9.9156E-09		<1.66E-09* Not Reported	<1.1204E-08	<9.3730E-09	<9.5269E-09	<9.6307E-09	<9.6939E-09	<4.47E-09	NA		<6.4163E-09	<7.23E-09	<9.11E-09	
Cs-137	µCi/cc	<7.1684E-09	<7.8491E-09	<8.1024E-09	<9.4524E-09		<1.77E-09* Not Reported	<7.4546E-09	<9.0125E-09	<6.6822E-09	<8.3972E-09	<8.1659E-09	<7.58E-09	NA		NA	NA	NA	NA
Sr-90	pCi/L						<3.97E-09*								NA	NA	NA	NA	
Tc-99	pCi/L						<3.05E-08*												

Well ID		EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	
Sample ID															EFT-9/S010410				
Date Sampled		July-2004	October-2004	February-2005	September-2005	February-2006	June-2006	December-2006	December-2006	July-2007	April-2008	March-2009	September-2009	January-2010	June-2010	October-2010	June-2011	October-2011	
Date Analyzed															February-10				
Parameter	Units								Duplicate						GEL Results				
H-3	µCi/cc	<1.22E-06	<1.22E-06	DRY - No sample	<1.25E-06	<1.13E-06	<4.82E-07*	<1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	DRY - No sample	NA	<1.16E-06	<1.18E-06	<6.47E-07	<1.14E-06	
Na-22	µCi/cc	<9.1340E-09	<9.7325E-09		<8.8513E-09	<1.3391E-08	<1.08E-09*	<1.1618E-08	<8.4420E-09	<3.0243E-07	<9.7922E-09	<8.8687E-09		<9.5197E-09	NA	<7.60E-09	<6.2251E-09	<6.78E-09	<7.41E-09
Co-60	µCi/cc	<1.3087E-08	<1.1806E-08		<1.0071E-08	<1.3905E-08	<9.78E-10*	<1.1436E-08	<8.0832E-09	<7.6620E-08	<1.0399E-08	<1.0762E-08		<9.1692E-09	NA	<1.00E-08	<8.817E-09	<1.00E-08	<7.36E-09
Cs-137	µCi/cc	<1.1375E-08	<8.8358E-09		<1.0929E-08	<8.2813E-09	<1.05E-09*	<8.9681E-09	<8.5120E-09	<1.1698E-08	<9.1120E-09	<1.0501E-08		<7.9167E-09	NA	<7.31E-09	<6.0579E-09	<6.44E-09	<7.27E-09
Sr-90	pCi/L						<1.90E-09*							NA	NA	NA	NA	NA	
Tc-99	pCi/L						<3.01E-08*												

Notes:

NA = Not analyzed

\* = Results reported from General Engineering Laboratories, LLC (GEL)

< = Sample activity was below the minimum detectable activity (MDA) for the analysis

UPDATED RADIONUCLIDE ANALYTICAL RESULTS  
SITE CONCEPTUAL MODEL  
DETROIT EDISON - FERMI ENERGY CENTER  
NEWPORT, MICHIGAN

Well ID		EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	
Sample ID											EFT-10S031609	EFT-10S91509	EFT-10/S123009		EFT-10/S123009		
Date Sampled		September-2005	February-2006	June-2006	December-2006	July-2007	January-2008	January-2008	March-2009	September-2009	March-2009	September-2009	December-2009	June-2010	October-2010	June-2011	December-2011
Date Analyzed											April-09	October-09	February-10				
Parameter	Units							Duplicate					GEL Results				
Parameter	Units																
H-3	µCi/cc	<1.25E-06	<1.10E-06	<4.87E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.14E-06	<1.14E-06	<1.12E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.11E-06		<1.08E-06	<1.22E-06
Na-22	µCi/cc	<8.4664E-09	<1.3278E-08	<1.2688 E-08 <2.22E-09*	<6.9959E-09	<7.9379E-09	<9.1591E-09	<9.4187E-09	<7.4898E-09	<7.1921E-09	<7.4898E-09	<7.1921E-09	NA	<9.27E-09		<6.41E-09	<8.59E-09
Co-60	µCi/cc	<1.3861E-08	<1.2286E-08	<1.2400E-08 <2.39E-09*	<9.2342E-09	<1.1914E-08	<9.2914E-09	<8.4915E-09	<9.8334E-09	<1.0482E-08	<9.8334E-09	<1.0482E-08	NA	<7.29E-09	DRY - No sample	<7.86E-09	<8.03E-09
Cs-137	µCi/cc	<1.0834E-08	<8.2228E-09	<2.12E-09* <9.8627E-09	<8.6467E-09	<8.7939E-09	<7.4487E-09	<7.1346E-09	<8.1403E-09	<6.8591E-09	<8.1403E-09	<6.8591E-09	NA	<7.81E-09		<6.85E-09	<6.56E-09
Sr-90	pCi/L			<1.47E-09*									NA	NA		NA	NA
Tc-99	pCi/L			<3.07E-08*													

Well ID		11-I	11-I	11-I	11-I	11-I
Sample ID			EFT-51811-11I			
Date Sampled		May-2011	May-2011	August-2011	October-2011	December-2011
Date Analyzed		May-11	June-11	August-11	October-11	December-11
Parameter	Units		GEL Results			
Parameter	Units					
H-3	µCi/cc	<1.21E-06	<5.29E-07	<1.50E-06	<1.14E-06	<1.22E-06
Na-22	µCi/cc	<1.14E-08	<5.81E-09	<6.32E-09	<8.10E-09	<6.99E-09
Co-60	µCi/cc	<6.88E-09	<5.39E-09	<8.25E-09	<8.39E-09	<8.32E-09
Cs-137	µCi/cc	<7.41E-09	<7.54E-09	<7.60E-09	<6.76E-09	<6.77E-09
Sr-90	pCi/L		<1.94E+00	NA	NA	NA
Tc-99	pCi/L		<2.85E+01	NA	NA	NA

Well ID		11-D	11-D	11-D	11-D	11-D
Sample ID			EFT-51811-11D			
Date Sampled		April-2011	May-2011	August-2011	October-2011	December-2011
Date Analyzed		April-11	June-11	August-11	October-11	December-11
Parameter	Units		GEL Results			
Parameter	Units					
H-3	µCi/cc	<1.29E-06	<5.36E-07	<1.50E-06	<1.14E-06	<1.22E-06
Na-22	µCi/cc	<6.15E-09	<3.65E-09	<6.60E-09	<6.79E-09	<9.91E-09
Co-60	µCi/cc	<8.72E-09	<6.16E-09	<7.37E-09	<9.59E-09	<8.54E-09
Cs-137	µCi/cc	<8.17E-09	<6.89E-09	<7.44E-09	<7.35E-09	<7.65E-09
Sr-90	pCi/L		<1.70E+00	NA	NA	NA
Tc-99	pCi/L		<2.99E+01	NA	NA	NA

Well ID		12-I	12-I	12-I	12-I	12-I
Sample ID			EFT-51811-12I			
Date Sampled		April-2011	May-2011	August-2011	October-2011	December-2011
Date Analyzed		April-11	June-11	August-11	October-11	December-11
Parameter	Units		GEL Results			
Parameter	Units					
H-3	µCi/cc	<1.29E-06	<5.34E-07	<1.45E-06	<1.10E-06	<1.22E-06
Na-22	µCi/cc	<5.19E-09	<3.60E-09	<6.48E-09	<6.28E-09	<8.57E-09
Co-60	µCi/cc	<1.01E-08	<3.08E-09	<8.89E-08	<8.89E-09	<8.99E-09
Cs-137	µCi/cc	<6.27E-09	<4.13E-09	<6.64E-09	<8.36E-09	<7.99E-09
Sr-90	pCi/L		<1.88E+00	NA	NA	NA
Tc-99	pCi/L		<2.81E+01	NA	NA	NA

Well ID		12-D	12-D	12-D	12-D	12-D
Sample ID			EFT-51811-12D			
Date Sampled		April-2011	May-2011	August-2011	October-2011	December-2011
Date Analyzed		April-11	June-11	August-11	October-11	December-11
Parameter	Units		GEL Results			
Parameter	Units					
H-3	µCi/cc	<1.29E-06	<5.32E-07	<1.50E-06	<1.13E-06	<1.22E-06
Na-22	µCi/cc	<7.94E-09	<5.10E-09	<6.73E-09	<9.88E-09	<7.27E-09
Co-60	µCi/cc	<9.12E-09	<6.23E-09	<6.57E-09	<7.69E-09	<8.27E-09
Cs-137	µCi/cc	<7.13E-08	<7.94E-09	<7.12E-09	<6.98E-09	<6.56E-09
Sr-90	pCi/L		<1.23E+00	NA	NA	NA
Tc-99	pCi/L		<2.78E+01	NA	NA	NA

Notes:

NA = Not analyzed

\* = Results reported from General Engineering Laboratories, LLC (GEL)

< = Sample activity was below the minimum detectable activity (MDA) for the analysis

UPDATED RADIONUCLIDE ANALYTICAL RESULTS  
SITE CONCEPTUAL MODEL  
DETROIT EDISON - FERMI ENERGY CENTER  
NEWPORT, MICHIGAN

Well ID		13-1	13-1	13-1	13-1	13-1	13-1	13-1	13-1	13-1	13-1
Sample ID				EFT-51911-131		EFT-4811-131	EFT-82211-131				
Date Sampled		April-2011	May-2011	May-2011	June-2011	August-2011	August-2011	August-2011	August-2011	October-2011	December-2011
Date Analyzed		April-11	May-11	June-11	June-11	August-11	September-11	August-11	August-11	October-11	December-11
Parameter	Units			GEL Results			GEL Results			GEL Results	
Parameter	Units										
H-3	pCi/cc	<1.29E-06	<1.14E-06	NA	<1.08E-06	NA	<2.91E-07	<1.50E-06	<1.24E-06	<1.14E-06	<1.22E-06
Na-22	pCi/cc	<9.40E-09	<6.82E-09	NA	NA	NA	<3.39E-09	<6.71E-09	<6.30E-09	<5.59E-09	<7.33E-09
Co-60	pCi/cc	<1.04E-08	<1.05E-08	NA	NA	NA	<4.78E-09	<9.78E-09	<8.32E-09	<8.22E-09	<8.60E-09
Cs-137	pCi/cc	<7.69E-09	<9.85E-09	NA	NA	NA	<4.62E-09	<7.80E-09	<6.39E-09	<6.21E-09	<7.25E-09
Sr-90	pCi/L			<1.90E+00	NA	NA	NA	NA	NA	NA	NA
Tc-99	pCi/L			NA	NA	<3.58E+01	NA	NA	NA	NA	NA

Sump ID		Sump 1	Sump 1	Sump 1	Sump 1	Sump 1	Sump 1	Sump 1	Sump 3	Sump 3	Sump 3	Sump 3	Sump 3	Sump 3	Sump 3	Sump 4	Sump 4	Sump 4	Sump 4	Sump 4	Sump 4	Sump 4
Sample ID																						
Date Sampled		April-2008	March-2009	December-2009	May-2010	December-2010	May-2011	November-2011	April-2008	March-2009	December-2009	December-2010	May-2011	November-2011	April-2008	March-2009	December-2009	May-2010	December-2010	May-2011	November-2011	
Date Analyzed		May & June-2008	March & May-2009	December-09	May-2010	January-2011	May-2011	November-2011	May & June-2008	March & May-2009	December-09	January-2011	May-2011	November-2011	May & June-2008	March & May-2009	December-09	May-2010	January-2011	May-2011	November-2011	
Parameter	Units																					
Parameter	Units																					
H-3	pCi/cc	<1.22E-06	<1.16E-06	<1.15E-06	<1.20E-06	<1.40E-06	<1.14E-06	<1.06E-06	<1.22E-06	<1.16E-06	<1.08E-06	<1.40E-06	<1.18E-06	<1.21E-06	<1.31E-06	<1.16E-06	<1.15E-06	<1.21E-06	<1.40E-06	<1.18E-06	<1.28E-06	
Na-22	pCi/cc	<9.0631E-09	<8.87E-09	<1.06E-08	<5.78E-09	<5.1084E-09	<5.71E-09	<6.84E-09	<1.03E-08	<8.66E-09	<1.18E-08	<6.8372E-09	<7.08E-09	<6.29E-09	<9.06E-09	<8.40E-09	<8.80E-09	<6.35E-09	<1.0444E-08	<6.93E-09	<8.85E-09	
Co-60	pCi/cc	<8.8998E-09	<1.05E-08	<8.33E-09	<7.63E-09	<7.2319E-09	<7.64E-09	<9.09E-09	<6.94E-09	<1.35E-08	<1.061E-08	<6.0617E-09	<8.64E-09	<9.11E-09	<7.11E-09	<9.14E-09	<7.65E-09	<9.5972E-09	<9.41E-09	<8.15E-09		
Cs-137	pCi/cc	<9.5851E-09	<9.20E-09	<8.69E-09	<7.55E-09	<7.4335E-09	<7.08E-09	<7.81E-09	<9.24E-09	<1.05E-08	<9.30E-09	<8.2164E-09	<6.74E-09	<6.53E-09	<8.38E-09	<9.40E-09	<8.90E09	<6.17E-09	1.86-2.47E-08	<6.67E-09	<7.66E-09	
Sr-90	pCi/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Tc-99	pCi/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

Sump ID		Sump 5	Sump 5	Sump 5	Sump 5	Sump 5	Sump 5	Sump 5	Sump 8	Sump 8	Sump 9	Sump 9	Sump 9	Sump 9	Sump 9	Sump 9	Sump 9
Sample ID																	
Date Sampled		April-2008	March-2009	December-2009	May-2010	December-2010	May-2011	November-2011	May-2011	November-2011	April-2008	Nov.-2008	December-2009	May-2010	December-2010	May-2011	November-2011
Date Analyzed		May & June-2008	March & May-2009	December-09	May-2010	January-2011	May-2011	November-2011	May-2011	November-2011	May & June-2008	March & May-2009	December-09	May-2010	January-2011	May-2011	November-2011
Parameter	Units																
Parameter	Units																
H-3	pCi/cc	<1.22E-06	<1.16E-06	<1.08E-06	<1.21E-06	<1.40E-06	<1.18E-06	<1.21E-06	<1.18E-06	<1.21E-06	<1.22E-06	<1.16E-06	<1.15E-06	<1.21E-06	<1.40E-06	<1.18E-06	<1.28E-06
Na-22	pCi/cc	<8.65E-09	<1.12E-08	<1.29E-08	<6.37E-09	<9.3255E-09	<6.47E-09	<6.61E-09	<6.79E-09	<7.16E-09	<1.04E-08	<1.26E-08	<9.38E-09	<6.81E-09	<4.4551E-09	<6.38E-09	<7.71E-09
Co-60	pCi/cc	<8.29E-09	<9.07E-09	<1.44E-08	<8.21E-09	<9.4401E-09	<7.75E-09	<7.93E-09	<8.83E-09	<9.62E-09	<1.00E-08	<1.23E-08	<8.84E-09	<6.96E-09	<8.808E-09	<6.01E-09	<8.69E-09
Cs-137	pCi/cc	<7.23E-09	<8.89E-09	<8.20E-09	<5.57E-09	<7.3488E-09	<7.25E-09	<6.67E-09	<6.58E-09	<7.14E-09	<9.81E-09	<8.69E-09	<8.11E-09	<7.79E-09	<6.5062E-09	<7.16E-09	<7.40E-09
Sr-90	pCi/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tc-99	pCi/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Sump ID		Sump 10	Sump 10	Sump 10	Sump 10	Sump 10	Sump 10	Sump 10	Sump 11	Sump 11	Sump 11	Sump 11	Sump 11	Sump 11	Sump 11
Sample ID															
Date Sampled		April-2008	Nov.-2008	December-2009	May-2010	December-2010	May-2011	November-2011	April-2008	March-2009	December-2009	May-2010	December-2010	May-2011	November-2011
Date Analyzed		May & June-2008	March & May-2009	December-09	May-2010	January-2011	May-2011	November-2011	May & June-2008	March & May-2009	December-09	May-2010	January-2011	May-2011	November-2011
Parameter	Units														
Parameter	Units														
H-3	pCi/cc	<1.22E-06	<1.16E-06	<1.15E-06	<1.21E-06	<1.40E-06	<1.18E-06	<1.28E-06	<1.22E-06	<1.16E-06	<1.15E-06	<1.20E-06	<1.40E-06	<1.18E-06	<1.28E-06
Na-22	pCi/cc	<6.78E-09	<1.22E-08	<7.44E-09	<6.47E-09	<7.6968E-09	<6.17E-09	<7.18E-09	<9.58E-09	<9.54E-09	<9.52E-09	<6.77E-09	<6.092E-09	<6.63E-09	<6.89E-09
Co-60	pCi/cc	<9.74E-09	<1.19E-08	<6.90E-09	<7.16E-09	<9.3461E-09	<7.45E-09	<7.94E-09	<9.54E-09	<8.47E-09	<9.90E-09	<6.16E-09	<7.8248E-09	<8.27E-09	<7.10E-09
Cs-137	pCi/cc	<8.36E-09	<8.84E-09	<8.38E-09	<6.42E-09	<6.8833E-09	<5.84E-09	<6.94E-09	<8.67E-09	<9.46E-09	<9.00E-09	<6.51E-09	<7.1327E-09	<5.77E-09	<5.33E-09
Sr-90	pCi/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tc-99	pCi/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:  
NA = Not analyzed

\* = Results reported from General Engineering Laboratories, LLC (GEL)  
< = Sample activity was below the minimum detectable activity (MDA) for the analysis

**Fermi 1 NRC Docket No. 50-16  
NRC License No. DPR-9**

**Attachment 2 to  
NRC-12-0012**

**“Updated Fermi 1 Groundwater Monitoring Data”**

**Updated Table of Comparison of Analytical Results to Background**

**(Update of Table 6 of Site Conceptual Model)**



COMPARISON OF ANALYTICAL RESULTS TO BACKGROUND  
SITE CONCEPTUAL MODEL  
DETROIT EDISON - FERMI ENERGY CENTER  
NEWPORT, MICHIGAN

Hydro-Stratigraphic Zone	Well		Sample Date	Uranium-Alpha Activity (pCi/L) MCL = 15 (Note 1)				Radium Activity (pCi/L) MCL = 5			Gross Alpha/Beta	
				233	235	238	Total	226	228	Total	Alpha	Beta
				234	236							
Glacial Overburden	Background Wells	EFT-1S	2006	1.78	<1	0.617	2.40	0.621	1.75	2.37	<5	<5
			1/5/2010	1.55	<1	0.747	2.30	0.948	<3	0.95	<5	<5
		EFT-1I	1/14/2010	3.2	<1	3.82	7.02	<1	1.72	1.72	5.77	<5
		MW-393S	1/13/2010	15.5	0.989	12.2	28.69	<1	<3	<4	17.4	7.9
		MW-393S	4/1/2010	13.8	1.15	12.7	<1	<3				
		MW-393S (Dup)	4/1/2010	14.4	1.13	11.8	<1	<3				
		MW-393S (Avg)	4/1/2010	14.1	1.14	12.3	27.49	<1	<3	<4		
		MW-388S	1/13/2010	1.62	<1	0.908	2.53	0.908	1.69	2.60	15.2	35.8
		MW-388S	4/6/2010	3.76	<1	2.42	6.18	0.422	<3	0.42		
		MW-381S	4/6/2010	4.57	<1	3.24	7.81	0.377	<3	0.38		
	BKG-PAP	2006	2.82	<1	2.99	5.81	0.41	<3	0.41			
	GW-02	1/14/2010	2.42	<1	1.72	4.14	0.46	<3	0.46	<5	5.75	
	UTL (Note 2):					7.81			2.60			
						Assume log-normal data distribution:	16.06		6.97			
						Assume normal data distribution:	10.51		3.44			
	Monitor Wells	EFT-2S	2006	1.56	<1	1.39	2.95	<1	<3	<4		
			2010	NS	NS	NS	NS	NS	NS	NS	NS	NS
		EFT-4S	2006	3.89	<1	2.81	6.70	<1	<3	<4		
		EFT-4S/D	12/29/2009	NA	NA	NA	NA	NA	NA	NA	<5	<5
		EFT-5S	2006	3.67	0.49	2.65	6.81	0.48	<3	0.48		
		12/29/2009	3.62	0.31	2.8	6.73	0.47	1.51	1.98	<5	3.53	
EFT-6S		2006	<1	3.87	<1	3.87	0.33	<3	0.33			
		12/29/2009	NA	NA	NA	NA	NA	NA	NA	6.22	<5	
EFT-7S		2006	3.33	0.34	2.65	6.32	0.63	<3	0.63			
		1/4/2010	NA	NA	NA	NA	NA	NA	NA	<5	<5	
EFT-8S		2006	4.89	0.71	4.02	9.62	<1	<3	<4			
		1/4/2010	NA	NA	NA	NA	NA	NA	NA	<5	15.5	
EFT-9S		2006	9.71	<1	6.33	16.04	0.54	<3	0.54			
	1/4/2010	11.2	<1	6.93	18.13	NA	NA	NA	12	10.2		
EFT-10S	2006	1.02	<1	0.811	1.83	1.93	<3	1.93				
	12/30/2009	1.26	<1	1.04	2.30	NA	NA	NA	<5	5.59		
EFT-11I	5/18/2011	<1	<1	<1	<3	2.67	<3	2.67	<5	<5		
EFT-12I	5/18/2011	0.78	<1	0.586	1.37	0.74	<3	0.74	<5	<5		
EFT-13I	5/19/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	8/4/2011	NA	NA	NA	NA	<1	<3	<4	NA	NA		
	8/22/2011	3.34	<1	2.75	6.09	NA	NA	NA	6.97	75.5		
Deep (Bedrock)	Background Wells	EFT-1D	2006	1.67	<1	1.41	3.08	0.91	4.10	5.01		
			1/5/2010	2.04	<1	0.99	3.03	0.57	<3	0.57	<5	<5
		BKG-NTC	2006	1.03	<1	0.30	1.33	0.57	0.73	1.30		
		BKG-RNG	2006	1.16	<1	1.16	2.32	1.42	<3	1.42		
		GW-04	1/13/2010	0.283	<1	0.61	0.89	1.22	<3	1.22		
		GW-04	4/6/2010	0.885	<1	0.582	1.47	0.836	<3	0.84		
		MW-381D	1/13/2010	0.733	<1	0.56	1.29	1.51	<3	1.51	4.11	<5
		MW-393D	1/13/2010	0.673	<1	0.42	1.09	0.70	<3	0.70	<5	8.47
	MW-393D	4/6/2010	0.577	<1	<1	0.58	1.05	<3	1.05			
	UTL (Note 2):					3.08			5.01			
						Assume log-normal data distribution:	5.79		5.65			
						Assume normal data distribution:	3.92		4.83			
	Monitor Wells	GW-01	1/14/2010	<1	<1	<1	0.00	0.83	<3	0.83	<5	<5
		EFT-2D	2006	0.983	<1	<1	0.98	1.03	<3	1.03		
			1/4/2010	NA	NA	NA	NA	NA	NA	NA	<5	5.53
EFT-4D		2006	<1	<1	<1	<3	1.64	1.74	3.38			
EFT-4D (Dup)		2006	<1	<1	<1	<3	0.94	1.03	1.97			
EFT-4D		12/19/2009	NA	NA	NA	NA	NA	NA	NA	<5	5.07	
EFT-5D		2006	<1	<1	<1	<3	2.30	1.26	3.56			
		12/29/2009	<1	<1	<1	<3	2.26	<3	2.26	<5	6.77	
EFT-6D	2006	1.28	<1	<1	1.28	0.77	<3	0.77				
	12/29/2009	<1	<1	0.303	0.30	NA	NA	NA	<5	3.61		
EFT-11D	5/18/2011	<1	<1	<1	<3	2.54	<3	2.54	6.65	<5		
EFT-12D	5/18/2011	<1	<1	<1	<3	3.09	2.62	5.71	<5	11.4		

Notes:

- Values that were used to calculate the UTLs for Deep background
- Values that were used to calculate the UTLs for Shallow background
- New data



Shows the UTLs that are recommended for comparison. Most of the data sets fit a log-normal distribution; although the total radium values in groundwater from the Glacial overburden background wells only fit a normal distribution (the goodness of fit test rejected a log-normal distribution).

Monitor well results that exceed the corresponding UTL

1. Maximum Contaminant Level set by U.S. Environmental Protection Agency. Reference: *National Primary Drinking Water Regulations; Final Rule 65 FR 236; December 7, 2000.*
2. Upper Tolerance Limit for the 90th percentile, 95 % confidence; calculations performed using "*Statistical Software ProUCL 4.0 for Environmental Applications For Data Sets with and without Nondetect Observations*"; USEPA ProUCL Version 4.00.04. Available at: <http://www.epa.gov/esd/tsc/software.htm>
3. Based on Shapiro-Wilk goodness of fit tests, the background Uranium and Radium activity data generally fit both normal and lognormal distributions. Monitoring data were compared to the Upper Tolerance Limits (UTLs) for lognormal data distributions (highlighted yellow) since most environmental data fits this distribution. For Radium in the glacial overburden wells, the data are not lognormal based on the Shapiro-Wilk Test. Monitoring data were compared to the UTL for normal data distributions (highlighted yellow).
4. NA = Not analyzed; NS = Not sampled.
- 5, Sample EFT-13I collected 8/22/11 was analyzed to contain 101 pCi/L of K-40.

**Fermi 1 NRC Docket No. 50-16  
NRC License No. DPR-9**

**Attachment 3 to  
NRC-12-0012**

**“Updated Fermi 1 Groundwater Monitoring Data”**

**Onsite Laboratory Analytical Results**

**EFT-1S**

**2006**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-15060906

Sample Location (Well Number): EFT-15

1. Representative sample collected. Date/Time 06/09/06 / 1002

Sample collected by: Joy Slaback / Joy Marie Slaback <sup>Collection</sup> Date: 06/09/06  
Printed Name / Signature <sub>Signed 02/01/07</sub>

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Friling / Christopher Friling Date: 08/02/06  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Russ Bagan / Russ Bagan Date: 2-5-7  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: William V. Lipton / William V. Lipton Date: 2/15/07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks No tritium detected. William V. Lipton (865) 27152007

**Sample Information**

1. Sample Location	EFT-1S060906
2. Date Sampled	06/09/2006
3. Time Sampled	10:02
4. Sample Volume, (ml)	4 ml

**Instrument Count Data**

1. Date Sample Counted	02/02/2007
2. Time Sample Counted	10:00
3. Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.4 cpm
4. Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3388.1 cpm
Net Spike Count Rate (cpm)	3380.7 cpm
H3 Spike Activity (dpm on count date)	8340.7 dpm
Counter Efficiency	0.4053 cpm/dpm
5. Sample Info:	
Sample Gross Count Rate (cpm)	7.5 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.1 cpm
6. Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.12\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 dpm/uCi x Sample Volume}} < \text{MDA}$$

Technician 

Date 2-5-7

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-15060906

Sample Location (Well Number): EFT-15

1. Representative sample collected. Date/Time 060906 / 1002

Sample collected by: Jay Slezback for Jaybad LLC Date: 06/09/06  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Ersling / Christopher A. Ertz Date: 08/02/06  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Abere Andrew Steen Date: 8-9-06  
Fermi 2 RP Printed Name Signature

Sample number: EFT-15060906

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Abire | Andi Heri Date: 8-9-06  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: KD Lindsay | KD Lindsay Date: 7-21-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-1S060906 EF1

Sample End Time: 9-JUN-2006 10:02:00.00

REMARKS

PERFORMED BY:

*Andrew Yee*

SIGNATURE

REVIEWED BY:

*DP*

2-21-08

SIGNATURE/DATE



Sample ID : EFT-1S060906 EF1

Acquisition date : 9-AUG-2006 15:35:19

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-1S060906 EF1
Sample collection start date: 9-JUN-2006 10:02:00.00
Sample collection end date : 9-JUN-2006 10:02:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : M2LL Operator: AKG

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 9-AUG-2006 15:35:19.75
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:01.02 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 26-APR-2006 11:58:00.00
Kev/channel : 5.00467E-01 Zero offset: -2.61138E-03
Daily cal date : 9-AUG-2006 15:00:39.94

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Table with 11 columns: Pk It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. It contains 3 rows of peak data.

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	510.96	114	48	3.16	1021.29	1011	19	17.2		<i>Amplitude from</i>
0	558.52	45	16	1.58	1116.38	1111	11	22.9		<i>HWC</i>
0	1460.90	98	0	2.12	2921.61	2914	14	10.1		<i>K-40</i>

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	98	10.67*	2.308E+00	5.975E-07	5.975E-07	10.10

Flag: "\*" = Keyline

Total number of lines in spectrum 3  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 3 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	5.975E-07	5.975E-07	0.604E-07	10.10	
Total Activity :			5.975E-07	5.975E-07			

Grand Total Activity : 5.975E-07 5.975E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	803.61	511.00*	193.46	1.000E+35	17.20	Decay
% Abundances			Found = 100.00				
AS-76	26.32H	55.84	559.10*	44.70	2.272E+09	22.87	Decay, Abun.
			563.23	1.17	----	Not Found	----
			571.30	0.14	----	Not Found	----
			657.03	6.10	----	Not Found	----
			665.31	0.39	----	Not Found	----
			740.12	0.12	----	Not Found	----
			771.76	0.12	----	Not Found	----
			867.63	0.12	----	Not Found	----
			1129.87	0.14	----	Not Found	----
			1212.72	1.63	----	Not Found	----
			1216.02	3.84	----	Not Found	----
			1228.52	1.39	----	Not Found	----
			1439.13	0.33	----	Not Found	----
			1453.60	0.13	----	Not Found	----
			1767.67	0.33	----	Not Found	----
% Abundances			Found = 73.70				

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	510.96	114	48	3.16	1021.29	1011	19	6.36E-02	17.2	4.49E+00	T
0	558.52	45	16	1.58	1116.38	1111	11	2.51E-02	22.9	4.31E+00	T

Flags: "T" = Tentatively associated

\* Sample ID : EFT-15060906 EF1 \*

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	24.	477.59	1.7697E-07
F-18	0.	511.00	Half-Life too short
NA-22	12.	1274.54	1.1822E-08
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	16.	889.25	1.7705E-08
CR-51	41.	320.00	4.3041E-07
MN-54	14.	834.83	1.0922E-08
CO-56	14.	1238.25	2.9896E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	0.	158.38	Half-Life too short
CO-57	40.	122.06	1.2488E-08
CO-58	14.	810.76	1.6683E-08
FE-59	12.	1099.22	4.8006E-08
CO-60	16.	1332.49	1.3478E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	11.	1115.52	2.3866E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	36.	136.00	1.9336E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	41.	513.99	2.5642E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	41.	513.99	2.1146E-08
RB-86	8.	1076.63	9.7003E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	3.	1836.01	1.1868E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	12.	1204.90	7.3634E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT-15060906 EF1

Acquisition date : 9-AUG-2006 15:35:19

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	14.	702.63	8.0278E-09
NB-95	15.	765.79	3.0162E-08
NB-95M	0.	235.69	Half-Life too short
ZR-95	20.	756.72	3.5502E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	20.	497.08	2.5753E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	19.	621.84	9.6590E-08
CD-109	37.	88.03	4.3515E-07
AG-110M	14.	937.48	3.6420E-08
SN-113	28.	391.69	1.8177E-08
SN-117M	51.	158.56	2.3137E-07
SB-122	0.	563.93	Half-Life too short
SB-124	26.	602.71	1.9515E-08
SB-125	30.	427.89	3.0765E-08
TE-125M	47.	109.28	8.3415E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	31.	57.60	3.4039E-05
XE-127	61.	202.84	4.6039E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	16.	695.88	8.9866E-07
XE-129M	32.	196.56	1.8013E-05
I-130	0.	536.09	Half-Life too short
BA-131	39.	123.80	1.1255E-06
I-131	25.	364.48	1.8180E-06
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	39.	163.93	1.4195E-05
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	30.	302.84	4.4471E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	24.	604.70	1.0018E-08
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short



Sample ID : EFT-1S060906 EF1

Acquisition date : 9-AUG-2006 15:35:19

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	14.	818.50	2.3376E-07
I-136	0.	1313.02	Half-Life too short
CS-137	17.	661.65	9.7049E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	44.	165.85	1.3835E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	24.	537.32	9.6135E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	56.	145.44	7.2092E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	35.	133.54	8.5640E-08
FR-144	0.	1489.15	Half-Life too short
ND-147	34.	91.10	2.2563E-06
FM-148M	16.	550.27	2.1687E-08
EU-152	32.	344.27	3.1639E-08
EU-154	6.	1004.76	4.2683E-08
EU-156	20.	646.29	1.9909E-06
HF-181	27.	482.03	2.8710E-08
TA-182	8.	1221.42	4.8405E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	43.	279.19	2.9068E-08
BI-207	28.	569.67	9.7898E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	47.	186.21	2.5865E-07
AC-228	35.	338.32	7.7258E-08
TH-228	40.	84.37	1.4798E-06
PA-234	0.	131.20	Half-Life too short
TH-234	37.	63.29	6.9231E-06
U-235	57.	143.76	9.0809E-08
NP-239	0.	106.13	Half-Life too short
AM-241	32.	59.54	1.8029E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-15 121506

Sample Location (Well Number): EFT-15

1. Representative sample collected. Date/Time 12/15/06 1 0859

Sample collected by: J. Slaback / [Signature] Date: 02/01/07  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / [Signature] Date: 2/2/07  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: D. Howard / [Signature] Date: APR 20 2007  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KD LINDSAY / [Signature] Date: 11-14-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

Sample Information

1 . Sample Location	S nr 10/13/09 EFT-17121506
2 . Date Sampled	12/15/2006
3 . Time Sampled	08:59
4 . Sample Volume, (ml)	4 ml

Instrument Count Data

1 . Date Sample Counted	04/19/2007
2 . Time Sample Counted	18:07
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.7 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3407.6 cpm
Net Spike Count Rate (cpm)	3399.9 cpm
H3 Spike Activity (dpm on count date)	8243.8 dpm
Counter Efficiency	0.4124 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	8.8 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	1.1 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

Minimum Detectable Activity

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.12\text{E}-06 \text{ uCi/ml}$$

Sample Activity

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician *Am/ruand* Date APR 20 2007

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-15 121506

Sample Location (Well Number): EFT-15

1. Representative sample collected. Date/Time 12/15/06 1 0859

Sample collected by: J. Slaback / Jay Marie Slaback Date: 02/01/07  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 7/11/07  
~~2/2/07~~ <sup>7/11/07</sup>  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: RD Lindsay / RD Lindsay Date: 8-8-07  
Fermi 2 RP Printed Name Signature

Sample number: EFT-15 121506

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard [Signature] Date: 7-17-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: KD LINDSEY [Signature] Date: 8-8-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

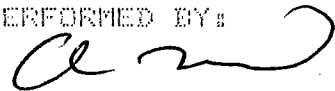
RADIATION PROTECTION DEPARTMENT  
GAMMA SPECTROSCOPY ANALYSIS REPORT  
HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1 EFT-18121506

Sample End Time: 15-DEC-2006 08:59:00.00

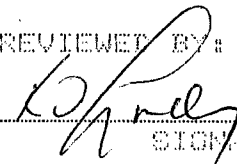
REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:



SIGNATURE

REVIEWED BY:



8-8-07

SIGNATURE/DATE

Sample ID : EF1 EFT-1S121506

Acquisition date : 17-JUL-2007 13:56:58

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-1S121506  
 Sample collection/start date: 15-DEC-2006 08:59:00.00  
 Sample collection end date : 15-DEC-2006 08:59:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.000000E+03 CC  
 Sample geometry : MELL Operator: CMH

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 17-JUL-2007 13:56:58.35  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:00.90 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16  
 KeV/channel : 4.99739E-01 Zero offset: -1.07317E-01  
 Daily cal date : 17-JUL-2007 08:15:42.31

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	140.92	49	06	1.11	292.37	278	12	2.71E-02	40.8	RN 223
2	1	509.55	48	15	1.76	1020.00	1015	16	2.64E-02	29.3	2.03E+00
3	1	511.55	114	13	1.76	1024.00	1015	16	6.33E-02	12.6	down detection
4	0	550.95	64	32	1.24	1110.06	1113	11	3.57E-02	21.7	HVC
5	0	609.76	48	34	1.02	1220.53	1211	15	2.23E-02	35.2	Bi 214
6	0	1377.68	23	3	1.56	2757.16	2750	12	1.26E-02	26.0	
7	0	1461.05	55	8	1.13	2924.00	2915	16	3.04E-02	17.8	K-40

5

## Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	140.92	49	06	1.11	282.37	270	12	40.8		
1	509.55	40	15	1.76	1020.00	1015	16	29.3	2.03E+00	
1	511.55	114	13	1.76	1024.00	1015	16	12.6		
0	550.95	64	32	1.24	1118.06	1113	11	21.7		
0	609.76	40	34	1.02	1220.53	1211	15	35.2		
0	1377.68	23	3	1.56	2757.16	2750	12	26.0		
0	1461.05	55	0	1.13	2924.00	2915	16	17.0		K-40



Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/CC	Decay Corr uCi/CC	1-Sigma %Error
K-40	1460.81	55	10.67*	2.501E+00	3.075E-07	3.075E-07	17.03

Flag: "\*" = Keyline

Summary of Nuclide Activity  
Sample ID : EF1 EFT-13121506

Page : 3  
Acquisition date : 17-JUL-2007 13:50:52

Total number of lines in spectrum 7  
Number of unidentified lines 0  
Number of lines tentatively identified by MID 7 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/CC	Decay Corr uCi/CC	Decay Corr 1-Sigma Error	1-Sigma MError	Flags
K-40	1.00E+03Y	1.00	3.075E-07	3.075E-07	0.548E-07	17.93	
Total Activity :			3.075E-07	3.075E-07			

Grand Total Activity : 3.075E-07 3.075E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Sample ID : CF1 EFT-10101500

Acquisition date : 17-JUL-2007 13:56:50

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/CC)	1-Sigma %Error	Rejected by
F-18	109.74M	2010.94	511.00*	100.00	1.0000E+35	12.57	Decay
% Abundances Found = 100.00							
SC-46	83.83D	2.56	142.53	62.70	1.069E-07	40.82	Abun.
			889.25*	99.98	----	Not Found	----
			1120.51	99.99	----	Not Found	----
% Abundances Found = 23.87							
FE-59	44.63D	4.80	142.65	1.03	3.004E-05	40.82	Abun.
			192.34	3.11	----	Not Found	----
			1099.22*	56.50	----	Not Found	----
			1291.56	43.20	----	Not Found	----
% Abundances Found = 0.99							
AS-76	26.32H	195.33	559.10*	44.70	1.0000E+35	21.67	Decay, Abun.
			563.23	1.17	----	Not Found	----
			571.30	0.14	----	Not Found	----
			657.03	6.10	----	Not Found	----
			665.31	0.39	----	Not Found	----
			740.12	0.12	----	Not Found	----
			771.76	0.12	----	Not Found	----
			867.63	0.12	----	Not Found	----
			1129.87	0.14	----	Not Found	----
			1212.72	1.63	----	Not Found	----
			1216.02	3.04	----	Not Found	----
			1228.52	1.39	----	Not Found	----
			1439.13	0.33	----	Not Found	----
			1453.60	0.13	----	Not Found	----
			1787.67	0.33	----	Not Found	----
% Abundances Found = 73.70							
ZR-97	16.90H	304.21	254.15	1.25	----	Not Found	Decay, Abun.
			355.39	2.27	----	Not Found	----
			507.63	5.30	1.0000E+35	29.27	
			602.52	1.39	----	Not Found	----
			743.36*	98.00	----	Not Found	----
			1021.30	1.21	----	Not Found	----
			1147.95	2.60	----	Not Found	----
			1362.66	1.35	----	Not Found	----
			1750.46	1.35	----	Not Found	----
% Abundances Found = 4.62							
MO-99	66.02H	77.87	140.51	3.00	0.3000E+16	40.82	Decay, Abun.
			181.06	6.20	----	Not Found	----
			366.43	1.37	----	Not Found	----
			739.50*	12.00	----	Not Found	----
			770.00	4.50	----	Not Found	----
% Abundances Found = 13.25							
TC-99M	6.02H	854.02	140.50*	99.07	1.0000E+35	40.82	Decay
% Abundances Found = 100.00							

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity 1-Sigma (uCi/CC)	%Error	Rejected by
RU-103	39.35D	5.44	497.00*	89.00	---	---	Abun.
			610.33	5.60	1.030E-05	35.24	
			% Abundances Found =		5.92		
XE-135	9.11H	564.35	249.79*	89.90	---	---	Decay, Abun.
			600.19	2.89	1.000E+35	35.24	
			% Abundances Found =		3.11		
PM-148M	41.30D	5.19	200.11	12.56	---	---	Abun.
			414.07	10.66	---	---	
			432.70	5.35	---	---	
			501.26	6.75	---	---	
			550.27*	94.90	---	---	
			599.74	12.54	---	---	
			611.26	5.40	0.070E-06	35.24	
			629.97	89.00	---	---	
			725.70	32.00	---	---	
			915.33	17.17	---	---	
			1013.01	20.30	---	---	
% Abundances Found =		1.74					
BI-214	19.90M	15501.15	609.31*	46.30	1.000E+35	35.24	Decay
			760.36	5.04	---	---	
			934.06	3.21	---	---	
			1120.29	15.10	---	---	
			1230.11	5.94	---	---	
			1377.67	4.11	1.000E+35	26.00	
			1764.49	15.00	---	---	
% Abundances Found =		52.79	(Abn. Limit = 40.48%)				

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EF1 EFT-1S121506

Page : 6  
Acquisition date : 17-JUL-2007 13:56:59

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	140.92	49	86	1.11	282.37	278	12	2.71E-02	40.8	6.42E+00	T
1	509.55	48	15	1.76	1020.00	1015	16	2.64E-02	29.3	4.89E+00	T
1	511.55	114	13	1.76	1024.00	1015	16	6.33E-02	12.6	4.88E+00	T
0	558.95	64	32	1.24	1119.86	1113	11	3.57E-02	21.7	4.68E+00	T
0	609.76	40	34	1.02	1220.53	1211	15	2.23E-02	35.2	4.52E+00	T
0	1377.68	23	3	1.56	2757.16	2750	12	1.26E-02	26.0	2.58E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/CC)
BE-7	21.	477.59	1.1050E-06
F-18	0.	511.00	Half-Life too short
NA-22	7.	1274.54	9.5500E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	9.	889.25	4.5522E-08
CR-51	34.	320.00	1.6415E-05
MN-54	11.	934.83	1.2429E-08
CO-56	10.	1238.25	9.2984E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	0.	158.30	Half-Life too short
CO-57	37.	122.06	1.6104E-08
CO-58	11.	810.76	6.1000E-08
FE-59	7.	1099.22	3.7519E-07
CO-60	3.	1332.49	6.6331E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	9.	1115.52	3.1124E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	45.	136.00	4.7077E-08
AG-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	31.	513.99	2.1435E-06
KR-85M	0.	151.10	Half-Life too short
SR-85	31.	513.99	8.8274E-08
RB-86	0.	1076.63	Half-Life too short
KR-87	0.	402.58	Half-Life too short
GR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	1.	1836.01	2.0262E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	6.	1204.90	3.2658E-05
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1303.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EF1 EFT-18121506

Acquisition date : 17-JUL-2007 13:56:50

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/CC)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NE-94	17.	702.63	8.0168E-09
NE-95	9.	765.79	4.6130E-07
NE-95M	0.	235.69	Half-Life too short
ZR-95	13.	756.72	1.4278E-07
NE-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	24.	497.08	3.7883E-07
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.58	Half-Life too short
RU-106	16.	621.04	1.0935E-07
CD-109	39.	88.03	4.9956E-07
AG-110M	10.	937.48	4.3973E-08
SN-113	21.	391.69	3.6661E-08
SN-117M	0.	158.56	Half-Life too short
SB-122	0.	563.93	Half-Life too short
SB-124	19.	602.71	9.0723E-08
SB-125	23.	427.89	2.8015E-08
TE-125M	36.	109.28	4.1690E-05
TE-127	0.	417.90	Half-Life too short
TE-127M	27.	57.00	8.8823E-05
XE-127	54.	202.84	7.3002E-07
TE-129	0.	459.60	Half-Life too short
TE-129M	22.	695.88	2.2000E-05
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	0.	123.80	Half-Life too short
I-131	0.	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	0.	163.93	Half-Life too short
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	34.	302.04	4.3587E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	19.	604.70	9.5854E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page 4 3

Sample ID : EF1 EFT-18121506

Acquisition date : 17 JUL 2007 13:56:50

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/CC)
CS-136	0.	818.50	Half-Life too short
I-136	0.	1313.02	Half-Life too short
CS-137	13.	661.65	7.9235E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	41.	165.85	2.6612E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	0.	537.32	Half-Life too short
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	42.	145.44	1.5860E-06
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	40.	133.54	1.2115E-07
PR-144	0.	1489.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PM-148M	16.	550.27	2.5843E-07
EU-152	35.	344.27	3.0834E-08
EU-154	11.	1004.76	5.2399E-08
EU-156	0.	646.29	Half-Life too short
HF-181	15.	482.83	2.4796E-07
TA-182	7.	1221.42	1.0927E-07
W-187	0.	695.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HO-203	44.	279.19	2.5434E-07
BI-207	30.	569.67	9.4997E-09
TL-208	0.	503.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	46.	186.21	2.3433E-07
AC-228	26.	338.32	6.4710E-08
TH-228	28.	84.37	1.3156E-06
PA-234	0.	131.20	Half-Life too short
TH-234	32.	63.29	4.9623E-04
U-235	46.	143.76	7.5501E-08
NP-239	0.	106.13	Half-Life too short
AM-241	29.	59.54	1.6900E-07



**EFT-1S**

**2007**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-157307

Sample Location (Well Number): EFT-15

1. Representative sample collected. Date/Time 7/3/07 0937

Sample collected by: Joy Marie Slaback / Joy Marie Slaback Date: 12/10/2007  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 12/10/07  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: R. Burgess / [Signature] Date: 12/14/07  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KD Lindsay / KD Lindsay Date: 2-26-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location 1S  
 2 . Date Sampled 07/03/2007  
 3 . Time Sampled 09:37  
 4 . Sample Volume, (ml) 4 ml

**Instrument Count Data**

1 . Date Sample Counted 12/14/2007  
 2 . Time Sample Counted 08:00  
 3 . Background Inf.:  
     Minutes Counted 10 min.  
     Background Count Rate (cpm) 8.2 cpm  
 4 . Efficiency Inf.: (Daily Spike Source ID # 111)  
     Gross Spike Count Rate (cpm) 3189.3 cpm  
     Net Spike Count Rate (cpm) 3181.1 cpm  
     H3 Spike Activity (dpm on count date) 7944.9 dpm  
     Counter Efficiency 0.4004 cpm/dpm  
 5 . Sample Info:  
     Sample Gross Count Rate (cpm) 7.6 cpm  
     Sample Count Time (min.) 10.0 min.  
     Net Sample Count Rate (cpm) 0.0 cpm  
 6 . Critical Level:  
     Critical Level Count Rate (cpm) 2.1 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.19\text{E}-06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician \_\_\_\_\_



Date

12/14/07

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-157307

Sample Location (Well Number): EFT-15

1. Representative sample collected. Date/Time 07/03/2007 0937

Sample collected by: J. Slaback / Joy Marie Slaback Date: 07/16/2007  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 7/16/2007  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: KD Lindsay / KD Lindsay Date: 8-8-07  
Fermi 2 RP Printed Name Signature

Sample number: EFT-157307

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard [Signature] Date: 7-18-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System.  
If so, verify the critical levels and LLDs and count sample in accordance  
with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or  
delegate.

Performed by: RO Lindsay [Signature] Date: 8-8-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological  
Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Numbers: EF1 EFT-157307

Sample End Timer: 3-JUL-2007 09:37:00.00

REMARKS

PERFORMED BY:

*[Handwritten Signature]*

SIGNATURE

REVIEWED BY:

*[Handwritten Signature]* 8-8-07

SIGNATURE/DATE

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-107307  
Sample collection start date: 3-JUL-2007 09:37:00.00  
Sample collection end date : 3-JUL-2007 09:37:00.00  
Type of sample : 1 L Mari. Liquid  
Sample quantity : 1.00000E+03 cc  
Sample geometry : M2LL Operator: CMH

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 10-JUL-2007 11:19:34.68  
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
Elapsed real time : 0 00:30:00.92 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 8 Yearly cal date : 20-JUN-2007 12:16:46.16  
Kev/channel : 4.99749E-01 Zero offset: -1.04251E-01  
Daily cal date : 10-JUL-2007 07:51:31.39

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
Abundance limit : 75.00000 Library : dacmaster.nlb  
Efficiency file : EFFD4\_m2ll Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	66.49	44	64	0.99	133.41	127	11	2.47E-02	37.0	RN 227
2	0	352.71	54	42	1.49	706.13	699	13	2.99E-02	28.4	PB 214
3	1	510.44	98	29	2.13	1021.74	1016	17	4.97E-02	17.3	2.01E+00
4	1	512.27	75	24	1.75	1025.40	1016	17	4.19E-02	20.1	annihilation
5	0	550.54	76	21	0.99	1117.99	1111	17	4.25E-02	17.9	Hu c
6	0	609.41	46	19	0.78	1219.78	1214	11	2.57E-02	23.5	B1 214
7	0	1120.40	22	2	1.43	2242.34	2237	10	1.20E-02	25.5	
8	0	1460.69	62	17	1.50	2923.10	2915	17	3.44E-02	19.8	K 40

3

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	66.49	44	64	0.99	133.41	127	11	37.0		
0	352.71	54	42	1.49	706.13	699	13	28.4		
1	510.44	90	29	2.13	1021.74	1016	17	17.3	2.01E:00	
1	512.27	75	24	1.75	1025.40	1016	17	20.1		SR-85 KR-85
0	558.54	76	21	0.89	1117.99	1111	17	17.9		
0	609.41	46	19	0.78	1219.79	1214	11	23.5		
0	1120.46	22	2	1.43	2242.34	2237	10	25.5		
0	1460.69	62	17	1.50	2923.10	2915	17	19.8		K-40



Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	62	10.67*	2.501E+00	3.488E-07	3.488E-07	19.04

Nuclide Type: fission gas

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
KR-85	513.99	75	0.43*	4.874E+00	5.487E-06	5.422E-06	20.12

Nuclide Type: activation

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
SR-85	513.99	75	99.27*	4.874E+00	2.342E-06	2.752E-06	20.12

Flag: "\*" = Keyline

Total number of lines in spectrum 8  
 Number of unidentified lines 0  
 Number of lines tentatively identified by NID 8 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma XError	Flags
K-40	1.00E+05Y	1.00	3.408E-07	3.408E-07	0.692E-07	19.94	
Total Activity :			3.408E-07	3.408E-07			

Nuclide Type : fission gas

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma XError	Flags
KR-85	10.72Y	1.00	5.407E-06	5.422E-06	1.091E-06	20.12	
Total Activity :			5.407E-06	5.422E-06			

Nuclide Type : activation

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma XError	Flags
SR-85	64.64D	1.17	2.342E-08	2.752E-08	0.554E-08	20.12	
Total Activity :			2.342E-08	2.752E-08			

Grand Total Activity : 5.779E-06 5.790E-06

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Isotope	Half-life	Ratio	Energy	%Abund	Activity (uCi/cc)	%Error	Rejected by
F-18	109.74M	107.98	511.00*	100.46	1.000E+35	17.25	Decay
		% Abundances	Found = 100.00				
SC-46	83.83D	0.10	142.53	62.70	---- Not Found ----		Abun.
			889.25*	99.90	---- Not Found ----		
			1120.51	99.99	1.265E-08	25.51	
		% Abundances	Found = 38.07				
SE-75	119.78D	0.13	66.05	1.02	4.983E-06	37.70	Abun.
			96.73	3.41	---- Not Found ----		
			121.12	16.70	---- Not Found ----		
			136.00*	59.20	---- Not Found ----		
			198.60	1.45	---- Not Found ----		
			264.65	59.80	---- Not Found ----		
			279.53	25.20	---- Not Found ----		
			303.91	1.32	---- Not Found ----		
			400.65	11.40	---- Not Found ----		
		% Abundances	Found = 0.57				
AS-76	26.32H	13.75	559.10*	44.70	7.565E-04	17.90	Decay, Abun.
			563.33	1.17	---- Not Found ----		
			571.30	0.14	---- Not Found ----		
			657.03	6.10	---- Not Found ----		
			665.31	0.39	---- Not Found ----		
			740.12	0.12	---- Not Found ----		
			771.76	0.12	---- Not Found ----		
			867.63	0.12	---- Not Found ----		
			1129.07	0.14	---- Not Found ----		
			1212.72	1.63	---- Not Found ----		
			1216.02	3.84	---- Not Found ----		
			1228.52	1.39	---- Not Found ----		
			1439.13	0.33	---- Not Found ----		
			1453.60	0.13	---- Not Found ----		
			1787.67	0.33	---- Not Found ----		
		% Abundances	Found = 73.70				
KR-90	32.32S	40317.30	121.92	32.00	---- Not Found ----		Decay, Abun.
			539.49	29.00	---- Not Found ----		
			1118.69*	37.00	1.000E+35	25.51	
		% Abundances	Found = 37.76				
RU-103	39.35D	0.30	497.00*	89.00	---- Not Found ----		Abun.
			610.33	5.00	3.574E-07	23.52	
		% Abundances	Found = 5.92				
XE-135	9.11H	39.73	249.70*	89.90	---- Not Found ----		Decay, Abun.
			600.19	2.89	4.848E+05	23.52	
		% Abundances	Found = 3.11				
CS-130	13.16D	1.15	66.91	12.50	0.246E-07	37.70	Abun.
			80.29	6.30	---- Not Found ----		
			153.23	7.46	---- Not Found ----		

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
CS-136	13.16D	1.15	163.89	4.61	----	Not Found	Abun.
			176.55	13.56	----	Not Found	
			273.65	12.66	----	Not Found	
			340.57	48.50	----	Not Found	
			818.50*	99.70	----	Not Found	
			1048.07	79.60	----	Not Found	
			1235.34	19.70	----	Not Found	
% Abundances Found =			4.10				
PM-146M	41.30D	0.37	288.11	12.56	----	Not Found	Abun.
			414.87	10.66	----	Not Found	
			432.78	5.35	----	Not Found	
			501.26	6.75	----	Not Found	
			550.27*	94.90	----	Not Found	
			590.74	12.54	----	Not Found	
			611.26	5.48	3.606E-07	23.52	
			629.97	89.00	----	Not Found	
			725.70	32.00	----	Not Found	
915.33	17.17	----	Not Found				
1013.81	20.30	----	Not Found				
% Abundances Found =			1.74				
TA-182	114.74D	0.13	67.75	42.30	1.206E-07	37.70	Abun.
			100.10	14.10	----	Not Found	
			1189.05	16.30	----	Not Found	
			1221.42*	27.10	----	Not Found	
			1230.97	11.50	----	Not Found	
% Abundances Found =			38.01				
BI-214	19.90M	1091.34	609.31*	46.30	1.000E+35	23.52	Decay
			768.36	5.04	----	Not Found	
			934.06	3.21	----	Not Found	
			1120.09	15.10	1.000E+35	25.51	
			1238.11	5.94	----	Not Found	
			1377.67	4.11	----	Not Found	
			1764.49	15.80	----	Not Found	
% Abundances Found =			64.29	(Abn. Limit = 40.40%)			
PB-214	26.80M	810.36	87.30	4.67	----	Not Found	Decay
			241.98	7.49	----	Not Found	
			295.21	19.20	----	Not Found	
			351.92*	37.20	1.000E+35	20.42	
			785.91	1.10	----	Not Found	
% Abundances Found =			53.40	(Abn. Limit = 37.20%)			

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	66.49	44	64	0.99	133.41	127	11	2.47E-02	37.0	1.43E+00	T
0	352.71	54	42	1.49	706.13	699	13	2.99E-02	20.4	5.69E+00	T
1	510.44	90	29	2.13	1021.74	1016	17	4.97E-02	17.3	4.30E+00	T
0	550.54	70	21	0.89	1117.99	1111	17	4.25E-02	17.9	4.69E+00	T
0	699.41	46	19	0.70	1219.70	1214	11	2.57E-02	23.5	4.50E+00	T
0	1120.46	22	2	1.43	2242.34	2237	10	1.20E-02	25.5	2.90E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Backgd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	21.	477.59	8.3486E-08
F-18	0.	511.00	Half-Life too short
NA-22	2.	1274.54	5.5124E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1814.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	13.	809.25	1.0120E-08
CR-51	23.	320.00	9.3556E-09
MN-54	12.	834.83	8.4202E-09
CO-56	24.	1239.25	2.3604E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	47.	158.30	4.3068E-08
CO-57	53.	122.00	1.1435E-08
CO-58	17.	818.76	1.0676E-08
FE-59	6.	1099.22	1.6167E-08
CO-60	8.	1332.49	9.3011E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	6.	1115.52	1.5310E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	35.	136.00	1.3220E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85M	0.	151.10	Half-Life too short
RE-86	8.	1076.63	1.5072E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RE-90	0.	1382.39	Half-Life too short
Y-90	6.	1036.01	1.0638E-08
KR-89	0.	228.90	Half-Life too short
RE-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.09	Half-Life too short
RE-90	0.	831.69	Half-Life too short
RE-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	17.	1204.90	4.7167E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
ND-94	18.	702.63	8.2226E-09
NE-95	10.	765.79	9.4410E-09
NE-95M	34.	235.09	5.1200E-07
ZR-95	15.	756.72	1.7524E-08
NE-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
NO-99	15.	709.50	2.7811E-06
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	20.	497.08	1.0471E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	13.	621.04	6.9200E-08
CD-109	37.	88.03	3.6339E-07
AG-110M	12.	937.48	2.6976E-08
SN-113	21.	391.69	1.1169E-08
SN-117M	49.	158.56	1.9810E-08
SD-122	15.	563.93	4.4747E-07
SB-124	34.	602.71	1.2019E-08
SD-125	22.	427.09	2.4160E-08
TE-125M	40.	109.20	4.0212E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	38.	57.60	2.9070E-05
XE-127	37.	202.04	1.3929E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	17.	695.00	3.2730E-07
XE-129M	54.	196.56	5.7416E-07
I-130	0.	536.09	Half-Life too short
BA-131	40.	123.00	6.0587E-08
I-131	31.	364.40	3.4398E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	52.	163.93	1.0023E-06
I-132	0.	667.69	Half-Life too short
TE-132	37.	220.16	2.0632E-07
BA-133	31.	302.04	4.0036E-08
BA-133M	43.	276.09	2.0207E-05
I-133	0.	529.07	Half-Life too short
TE-133M	0.	912.59	Half-Life too short
XE-133	39.	81.00	3.3155E-07
XE-133M	36.	233.22	0.3570E-06
CS-134	28.	604.70	9.4733E-09
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	349.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short
CS-136	9.	018.50	1.5545E-08
I-136	0.	1313.02	Half-Life too short

Sample ID : EPI EFT-197307

Acquisition date : 18 JUL-2007 11:19:34

Nuclide	Backgrd Sum	Energy (keV)	MDA (uCi/cc)
CS-137	14.	661.65	8.1314E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1428.58	Half-Life too short
CE-139	49.	165.05	1.0570E-08
CS-139	0.	1203.23	Half-Life too short
BA-140	22.	537.32	7.8370E-08
LA-140	9.	1596.49	5.6243E-06
BA-141	0.	198.22	Half-Life too short
CE-141	48.	145.44	2.3003E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	43.	133.54	7.6771E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	26.	91.10	9.7248E-08
PM-148M	28.	558.27	1.0069E-08
EU-152	29.	344.27	2.7608E-08
EU-154	11.	1004.76	5.8336E-08
EU-156	12.	646.29	1.7893E-07
HF-191	19.	482.83	1.8558E-08
TA-182	11.	1221.42	3.9246E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.83	Half-Life too short
HG-203	45.	279.19	1.3319E-08
BI-207	20.	560.67	7.7944E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	56.	248.98	4.8551E-06
RA-226	45.	106.21	2.3174E-07
AC-228	36.	338.32	6.9888E-08
TH-228	38.	84.37	1.2353E-06
PA-234	0.	131.20	Half-Life too short
TH-234	34.	63.29	1.6610E-06
U-235	47.	143.76	7.5970E-08
NP-239	34.	106.13	3.4004E-06
AM-241	32.	59.54	1.7901E-07



**EFT-1S**

**2008**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-1541508

Sample Location (Well Number): EFT-15

1. Representative sample collected. Date/Time 4/15/08 1 1400

Sample collected by: Joy Marie Slaback / Joy Marie Slaback Date: 04/21/2008  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 4/21/08  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Ross Burnett / [Signature] Date: 4-22-08  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KD Lindsey / KD Lindsey Date: 4-28-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

\_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-1S41508
2 . Date Sampled	04/15/2008
3 . Time Sampled	14:00
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	04/21/2008
2 . Time Sample Counted	21:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.8 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3020.9 cpm
Net Spike Count Rate (cpm)	3013.1 cpm
H3 Spike Activity (dpm on count date)	7788.2 dpm
Counter Efficiency	0.3869 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	8.2 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.4 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.20\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 uCi/ml x Sample Volume}} < \text{MDA}$$

Technician 

Date 4-22-08

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-15 41508

Sample Location (Well Number): EFT-15

1. Representative sample collected. Date/Time 4/15/08 1 1400

Sample collected by: Joy Marie Slaback / Joy Marie Slaback Date: 4/21/2008  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 4/21/08  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: J. Southward / J. Southward Date: 4/22/08  
Fermi 2 RP Printed Name Signature

Sample number: EFT-1541508

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: J. Southward / J. Southward Date: 4/22/08  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: \_\_\_\_\_ / \_\_\_\_\_ Date: \_\_\_\_\_  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DETROIT EDISON FERMI-2 POWER PLANT

02 APR 2000 10:12:55.71

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Numbers: EFT-10\*1500

Sample End Time: 15-APR-2000 14:50:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*J. Sutherland*  
SIGNATURE

REVIEWED BY:

*W. Radey* 4.24.00  
SIGNATURE/DATE

Sample ID : ETT-1341500

Acquisition date : 22 APR-2000 11:42:30

Faird 2 Radiation Protection Gamma Spectroscopy Report

Sample Parameters

Sample ID Number: ETT-1341500  
 Sample collection start date: 15-APR-2000 14:00:00.00  
 Sample collection end date : 15-APR-2000 14:00:00.00  
 Type of sample : 1 L Marin. Liquid  
 Sample quantity : 1.000000E+03 cc  
 Sample geometry : BELL Operator: JHG

Acquisition Parameters

Detector number : DET 4 Acquire date : 22-APR-2000 11:42:35.91  
 Project live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:00.94 Percent dead time : 0.02 %

Calibration Parameters

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:10:46.10  
 KeV/channel : 5.00109E-01 Zero offset: -1.47005E-01  
 Daily cal date : 22-APR-2000 06:30:50.32

Peak Search Parameters

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

Nuclide Identification Parameters

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.lib  
 Efficiency file : eFFD4\_mell Efficiencies at : Peak energy

PK	Id	Energy	Area	Exgnd	FWHM	Channel	Left	Pu	Std/Sec	XLrr	FIL
1	0	511.31	134	44	1.34	1622.50	1015	16	7.40E-02	11.0	
2	0	359.07	43	37	0.99	1117.99	1110	17	2.30E-02	37.7	
3	0	510.23	20	28	1.51	1220.33	1014	15	1.50E-02	47.1	
4	0	741.25	13	6	0.93	1493.40	1477	11	6.34E-03	46.0	
5	0	1461.13	32	9	1.98	2921.20	2915	13	1.01E-02	26.4	

Sample Title # EFT-18-1500  
Decay Time # 6 21:42:00.01

Page # 1  
Acquisition Time # 22-SEP-2006 11:12:00.0

Post-MID Peak Search Report

It	Energy	Area	Height	FWHM	Channel	Left	FW	SE, %	Fit	Isotopes
0	511.51	134	44	1.34	1022.50	1015	10	14.0		<i>Annals HWC D. 214 <del>IR-97</del> 7.24-18 K-40</i>
0	550.87	43	37	0.90	1117.09	1110	17	37.7		
0	610.29	29	20	1.51	1220.37	1214	15	47.1		
0	741.05	13	5	3.03	1403.40	1477	11	45.0		
0	1461.13	33	9	1.90	2921.30	2915	13	26.4		



Nuclide Line Activity Report  
 Sample ID : EFT-1841500

Page : 2  
 Acquisition date : 22 APR 2006 11:43:30

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	NEff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma NEff
K-40	1460.81	33	10.37%	2.591E+00	1.032E-07	1.032E-07	25.35

Nuclide Type: fission

Nuclide	Energy	Area	%Abn	NEff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma NEff
U-235	254.15	-----	1.25	6.271E+00	-----	Line Not Found	-----
	355.39	-----	2.27	5.680E+00	-----	Line Not Found	-----
	507.63	-----	5.30%	4.093E+00	-----	Line Not Found	-----
	592.52	-----	1.30	4.539E+00	-----	Line Not Found	-----
	743.36	13	90.00%	3.895E+00	4.917E-09	4.444E-09	46.34
	1021.30	-----	1.21	3.044E+00	-----	Line Not Found	-----
	1147.95	-----	2.60	2.864E+00	-----	Line Not Found	-----
	1362.66	-----	1.38	2.528E+00	-----	Line Not Found	-----
	1750.46	-----	1.05	2.266E+00	-----	Line Not Found	-----

Flag: "X" = Keyline

Summary of Nuclide Activity  
 Sample ID : FFT-1041500

Page 0. 3  
 Acquisition Date : 22 APR 2020 12:12:30

Total number of lines in spectrum : 5  
 Number of unidentified lines : 0  
 Number of lines tentatively identified by MID : 5 100.00%

Nuclide Type : natural

Nuclide	Half-life	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error Flags
K 40	1.20E+05Y	1.00	1.832E-07	1.832E-07	0.483E-07	26.36
Total Activity :			1.832E-07	1.832E-07		

Nuclide Type : fission

Nuclide	Half-life	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error Flags
ZR-97	16.90H	004.	4.917E-09	4.444E-08	2.846E-08	45.04
Total Activity :			4.917E-09	4.444E-08		

GrandTotal Activity : 1.881E-07 4.627E-08

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Rejected Report  
 Sample ID : EFT-1541508

Page : 4  
 Acquisition date : 22-APR-2000 11:42:00

Nuclide	Half-life	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
		Ratio	%			(uCi/cc)	%Err	
F-18	109.74d	98.7%		511.00	100.00	4.403E+19	14.01	Decay
		% Abundances		Found = 100.00				
AS-76	26.32h	6.31		559.10*	44.70	2.486E-06	37.71	Abun.
				563.82	1.17	---	Not Found	---
				571.30	0.14	---	Not Found	---
				657.03	6.10	---	Not Found	---
				665.31	0.39	---	Not Found	---
				740.12	0.12	3.170E-04	46.04	---
				771.76	0.12	---	Not Found	---
				867.63	0.12	---	Not Found	---
				1129.07	0.14	---	Not Found	---
				1212.72	1.63	---	Not Found	---
				1216.02	3.84	---	Not Found	---
				1226.52	1.39	---	Not Found	---
				1439.13	0.33	---	Not Found	---
				1453.00	0.13	---	Not Found	---
				1707.07	0.33	---	Not Found	---
		% Abundances		Found = 73.90				
RU-100	39.25d	0.15		497.00*	89.00	---	Not Found	Abun.
				610.32	5.60	1.847E-07	47.14	---
		% Abundances		Found = 5.92				
TC-134	41.00m	230.22		79.45	21.00	---	Not Found	Decay, Abun.
				106.09	10.00	---	Not Found	---
				201.24	9.70	---	Not Found	---
				210.47*	21.90	---	Not Found	---
				277.95	21.30	---	Not Found	---
				435.06	10.60	---	Not Found	---
				461.60	10.00	---	Not Found	---
				464.64	5.10	---	Not Found	---
				505.99	10.90	---	Not Found	---
				742.59	14.70	1.000E-05	46.04	---
				767.20	30.00	---	Not Found	---
		% Abundances		Found = 7.78				
PM-146M	41.30d	0.17		266.11	12.50	---	Not Found	Abun.
				414.07	15.66	---	Not Found	---
				432.72	5.35	---	Not Found	---
				501.26	6.75	---	Not Found	---
				550.27*	24.90	---	Not Found	---
				579.74	11.54	---	Not Found	---
				611.26	5.40	1.076E-07	47.14	---
				629.07	89.00	---	Not Found	---
				725.70	32.00	---	Not Found	---
				915.33	17.17	---	Not Found	---
				1013.81	20.30	---	Not Found	---

BI-214 19.90M 500.30 500.214 46.00 1.0000000 17.10 Decay  
 760.30 5.04 Not Found

Rejected Report (continued)  
 Sample ID : EFT-1541500

Page : 5  
 Acquisition date : 22 APR 2000 11:42:32

Nuclide	Half-life	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by	
		Ratio				(uCi/cc)	%Error		
BI-214	19.90M	500.30		934.06	3.21	---	Not Found	---	Decay
				1180.29	15.10	---	Not Found	---	
				1230.11	5.94	---	Not Found	---	
				1377.67	4.11	---	Not Found	---	
				1764.40	15.00	---	Not Found	---	
% Abundances Found =					40.40	(Con. Limit = 60.40%)			

Flags: 'x' = Keyline

Unidentified Energy Lines  
Sample ID : EFT-1041500

Page # 5  
Acquisition date : 22-APR 2009 11:42:00

ID	Energy	Area	Height	FWHM	Channel	Left	Right	Class	Class	Area	Area	Flags
6	511.01	131	11	1.34	1022.59	1015	10	7.46E-02	14.3	1.03E+00		T
8	552.07	43	37	0.99	1117.09	1110	17	2.58E-02	37.7	1.39E+00		T
0	610.27	28	20	1.51	1220.39	1214	15	1.53E-02	47.1	1.53E+00		T

Flags: "T" = tentatively associated

Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	20.	477.59	9.3132E-03
F-18	0.	511.00	Half-Life too short
NA-22	2.	1274.54	5.3522E-03
NA-24	0.	1369.53	Half-Life too short
NO-27	0.	1014.41	Half-Life too short
CL-38	0.	1612.32	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	6.	389.25	6.6477E-03
CR-51	34.	320.88	9.1601E-03
KH-51	10.	834.83	7.7451E-03
CO-56	17.	1239.25	1.9137E-03
MH-56	0.	1810.60	Half-Life too short
NI-56	41.	158.38	1.6304E-03
CO-57	40.	122.86	9.9495E-03
CO-58	12.	818.76	8.4700E-03
FE-59	10.	1097.22	1.7042E-03
CC-60	8.	1332.49	9.8103E-03
CJ-64	0.	1345.70	Half-Life too short
NI-63	0.	1481.84	Half-Life too short
ZN-65	14.	1115.52	2.0553E-03
ZN-69M	0.	438.63	Half-Life too short
GE-75	37.	136.00	1.3022E-03
AS-76	52.	559.10	2.0540E-03
BR-82	16.	776.49	2.6041E-03
DR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	47.	513.90	2.4917E-03
KR-85M	0.	151.18	Half-Life too short
SR-85	47.	513.90	1.1007E-03
RD-86	11.	1076.63	1.3410E-03
KR-87	0.	402.52	Half-Life too short
DR-87M	0.	388.48	Half-Life too short
KR-88	0.	198.32	Half-Life too short
RE-88	0.	1382.30	Half-Life too short
Y-88	9.	1036.01	1.1350E-03
KR-89	0.	220.98	Half-Life too short
RE-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RD-90	0.	831.69	Half-Life too short
RD-90M	0.	824.83	Half-Life too short
Y-90M	0.	202.51	Half-Life too short

Y-91M	0.	515.03	Half-Life too short
CR-92	0.	1303.74	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Minimum Detectable Activity Report (continued)

Sample ID: EFT-1841588

Acquisition Date: 22-APR-2000 11:42:30

Nuclide	Bkgdnd Sum	Energy/ (keV)	MDA (dCi/cc)
CR-92	0.	500.28	Half-Life too short
Y-93	0.	266.98	Half-Life too short
NB-94	13.	782.63	7.1736E-09
NB-95	11.	785.79	0.2662E-09
NB-95M	37.	235.69	1.1002E-07
ER-95	11.	756.72	1.4017E-08
NB-97	0.	657.90	Half-Life too short
NB-99	0.	730.58	2.6751E-07
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	10.	497.08	8.6457E-09
TC-104	0.	357.99	Half-Life too short
RH-105	26.	318.98	9.0884E-07
RU-105	0.	724.58	Half-Life too short
RU-106	14.	621.04	6.0802E-08
CD-109	35.	86.03	3.4798E-07
AG-110M	5.	937.48	1.8828E-08
SN-113	25.	391.09	1.1442E-08
SN-117M	43.	158.56	1.2230E-08
OB-122	23.	563.93	6.7837E-08
SI-124	24.	602.71	9.3939E-09
SB-125	31.	427.89	2.7539E-08
TE-125M	31.	109.23	3.2029E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	20.	57.68	2.9005E-06
XE-127	40.	282.04	1.2311E-06
TE-129	0.	459.60	Half-Life too short
TE-129M	20.	695.88	2.9416E-07
XE-129M	30.	196.56	2.5860E-07
I-130	0.	536.09	Half-Life too short
BA-131	35.	123.88	3.9841E-08
I-131	32.	364.48	1.7183E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	7.7543E-07
XE-131M	41.	164.93	5.5703E-07
I-132	0.	667.69	Half-Life too short
TE-132	34.	220.16	3.4975E-08
BA-133	33.	302.04	4.1307E-08
BA-133M	34.	276.09	7.7179E-07
I-133	17.	529.07	1.9793E-06
TE-133M	0.	912.58	Half-Life too short
XE-133	33.	01.00	1.1105E-07
XE-133M	35.	233.22	6.1500E-07
CS-134	19.	604.70	7.7945E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	35.	260.24	2.4906E-06

XE-135M	0.	506.56	Half Life too short
CC-136	0.	610.50	3.9244E-09

Minimum Detectable Activity Report (continued)

Page : 3

Sample ID : EFT-1541560

Acquisition date : 22-MAR-2008 11:42:00

Nuclide	Background Con.	Energy (keV)	MDA (uCi/cc)
I-136	0.	1313.02	Half-Life too short
CC-137	15.	661.05	3.5046E-09
XE-137	3.	455.49	Half-Life too short
CC-138	0.	1435.86	Half-Life too short
XE-138	0.	250.31	Half-Life too short
BA-139	0.	1400.50	Half-Life too short
CE-139	30.	165.85	9.0405E-09
CC-139	0.	1283.23	Half-Life too short
BA-140	15.	537.32	3.8026E-08
LA-140	5.	1536.49	1.5677E-07
SA-141	0.	100.22	Half-Life too short
CE-141	04.	145.44	1.0513E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	31.	293.26	5.4720E-07
CE-144	20.	133.54	7.0910E-08
FR-144	0.	1409.15	Half-Life too short
ND-147	34.	91.13	6.5202E-08
FM-148M	25.	550.27	9.7250E-09
EU-152	01.	344.27	2.0125E-08
EU-154	10.	1004.769	4.7621E-08
EU-156	10.	246.29	1.4800E-07
HF-161	23.	482.03	1.0211E-08
TA-182	11.	1221.42	3.7043E-08
W-187	7.	685.81	2.2630E-06
RE-188	35.	185.83	3.0939E-05
HC-203	34.	219.19	1.0321E-08
BI-207	10.	569.67	7.1107E-09
TL-208	0.	583.14	Half-Life too short
PD-212	0.	230.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PE-214	0.	351.92	Half-Life too short
RA-224	43.	240.90	7.4062E-07
RA-226	41.	180.21	2.3297E-07
AC-228	38.	330.32	7.1511E-08
TH-228	27.	84.37	1.3518E-06
PA-234	0.	131.20	Half-Life too short
TH-234	33.	63.29	1.3825E-06
U-235	39.	143.76	7.0320E-08
NP-239	38.	106.13	3.2552E-07
AM-241	20.	59.54	1.4279E-07



**EFT-1S**

**2009**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT 1591009

Sample Location (Well Number): 15

1. Representative sample collected. Date/Time 9/10/09 1 15 50

Sample collected by: Thomas Mow / Thomas Date: 9-10-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering:  
Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 9/21/09  
Printed Name / Signature

3. Sample counted in accordance with 76.000/70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: John A. Yovan / [Signature] Date: 9-21-09  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert G. [Signature] / [Signature] Date: 10/13/09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT1S91009
2 . Date Sampled	09/10/2009
3 . Time Sampled	15:50
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	09/21/2009
2 . Time Sample Counted	14:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.7 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2763.5 cpm
Net Spike Count Rate (cpm)	2755.8 cpm
H3 Spike Activity (dpm on count date)	7189.1 dpm
Counter Efficiency	0.3833 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	7.3 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

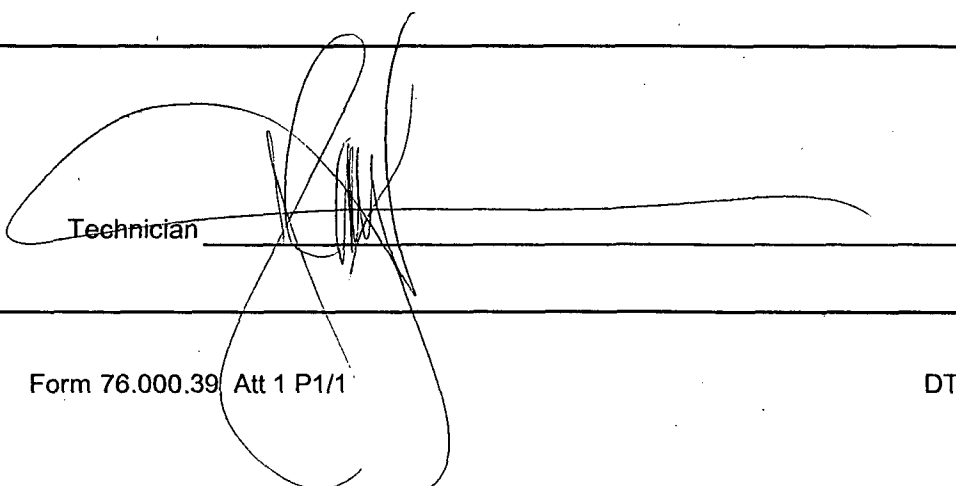
**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.20\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 uCi/ml x Sample Volume}} < \text{MDA}$$

Technician 

Date 4-22-09

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT 15 910 09

Sample Location (Well Number): 15

1. Representative sample collected. Date/Time 9/10/09 1 1550

Sample collected by: Thomas Mowl / Tom Date: 9-10-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 9/24/09  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Southward / Southward Date: 10/12/09  
Fermi 2 RP Printed Name Signature

Sample number: EFT 1591009

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Smithward 1 Smithward Date: 10/12/09  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray, Jr. Robert C. Gray, Jr. Date: 10-13-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT1S91009

Sample End Time: 10-SEP-2009 15:50:00.00

REMARKS

PERFORMED BY:

*Sam Howard*  
SIGNATURE

REVIEWED BY:

*Robt. S. [unclear]* 10-13-09  
SIGNATURE/DATE

Sample ID : EFT1S91009

Acquisition date : 12-OCT-2009 14:27:16

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT1S91009
Sample collection start date: 10-SEP-2009 15:50:00.00
Sample collection end date : 10-SEP-2009 15:50:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : M2LL Operator: JNS

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 12-OCT-2009 14:27:16.35
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:00.99 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 3-JUN-2009 17:37:00.00
KeV/channel : 5.00030E-01 Zero offset: 7.02676E-03
Daily cal date : 12-OCT-2009 14:12:36.26

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000
Abundance limit : 775.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m2ll Efficiencies at : Peak energy

Table with 11 columns: Pk It, Energy, Area, Bkgnd, FWHM, Channel, Left, Fw, Cts/Sec, %Err, Fit. It contains two rows of peak data.

5

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	511.10	83	54	1.16	1022.12	1016	13	21.0		ANN,
0	1461.49	37	14	1.13	2922.84	2914	14	27.0		K-40

f 10-13-09



Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma σ	%Error
K-40	1460.81	37	10.67*	2.501E+00	2.002E-07	2.002E-07		27.03

Flag: "\*" = Keyline

Sample ID : EFT1S91009

Acquisition date : 12-OCT-2009 14:27:16

Total number of lines in spectrum 2  
 Number of unidentified lines 0  
 Number of lines tentatively identified by NID 2 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.082E-07	2.082E-07	0.563E-07	27.03	
Total Activity :			2.082E-07	2.082E-07			
Grand Total Activity :			2.082E-07	2.082E-07			

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Rejected Report  
Sample ID : EFT1S91009

Page : 4  
Acquisition date : 12-OCT-2009 14:27:16

Nuclide	Half-life	Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	419.28	511.00	*193.46	1.000E+35	20.99	Decay
% Abundances Found = 100.00							

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EFV1S91009

Page : 5  
Acquisition date : 12-OCT-2009 14:27:16

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	4511.10	83	54	1.16	1022.12	1016	13	4.63E-02	21.0	4.88E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgrd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	26.	477.59	1.1451E-07
F-18	0.	511.00	Half-Life too short
NA-22	3.	1274.54	6.4882E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	7.	889.25	9.1561E-09
CR-51	36.	320.08	1.7547E-07
MN-54	16.	834.83	9.9171E-09
CO-56	10.	1238.25	1.8916E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	36.	158.38	2.6324E-07
CO-57	35.	122.06	9.8899E-09
CO-58	12.	810.76	1.0850E-08
FE-59	13.	1099.22	2.9261E-08
CO-60	8.	1332.49	9.2523E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	9.	1115.52	1.8561E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	36.	136.08	1.4907E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	42.	513.99	2.3812E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	42.	513.99	1.4432E-08
RE-86	7.	1076.63	2.7633E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RE-88	0.	1382.39	Half-Life too short
Y-88	4.	1836.01	1.0160E-08
KR-89<	0.	220.90	Half-Life too short
RE-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RE-90	0.	831.69	Half-Life too short
RE-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	> 14.	1204.90	5.2291E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT1591009

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Acquisition date : 12-OCT-2009 14:27:16

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	14.	702.63	7.3252E-09
NB-95	15.	765.79	1.5319E-08
NB-95M	30.	235.69	1.3040E-05
ZR-95	10.	756.72	1.7261E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	15.	497.00	1.2241E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	22.	621.84	8.9620E-08
CD-109	26.	88.03	3.1855E-07
AG-110M	7.	937.48	2.2690E-08
SN-113	19.	391.69	1.1652E-08
SN-117M	37.	150.56	4.1006E-08
SB-122	0.	563.93	Half-Life too short
SB-124	17.	602.71	1.0685E-08
SB-125	18.	427.89	2.2364E-08
TE-125M	27.	109.20	4.1325E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	30.	57.60	2.9337E-05
XE-127	40.	202.84	1.9051E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	16.	695.88	4.5061E-07
XE-129M	34.	196.56	1.7206E-06
I-130	0.	536.09	Half-Life too short
BA-131	34.	123.80	1.7128E-07
I-131	22.	364.48	1.2570E-07
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	30.	163.93	2.0067E-06
I-132	0.	667.69	Half-Life too short
TE-132	41.	228.16	7.7627E-06
BA-133	24.	302.84	3.5995E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	20.	81.00	2.2859E-06
XE-133M	0.	233.22	Half-Life too short
CS-134	19.	604.70	7.9742E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	?	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT1S91009

Acquisition date : 12-OCT-2009 14:27:16

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	11.	818.50	4.0987E-08
I-136	0.	1313.02	Half-Life too short
CS-137	11.	661.65	7.3685E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	35.	165.85	9.8309E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	13.	537.32	1.3679E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	36.	145.44	2.0995E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	23.	133.54	6.0234E-08
FR-144	0.	1489.15	Half-Life too short
ND-147	23.	91.10	2.6454E-07
PM-148M	21.	550.27	1.3657E-08
EU-152	20.	344.27	2.3169E-08
EU-154	6.	1004.76	3.8762E-08
EU-155	24.	105.31	3.8399E-08
EU-156	15.	646.29	4.2809E-07
HF-181	9.	482.03	1.0110E-08
TA-182	8.	1221.42	3.8870E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	33.	279.19	1.4807E-08
BI-207	18.	569.67	7.3706E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	37.	240.98	8.5116E-05
RA-226	37.	186.21	2.1238E-07
AC-228	19.	338.32	5.2826E-08
TH-228	21.	84.37	9.5977E-07
PA-234	0.	131.20	Half-Life too short
TH-234	27.	63.29	2.4492E-06
U-235	48.	143.76	7.6798E-08
NF-239	0.	106.13	Half-Life too short
AM-241	25.	59.54	1.5888E-07

**EFT-1S**

**2010**



## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EF1-52610-15

Sample Location (Well Number): 15

1. Representative sample collected. Date/Time 5/26/10 1 17 10

Sample collected by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

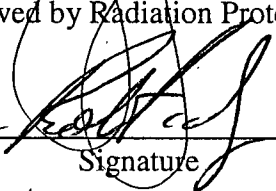
2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: John M. Yarnall /  Date: 6-25-10  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gieg JR /  Date: 6-30-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EF1-52610-1S
2 . Date Sampled	05/26/2010
3 . Time Sampled	17:10
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	06/24/2010
2 . Time Sample Counted	13:40
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	6.7 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2671.8 cpm
Net Spike Count Rate (cpm)	2665.1 cpm
H3 Spike Activity (dpm on count date)	6889.0 dpm
Counter Efficiency	0.3869 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	7.1 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.4 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	1.9 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.11\text{E-}06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 6-25-10

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EF1-52610-15

Sample Location (Well Number): 15

1. Representative sample collected. Date/Time 5/26/10 1 1710

Sample collected by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Charles Proffitt / Charles Proffitt Date: 9-14-10  
Fermi 2 RP Printed Name Signature

Sample number: EF1-52610-15

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Charles Proffitt | Charles Proffitt | Date: 9-14-10  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray | [Signature] | Date: 10-5-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT  
GAMMA SPECTROSCOPY ANALYSIS REPORT  
HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1-5260-1S

Sample End Time: 25-MAY-2010 17:10:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*Charles Proffitt*  
SIGNATURE

REVIEWED BY:

*Robert J...*  
SIGNATURE DATE

Sample ID : EF1-5260-1S

Acquisition date : 14-SEP-2010 13:15:51

\*\*\*\*\*  
 Fermi 2 Radiation Protection Gamma Spectroscopy Report  
 \*\*\*\*\*

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1-5260-1S  
 Sample collection start date: 26-MAY-2010 17:10:00.00  
 Sample collection end date : 26-MAY-2010 17:10:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : M2LL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 14-SEP-2010 13:15:51.53  
 Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00  
 Elapsed real time : 0 00:45:00.84 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 23-JUN-2010 12:20:00.00  
 Kev/channel : 5.00041E-01 Zero offset: 0.46290E-02  
 Daily cal date : 14-SEP-2010 06:21:27.75

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	190.50	74	105	2.17	396.97	391	12	2.75E-02	29.9	
2	2	510.29	79	59	2.25	1020.35	1012	19	2.91E-02	27.6	1.94E+00
3	2	511.40	120	63	2.27	1022.57	1012	19	4.75E-02	17.7	
4	0	559.06	80	76	1.60	1117.90	1113	14	2.95E-02	25.5	
5	0	1460.99	70	25	1.83	2921.76	2913	17	2.59E-02	20.4	

Sample Title : EF1-5260-1S  
Decay Time = 110 20:05:51.53

Page : 1  
Acquisition Time = 14-SEP-2010 13:15:51.5

3

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	190.50	74	105	2.17	396.97	391	12	29.9	-HWC	
2	510.29	79	59	2.25	1020.35	1012	19	27.6	1.94E+00	} ANP.
2	511.40	120	63	2.27	1022.57	1012	19	17.7		
0	559.06	80	76	1.60	1117.90	1113	14	25.5	-HWC	
0	1460.99	70	25	1.03	2921.76	2913	17	20.4		K-40

Nuclide Line Activity Report  
Sample ID : EF1-5250-19

Page : 2  
Acquisition date : 14-SEP-2010 13:15:51

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	70	10.67*	2.501E+00	2.624E-07	2.624E-07	20.39

Flag: "\*" = Keyline



Summary of Nuclide Activity  
Sample ID : EF1-5250-1S

Page : 3  
Acquisition date : 14-SEP-2010 13:15:51

Total number of lines in spectrum 5  
Number of unidentified lines 1  
Number of lines tentatively identified by NID 4 80.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.624E-07	2.624E-07	0.535E-07	20.39	
Total Activity :			2.624E-07	2.624E-07			

Grand Total Activity : 2.624E-07 2.624E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
F-18	109.74M	1454.61	511.00*	193.46	1.000E+35	17.74	Decay
% Abundances Found =				100.00			
SE-75	119.78D	0.93	66.05	1.02	---- Not Found	----	Abun.
			96.73	3.41	---- Not Found	----	
			121.12	16.70	---- Not Found	----	
			136.00*	59.20	---- Not Found	----	
			190.60	1.45	1.476E-06	29.93	
			264.65	59.90	---- Not Found	----	
			279.53	25.20	---- Not Found	----	
			303.91	1.32	---- Not Found	----	
			400.65	11.40	---- Not Found	----	
% Abundances Found =				0.01			
AS-76	26.32H	101.00	559.10*	44.70	1.021E+23	25.54	Decay, Abun.
			563.23	1.17	---- Not Found	----	
			571.30	0.14	---- Not Found	----	
			657.03	6.10	---- Not Found	----	
			665.31	0.39	---- Not Found	----	
			740.12	0.12	---- Not Found	----	
			771.76	0.12	---- Not Found	----	
			867.63	0.12	---- Not Found	----	
			1129.87	0.14	---- Not Found	----	
			1212.72	1.63	---- Not Found	----	
			1216.02	3.04	---- Not Found	----	
			1220.52	1.39	---- Not Found	----	
			1439.13	0.33	---- Not Found	----	
			1453.60	0.13	---- Not Found	----	
			1707.67	0.33	---- Not Found	----	
% Abundances Found =				73.70			

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EF1-5260-1S

Page : 5  
Acquisition date : 14-SEP-2010 13:15:51

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	190.50	74	105	2.17	396.97	391	12	2.75E-02	29.9	6.60E+00	T
2	510.29	79	59	2.25	1020.35	1012	19	2.91E-02	27.6	4.00E+00	
2	511.40	120	63	2.27	1022.57	1012	19	4.75E-02	17.7	4.00E+00	T
0	559.06	00	76	1.60	1117.90	1113	14	2.95E-02	25.5	4.60E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	32.	477.59	2.3469E-07
F-18	0.	511.00	Half-Life too short
NA-22	14.	1274.54	8.1119E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	14.	809.25	1.5467E-08
CR-51	59.	320.00	1.0609E-06
MN-54	24.	834.03	9.2786E-09
CO-56	14.	1238.25	2.9318E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	0.	158.38	Half-Life too short
CO-57	58.	122.06	1.0224E-08
CO-58	18.	810.76	1.0461E-08
FE-59	15.	1099.22	7.0850E-08
CO-60	19.	1332.49	9.0491E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	17.	1115.52	2.0212E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	56.	136.00	1.9072E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	82.	513.99	2.1896E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	82.	513.99	3.0420E-08
RB-86	13.	1076.63	4.6312E-06
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	5.	1836.01	1.2313E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1119.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	18.	1204.90	9.9798E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EF1-5260-1S

Acquisition date : 14-SEP-2010 13:15:51

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	27.	702.63	6.5636E-09
NB-95	15.	765.79	4.9754E-08
NB-95M	0.	235.69	Half-Life too short
ZR-95	24.	756.72	3.9764E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	20.	497.08	4.4008E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	30.	621.84	7.8605E-08
CD-109	50.	88.03	3.2177E-07
AG-110M	17.	937.48	2.7139E-08
SN-113	37.	391.69	1.7010E-08
SN-117M	55.	158.56	1.0267E-06
SB-122	0.	563.93	Half-Life too short
SB-124	33.	602.71	2.3068E-08
SB-125	25.	427.89	1.8114E-08
TE-125M	54.	109.28	9.6806E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	41.	57.60	3.7171E-05
XE-127	59.	202.84	7.1249E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	27.	695.88	1.9134E-06
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	57.	123.00	1.4996E-05
I-131	0.	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	64.	163.93	1.9929E-04
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	58.	302.84	3.6148E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	34.	604.70	7.4410E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EF1-5260-18

Acquisition date : 14-SEP-2010 13:15:51

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	16.	818.50	2.0449E-06
I-136	0.	1313.02	Half-Life too short
CS-137	18.	661.65	6.1689E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.06	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	67.	165.05	1.3174E-08
CS-139	0.	1203.23	Half-Life too short
BA-140	35.	537.32	1.0281E-05
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	50.	145.44	1.2027E-07
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	65.	133.54	7.0409E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PM-148M	24.	550.27	3.6360E-08
EU-152	49.	344.27	2.3519E-08
EU-154	13.	1004.76	3.6775E-08
EU-155	46.	105.31	3.5667E-08
EU-156	23.	646.29	1.2614E-05
HF-181	33.	402.03	4.3452E-08
TA-182	14.	1221.42	5.2131E-08
W-187	0.	605.01	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	53.	279.19	3.9026E-08
BI-207	32.	569.67	6.4127E-09
TL-208	0.	503.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.90	Half-Life too short
RA-226	50.	106.21	1.7456E-07
AC-228	46.	330.32	5.3624E-08
TH-228	56.	04.37	1.0039E-06
PA-234	0.	131.20	Half-Life too short
TH-234	65.	63.29	2.3407E-05
U-235	67.	143.76	6.0095E-08
NP-239	0.	106.13	Half-Life too short
AM-241	51.	59.54	1.4643E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-102510 1/S

Sample Location (Well Number): 1 S

1. Representative sample collected. Date/Time 11-11-10 1:30:00

Sample collected by: C Proffitt / C Proffitt Date: 11-11-10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: C Proffitt / C Proffitt Date: 11-11-10  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: L R Dyer / [Signature] Date: 11-12-10  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray, JR. / [Signature] Date: 11-15-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

\_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1. Sample Location	EFT EPT-102510-1/S
2. Date Sampled	11/11/2010
3. Time Sampled	13:20
4. Sample Volume, (ml)	4 ml

**Instrument Count Data**

1. Date Sample Counted	11/11/2010
2. Time Sample Counted	22:08
3. Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.2 cpm
4. Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2546.6 cpm
Net Spike Count Rate (cpm)	2539.4 cpm
H3 Spike Activity (dpm on count date)	6741.6 dpm
Counter Efficiency	0.3767 cpm/dpm
5. Sample Info:	
Sample Gross Count Rate (cpm)	8.4 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	1.2 cpm
6. Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

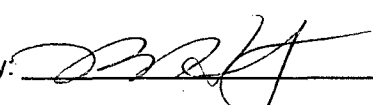
$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.18\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician  Date 11-12-10

Reviewed By:  Date 11/15/10



## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-102510-1/5

Sample Location (Well Number): 2/5

1. Representative sample collected. Date/Time 10/25/10 1 16:05

Sample collected by: Thomas Mow / [Signature] Date: 11-11-10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

**Note:** Use new sample containers only

Sample sealed by: C Prothier / [Signature] Date: 11-30-10  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: C Prothier / [Signature] Date: 11-30-10  
Fermi 2 RP Printed Name Signature

Sample number: GFT-102510 1/S

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Prostko 1 Propper Date: 11-30-10  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray, Jr. [Signature] Date: 12-27-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT102510-1/S

Sample End Time: 25-OCT-2010 16:05:00.00

REMARKS

PERFORMED BY:

*Charles Rappaport*

SIGNATURE

REVIEWED BY:

*[Signature]*

SIGNATURE/DATE

Sample ID : EFT102510 1/S

Acquisition date : 9-DEC-2010 12:38:04

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT102510-1/S
Sample collection start date: 25-OCT-2010 16:05:00.00
Sample collection end date: 25-OCT-2010 16:05:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.22000E+03 cc
Sample geometry : MELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 9-DEC-2010 12:38:04.86
Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00
Elapsed real time : 0 00:45:00.59 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 23-JUN-2010 12:20:00.00
Kev/channel : 5.00192E-01 Zero offset: 9.56460E-02
Daily cal date : 9-DEC-2010 10:08:55.12

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nib
Efficiency file : EFFD4\_mell Efficiencies at : Peak energy

\*\*\*\*\*

Table with 11 columns: Pk It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. It contains 5 rows of peak data.

Sample Title : EFT102510-1/S  
Decay Time = 44 20:33:04.06

Page : 1  
Acquisition Time = 9-DEC-2010 12:38:04.00

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	352.46	33	46	1.54	704.47	700	10	43.0		<del>Pb-214</del>
1	510.47	63	65	2.06	1020.37	1013	15	30.0	4.59E+00	→ ANPPeak.
1	511.37	69	48	1.75	1023.37	1013	15	24.5		
0	609.35	51	30	1.04	1210.06	1212	12	25.5		<del>Bi-214</del>
0	1460.97	86	5	2.34	3320.76	2911	10	12.2		K-40

*Jr 12-27-10*

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	88	10.67%	2.501E+00	3.235E-07	3.235E-07	12.23

Flags: "\*" = Keyline

Summary of Nuclide Activity

Sample ID : EFT102510-1/S

Acquisition date : 9-DEC-2010 12:38:04

Total number of lines in spectrum 5  
 Number of unidentified lines 1  
 Number of lines tentatively identified by NID 4 80.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	3.235E-07	3.235E-07	0.396E-07	12.23	
Total Activity :			3.235E-07	3.235E-07			

Grand Total Activity : 3.235E-07 3.235E-07

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Sample ID : EFT102510-1/3

Acquisition date : 9-DEC-2010 12:30:04

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	500.01	511.00*	100.00	1.000E+35	30.05	Decay
		% Abundances	Found = 100.00				
Ru-103	39.35D	1.14	497.08*	89.00	---	Not Found	Abun.
			610.33	5.60	4.466E-07	25.53	
		% Abundances	Found = 5.92				
Xe-135	9.11H	110.21	249.79*	89.90	---	Not Found	Decay, Abun.
			600.19	2.09	1.513E+29	25.53	
		% Abundances	Found = 3.11				
Bi-214	19.90M	3247.01	609.31*	46.30	1.000E+35	25.53	Decay
			768.36	5.04	---	Not Found	
			934.06	3.21	---	Not Found	
			1120.29	15.10	---	Not Found	
			1238.11	5.94	---	Not Found	
			1377.67	4.11	---	Not Found	
			1764.49	15.00	---	Not Found	
		% Abundances	Found = 48.48 (Abn. Limit = 48.48%)				
Pb-214	26.00M	2411.03	87.30	4.67	---	Not Found	Decay
			241.98	7.49	---	Not Found	
			295.21	19.20	---	Not Found	
			351.92*	37.20	1.000E+35	42.98	
			785.91	1.10	---	Not Found	
		% Abundances	Found = 53.40 (Abn. Limit = 37.20%)				

Flag: "\*" = Keyline



Unidentified Energy Lines  
Sample ID : EFT102510-1/G

Page : 5  
Acquisition date : 9-DEC-2013 12:38:04

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	NErr	NEff	Flags
0	352.46	33	46	1.54	704.47	700	10	1.21E-02	43.0	5.70E+00	T
1	510.47	63	65	2.06	1020.37	1013	15	2.33E-02	30.0	4.80E+00	T
1	511.97	69	48	1.75	1023.37	1013	15	2.50E-02	24.5	4.80E+00	
0	609.35	51	30	1.04	1210.06	1212	12	1.90E-02	25.5	4.53E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	25.	477.59	8.9100E-08
F-18	0.	511.00	Half-Life too short
NA-22	14.	1274.54	7.6214E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	22.	889.25	1.0921E-08
CR-51	43.	320.00	1.7525E-07
MN-54	18.	834.83	7.1430E-09
CO-56	22.	1230.25	1.9723E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	57.	150.30	9.4153E-07
CO-57	50.	122.06	8.0469E-09
CO-58	19.	810.76	9.9007E-09
FE-59	14.	1099.22	2.4077E-08
CO-60	12.	1332.49	7.2055E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	14.	1115.52	1.5701E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	45.	136.00	1.1026E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	801.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	59.	513.99	1.8464E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	59.	513.99	1.2019E-08
RB-86	13.	1076.63	3.9624E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	300.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	4.	1836.01	7.3315E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.00	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.09	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	15.	1204.90	4.2173E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1303.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT102510-1/8

Acquisition date : 9-DEC-2010 12:38:04

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	530.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NE-94	24.	702.63	6.1577E-09
NE-95	17.	765.79	1.4004E-08
NE-95M	0.	235.69	Half-Life too short
ZR-95	14.	756.72	1.5679E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	25.	497.08	1.3081E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	19.	621.64	5.6404E-08
CD-109	38.	88.03	2.3138E-07
AO-110M	14.	937.40	2.1073E-08
SN-113	29.	391.69	1.0225E-08
SN-117M	57.	158.56	6.4696E-08
SB-122	0.	563.93	Half-Life too short
SB-124	38.	602.71	1.0713E-08
SB-125	23.	427.89	1.6620E-08
TE-125M	38.	109.28	3.7676E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	43.	57.60	2.4804E-05
XE-127	50.	202.84	1.8801E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	25.	695.88	4.7613E-07
XE-129M	53.	196.56	3.8529E-06
I-130	0.	536.09	Half-Life too short
BA-131	42.	123.80	2.7075E-07
I-131	38.	364.48	2.9730E-07
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	50.	163.93	3.7520E-06
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	37.	302.84	2.9034E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	39.	81.00	1.1321E-05
XE-133M	0.	233.22	Half-Life too short
CS-134	20.	604.70	5.5748E-09
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT102510-1/S

Acquisition date : 9-DEC-2010 12:38:04

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	25.	918.59	7.7712E-08
I-136	0.	1313.02	Half-Life too short
CS-137	21.	661.65	6.5733E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	48.	165.85	8.1127E-09
CS-139	0.	1263.23	Half-Life too short
BA-140	24.	537.32	2.4178E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	37.	145.44	2.5587E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	48.	133.54	5.7948E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	32.	91.10	4.6315E-07
PM-148M	21.	550.27	1.1361E-08
EU-152	38.	344.27	2.0687E-08
EU-154	0.	1004.75	2.9593E-08
EU-155	33.	105.31	2.9936E-08
EU-156	16.	646.29	5.3371E-07
HF-181	27.	482.03	1.3592E-08
TA-182	15.	1221.42	3.6022E-08
W-187	0.	605.01	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	44.	279.19	1.3630E-08
BI-207	25.	569.67	5.6902E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PO-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	58.	106.21	1.7456E-07
AC-228	51.	338.32	5.5420E-08
TH-228	47.	84.37	9.3224E-07
PA-234	0.	131.20	Half-Life too short
TH-234	29.	63.29	2.4473E-06
U-235	58.	143.76	5.5807E-08
NP-239	0.	106.13	Half-Life too short
AM-241	38.	59.54	1.2869E-07

**EFT-1S**

**2011**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT61711-1S

Sample Location (Well Number): 1S

1. Representative sample collected. Date/Time 6-17-11 11:15

Sample collected by: C. Proffitt / C. Proffitt Date: 6-17-11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: C. Proffitt / J. Proffitt Date: 6-21-11  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: S. R. Dyer / S. R. Dyer Date: 6-22-11  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Chey / Robert C. Chey Date: 6-22-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks W A 6-23-11

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT61711-1S
2 . Date Sampled	06/17/2011
3 . Time Sampled	11:15
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	06/22/2011	
2 . Time Sample Counted	06:42	
3 . Background Inf.:		
Minutes Counted	10	min.
Background Count Rate (cpm)	7.5	cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)		
Gross Spike Count Rate (cpm)	2306.3	cpm
Net Spike Count Rate (cpm)	2298.8	cpm
H3 Spike Activity (dpm on count date)	6513.3	dpm
Counter Efficiency	0.3529	cpm/dpm
5 . Sample Info:		
Sample Gross Count Rate (cpm)	7.1	cpm
Sample Count Time (min.)	10.0	min.
Net Sample Count Rate (cpm)	0.0	cpm
6 . Critical Level:		
Critical Level Count Rate (cpm)	2.0	cpm

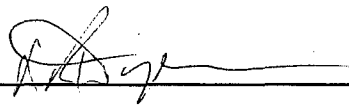
**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.29\text{E-}06 \text{ uCi/ml}$$

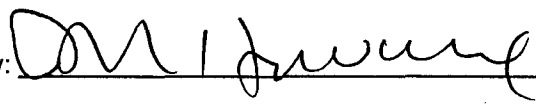
Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 6-22-11

Reviewed By: 

Date 6-22-11

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-61311-1E

Sample End Time: 13-JUN-2011 11:15:00.00

REMARKS *Natural*

PERFORMED BY:

*Charles Ruffalo*  
SIGNATURE

REVIEWED BY:

*[Signature]*  
SIGNATURE DATE



Sample ID : EFT-61311-1S

Acquisition date : 17-JUN-2011 13:34:43

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-61311-1S
Sample collection start date: 13-JUN-2011 11:15:00.00
Sample collection end date : 13-JUN-2011 11:15:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : MELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 17-JUN-2011 13:34:43.84
Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00
Elapsed real time : 0 00:45:00.60 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 14-JUN-2011 14:50:56.41
Kev/channel : 4.99954E-01 Zero offset: 2.18996E-01
Daily cal date : 17-JUN-2011 10:07:38.66

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 / Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Table with 11 columns: Pk, It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. It contains 4 rows of peak data.

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	66.21	42	74	1.11	131.99	126	11	43.0		<i>Ge N. Cosmic</i> <i>Anti. Peak</i> <i>Bi-214</i> <i>K-40</i> <i>J. 6-17-11</i>
0	511.03	195	39	2.60	1021.73	1012	22	10.8		
0	609.76	76	21	1.78	1219.21	1214	14	17.2		
0	1460.93	64	8	2.75	2921.74	2912	18	16.6		

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	64	10.67*	2.353E+00	2.546E-07	2.546E-07	16.61

Flag: "\*" = Keyline

Total number of lines in spectrum 4  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 4 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.546E-07	2.546E-07	0.423E-07	16.61	
Total Activity :			2.546E-07	2.546E-07			

Grand Total Activity : 2.546E-07 2.546E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	53.97	511.00*	193.46	3.856E+08	10.83	Decay
		% Abundances	Found =	100.00			
SE-75	119.78D	0.03	66.05	1.02	3.132E-06	43.04	Abun.
			96.73	3.41	----	Not Found	----
			121.12	16.70	----	Not Found	----
			136.00*	59.20	----	Not Found	----
			198.60	1.45	----	Not Found	----
			264.65	59.80	----	Not Found	----
			279.53	25.20	----	Not Found	----
			303.91	1.32	----	Not Found	----
			400.65	11.40	----	Not Found	----
		% Abundances	Found =	0.57			
RU-103	39.35D	0.10	497.00*	89.00	----	Not Found	----
			610.33	5.60	3.439E-07	17.10	Abun.
		% Abundances	Found =	5.92			
XE-135	9.11H	10.83	249.79*	89.90	----	Not Found	----
			600.19	2.89	1.132E-03	17.10	Decay, Abun.
		% Abundances	Found =	3.11			
CS-136	13.16D	0.31	66.91	12.50	3.099E-07	43.04	Abun.
			86.29	6.30	----	Not Found	----
			153.22	7.46	----	Not Found	----
			163.89	4.61	----	Not Found	----
			176.55	13.56	----	Not Found	----
			273.65	12.66	----	Not Found	----
			340.57	40.50	----	Not Found	----
			818.50*	99.70	----	Not Found	----
			1048.07	79.60	----	Not Found	----
			1235.34	19.70	----	Not Found	----
		% Abundances	Found =	4.10			
PM-148M	41.30D	0.10	288.11	12.56	----	Not Found	----
			414.07	18.66	----	Not Found	----
			432.78	5.35	----	Not Found	----
			501.26	6.75	----	Not Found	----
			550.27*	94.90	----	Not Found	----
			599.74	12.54	----	Not Found	----
			611.26	5.48	3.502E-07	17.10	Abun.
			629.97	89.00	----	Not Found	----
			725.70	32.00	----	Not Found	----
			915.33	17.17	----	Not Found	----
			1013.81	20.30	----	Not Found	----
		% Abundances	Found =	1.74			
TA-182	114.74D	0.04	67.75	42.30	7.560E-08	43.04	Abun.
			100.10	14.10	----	Not Found	----
			1109.05	16.30	----	Not Found	----
			1221.42*	27.10	----	Not Found	----
			1230.97	11.50	----	Not Found	----
		% Abundances	Found =	38.01			

Nuclide	Half-life	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
		Ratio				(uCi/cc)	%Error	
BI-214	19.90M	297.60		609.31*	46.30	1.000E+35	17.10	Decay
				768.36	5.04	----	Not Found	----
				934.06	3.21	----	Not Found	----
				1120.29	15.10	----	Not Found	----
				1238.11	5.94	----	Not Found	----
				1377.67	4.11	----	Not Found	----
				1764.49	15.00	----	Not Found	----
% Abundances Found =				48.48	(Abn. Limit = 48.48%)			

Flag: "\*" = Keyline

## Unidentified Energy Lines

Page : 6

Sample ID : EFT-61311-1S

Acquisition date : 17-JUN-2011 13:34:43

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	66.21	42	74	1.11	131.99	126	11	1.54E-02	43.0	1.33E+00	T
0	511.03	195	39	2.60	1021.73	1012	22	7.22E-02	10.8	4.59E+00	T
0	609.76	76	21	1.78	1219.21	1214	14	2.81E-02	17.2	4.25E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	36.	477.59	6.5924E-08
F-18	0.	511.00	Half-Life too short
NA-22	7.	1274.54	5.8459E-09
NA-24	15.	1368.53	8.2119E-07
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	13.	889.25	6.4327E-09
CR-51	48.	320.08	6.9797E-08
MN-54	24.	834.83	7.7747E-09
CO-56	11.	1238.25	1.0924E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	52.	158.38	9.2397E-09
CO-57	32.	122.06	6.3434E-09
CO-58	17.	810.76	6.7721E-09
FE-59	11.	1099.22	1.2345E-08
CO-60	17.	1332.49	8.9940E-09
CU-64	13.	1345.90	5.5746E-04
NI-65	0.	1481.04	Half-Life too short
ZN-65	16.	1115.52	1.5555E-08
ZN-69M	18.	438.63	7.0160E-07
SE-75	47.	136.00	1.0076E-08
AS-76	56.	559.10	2.5745E-07
BR-82	21.	776.49	5.6305E-08
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	62.	513.99	2.0018E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	62.	513.99	9.0541E-09
RB-86	12.	1076.63	8.9577E-08
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	11.	1036.01	9.0766E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	14.	1204.90	2.6872E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short



Sample ID : EFT-61311-1S

Acquisition date : 17-JUN-2011 13:34:43

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	46.	266.90	7.2627E-05
NB-94	21.	702.63	6.2127E-09
NB-95	21.	765.79	7.3572E-09
NB-95M	44.	235.69	4.8935E-08
ZR-95	17.	756.72	1.1349E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	20.	743.36	3.7472E-07
MO-99	17.	739.58	1.3102E-07
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	22.	497.00	6.3636E-09
TC-104	0.	357.99	Half-Life too short
RH-105	50.	318.90	2.2707E-07
RU-105	0.	724.50	Half-Life too short
RU-106	29.	621.04	6.8171E-08
CD-109	32.	88.03	2.3329E-07
AG-110M	18.	937.48	2.2257E-08
SN-113	27.	391.69	8.2906E-09
SN-117M	55.	158.56	8.3175E-09
SB-122	27.	563.93	2.5060E-08
SB-124	27.	602.71	6.7510E-09
SB-125	25.	427.89	1.7921E-08
TE-125M	36.	109.28	2.3709E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	19.	57.60	1.5602E-05
XE-127	30.	202.04	7.9481E-09
TE-129	0.	459.60	Half-Life too short
TE-129M	22.	695.08	2.0811E-07
XE-129M	51.	196.56	1.6520E-07
I-130	20.	536.09	1.3303E-06
BA-131	45.	123.00	2.6989E-08
I-131	31.	364.48	9.4764E-09
TE-131	0.	149.72	Half-Life too short
TE-131M	14.	773.67	1.4740E-07
XE-131M	54.	163.93	3.7283E-07
I-132	0.	667.69	Half-Life too short
TE-132	43.	228.16	1.4918E-08
BA-133	35.	302.04	2.9504E-08
BA-133M	44.	276.09	1.8271E-07
I-133	22.	529.07	1.7064E-07
TE-133M	0.	912.50	Half-Life too short
XE-133	29.	81.00	4.7400E-08
XE-133M	43.	233.22	1.9589E-07
CS-134	28.	604.70	6.5735E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	39.	268.24	3.5954E-07
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT-61311-18

Acquisition date : 17-JUN-2011 13:34:43

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	13.	818.50	7.2125E-09
I-136	0.	1313.02	Half-Life too short
CS-137	17.	661.65	6.2735E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	48.	165.85	6.9075E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	22.	537.32	2.7279E-08
LA-140	7.	1596.49	3.9060E-08
BA-141	0.	190.22	Half-Life too short
CE-141	53.	145.44	1.3380E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	42.	293.26	1.0688E-07
CE-144	48.	133.54	5.6007E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	32.	91.10	3.7012E-08
PM-148M	18.	550.27	5.6901E-09
EU-152	29.	344.27	1.9387E-08
EU-154	19.	1004.76	4.3928E-08
EU-155	38.	105.31	3.3241E-08
EU-156	16.	646.29	8.6345E-08
HF-181	18.	482.03	6.1239E-09
TA-182	12.	1221.42	2.7281E-08
W-187	19.	685.01	3.4924E-07
RE-188	51.	155.03	2.1365E-06
AU-199	52.	158.38	3.8518E-08
HG-203	40.	279.19	7.4597E-09
BI-207	23.	569.67	5.9029E-09
TL-208	0.	583.14	Half-Life too short
PB-212	48.	238.63	8.0311E-06
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	52.	240.98	3.3430E-07
RA-226	41.	186.21	1.5370E-07
AC-228	51.	338.32	5.7441E-08
TH-228	34.	84.37	8.0531E-07
PA-234	0.	131.20	Half-Life too short
TH-234	32.	63.29	8.4450E-07
U-235	56.	143.76	5.8210E-08
NP-239	27.	106.13	8.5959E-08
AM-241	37.	59.54	1.3965E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-101711-15

Sample Location (Well Number): EFT-115

1. Representative sample collected. Date/Time 10/17/11 1 15:50

Sample collected by: Thomas Mew / [Signature] Date: 10/25/11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
**Note:** Use new sample containers only

Sample sealed by: Thomas Mew / [Signature] Date: 10/25/11  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: John M. [Signature] / [Signature] Date: 11-1-11  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. [Signature] / [Signature] Date: 11-2-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks [Signature]

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-1/S
2 . Date Sampled	10/17/2011
3 . Time Sampled	15:50
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	10/30/2011
2 . Time Sample Counted	14:40
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.5 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2548.6 cpm
Net Spike Count Rate (cpm)	2541.1 cpm
H3 Spike Activity (dpm on count date)	6383.7 dpm
Counter Efficiency	0.3981 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	6.8 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

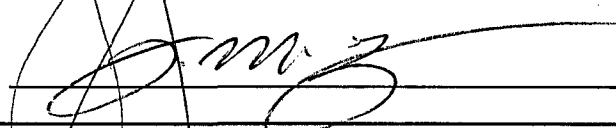
$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.14\text{E}-06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician  \_\_\_\_\_

Date 11-1-11

Reviewed  \_\_\_\_\_

Date NOV 01 2011

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-101711-15

Sample Location (Well Number): EFT- 1/5

1. Representative sample collected. Date/Time 10/17/11 1 15:50

Sample collected by: Thomas Mew / [Signature] Date: 10/23/11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Thomas Mew / [Signature] Date: 10/25/11  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: C. Pratt / [Signature] Date: 11-2-11  
Fermi 2 RP Printed Name / Signature

Sample number: EFT101711 - 1S

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: C. Proth | C. Draper Date: 11-2-11  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Greg | [Signature] Date: 11-2-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-101711-15

Sample End Time: 17-OCT-2011 15:50:00.00

REMARKS no plant related isotopes

PERFORMED BY:

Charles Proffos  
SIGNATURE

REVIEWED BY:

[Signature]  
SIGNATURE/DATE

Sample ID : EFT-101711-1S

Acquisition date : 2-NOV-2011 00:43:40

\*\*\*\*\*

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-101711-1S
Sample collection start date: 17-OCT-2011 15:50:00.00
Sample collection end date : 17-OCT-2011 15:50:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : P2LL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4
Acquire date : 2-NOV-2011 00:43:40.29
Preset live time : 0 00:45:00.00
Elapsed live time : 0 00:45:00.00
Elapsed real time : 0 00:45:00.65 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 14-JUN-2011 14:50:56.41
Kev/channel : 5.00053E-01 Zero offset: -5.47137E-01
Daily cal date : 2-NOV-2011 00:42:06.40

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000
Abundance limit : 75.00000
Efficiency file : EFFD4\_m211
Half-life ratio : 10.00000
Library : dacmaster.nlb
Efficiencies at : Peak energy

\*\*\*\*\*

Table with 11 columns: Pk It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. It contains 7 rows of peak data.



Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	66.63	69	66	1.12	134.35	129	11	25.8		Ge-76
0	297.67	53	139	1.83	596.37	586	20	56.7		High % Error
0	352.23	87	83	1.75	705.49	699	16	25.5		Pb-214
0	511.06	167	93	2.30	1023.13	1013	23	16.8		Ann. Peak
0	559.60	80	26	2.73	1120.34	1112	32	20.1		Cd-115
0	609.30	109	56	1.60	1219.58	1212	17	18.3		Bi-214
0	1461.22	77	0	2.70	2923.34	2914	18	11.4		K-40

Ge-76  
High % Error  
Pb-214  
Ann. Peak  
Cd-115  
Bi-214  
K-40  
11-2-11

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	77	10.67*	2.353E+00	3.070E-07	3.070E-07	11.40

Flag: "\*" = Keyline

Sample ID : EFT-101711-1S

Acquisition date : 2-NOV-2011 08:43:40

Total number of lines in spectrum	7	
Number of unidentified lines	1	
Number of lines tentatively identified by NID	6	85.71%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	3.070E-07	3.070E-07	0.350E-07	11.40	
Total Activity :			3.070E-07	3.070E-07			

Grand Total Activity :	3.070E-07	3.070E-07
------------------------	-----------	-----------

Flags: "K" = Keyline not found

"M" = Manually accepted

"E" = Manually edited

"A" = Nuclide specific abn. limit

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
F-18	109.74H	206.27	511.00*	193.46	1.000E+35	16.83	Decay
% Abundances Found = 100.00							
SE-75	119.78D	0.13	66.05	1.02	5.379E-06	25.78	Abun.
96.73 3.41 --- Not Found ---							
121.12 16.70 --- Not Found ---							
136.00* 59.20 --- Not Found ---							
198.60 1.45 --- Not Found ---							
264.65 59.80 --- Not Found ---							
279.53 25.20 --- Not Found ---							
303.91 1.32 --- Not Found ---							
400.65 11.40 --- Not Found ---							
% Abundances Found = 0.57							
AS-76	26.32H	14.33	559.10*	44.70	8.373E-04	20.13	Decay, Abun.
563.23 1.17 --- Not Found ---							
571.30 0.14 --- Not Found ---							
657.03 6.10 --- Not Found ---							
665.31 0.39 --- Not Found ---							
740.12 0.12 --- Not Found ---							
771.76 0.12 --- Not Found ---							
867.63 0.12 --- Not Found ---							
1129.87 0.14 --- Not Found ---							
1212.72 1.63 --- Not Found ---							
1216.02 3.84 --- Not Found ---							
1228.52 1.39 --- Not Found ---							
1439.13 0.33 --- Not Found ---							
1453.60 0.13 --- Not Found ---							
1787.67 0.33 --- Not Found ---							
% Abundances Found = 73.70							
Y-92	3.54H	106.57	448.50	2.30	---	---	Decay, Abun.
561.10 2.40 9.112E+25 20.13							
844.30 1.25 --- Not Found ---							
934.46* 13.90 --- Not Found ---							
1405.40 4.80 --- Not Found ---							
% Abundances Found = 9.74							
RU-103	39.35D	0.40	497.08*	89.00	---	---	Abun.
610.33 5.60 6.067E-07 18.29							
% Abundances Found = 5.92							
XE-135	9.11H	41.41	249.79*	89.90	---	---	Decay, Abun.
608.19 2.89 2.609E+06 18.29							
% Abundances Found = 3.11							
CS-136	13.16D	1.19	66.91	12.50	9.172E-07	25.78	Abun.
86.29 6.30 --- Not Found ---							
153.22 7.46 --- Not Found ---							
163.89 4.61 --- Not Found ---							
176.55 13.56 --- Not Found ---							
273.65 12.66 --- Not Found ---							

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
CS-136	13.16D	1.19	340.57	48.50	---	Not Found	Abun.
			818.50*	99.70	---	Not Found	
			1048.07	79.60	---	Not Found	
			1235.34	19.70	---	Not Found	
			% Abundances Found =		4.10		
TA-182	114.74D	0.14	67.75	42.30	1.302E-07	25.78	Abun.
			100.10	14.10	---	Not Found	
			1189.05	16.30	---	Not Found	
			1221.42*	27.10	---	Not Found	
			1230.97	11.50	---	Not Found	
% Abundances Found =		38.01					
BI-214	19.90M	1137.50	609.31*	46.30	1.000E+35	18.29	Decay
			768.36	5.04	---	Not Found	
			934.06	3.21	---	Not Found	
			1120.29	15.10	---	Not Found	
			1238.11	5.94	---	Not Found	
			1377.67	4.11	---	Not Found	
1764.49	15.80	---	Not Found				
% Abundances Found =		48.48	(Abn. Limit = 48.48%)				
PB-214	26.80M	844.64	87.30	4.67	---	Not Found	Decay
			241.98	7.49	---	Not Found	
			295.21	19.20	---	Not Found	
			351.92*	37.20	1.000E+35	25.48	
			785.91	1.10	---	Not Found	
% Abundances Found =		53.40	(Abn. Limit = 37.20%)				

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	66.63	69	66	1.12	134.35	129	11	2.56E-02	25.8	1.38E+00	T
0	297.67	53	139	1.83	596.37	586	20	1.98E-02	56.7	5.80E+00	
0	352.23	87	83	1.75	705.49	699	16	3.22E-02	25.5	5.38E+00	T
0	511.06	167	93	2.30	1023.13	1013	23	6.18E-02	16.8	4.59E+00	T
0	559.60	80	26	2.73	1120.34	1112	22	2.95E-02	20.1	4.40E+00	T
0	609.30	109	56	1.60	1219.58	1212	17	4.05E-02	18.3	4.25E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	33.	477.59	7.3281E-08
F-18	0.	511.00	Half-Life too short
NA-22	17.	1274.54	8.6676E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	23.	889.25	9.2221E-09
CR-51	42.	320.00	8.7727E-08
MN-54	27.	834.03	8.4100E-09
CO-56	19.	1238.25	1.5378E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	61.	158.38	3.7093E-08
CO-57	36.	122.06	6.8526E-09
CO-58	22.	810.76	8.5150E-09
FE-59	14.	1099.22	1.6610E-08
CO-60	15.	1332.49	8.4587E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	17.	1115.52	1.6414E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	48.	136.00	1.0931E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	67.	513.99	2.0773E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	67.	513.99	1.0615E-08
RB-86	13.	1076.63	1.4235E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	12.	1836.01	9.8570E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	12.	1204.90	2.9171E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT-101711-15

Acquisition date : 2-NOV-2011 09:43:48

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	20.	702.63	6.0147E-09
NB-95	14.	765.79	7.7949E-09
NB-95M	47.	235.69	4.6557E-07
ZR-95	19.	756.72	1.3511E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
NO-99	13.	739.58	2.1894E-06
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	32.	497.08	9.2796E-09
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	24.	621.84	6.3483E-08
CD-109	54.	88.03	3.0031E-07
AG-110M	21.	937.48	2.4189E-08
SN-113	34.	391.69	9.7569E-09
SN-117M	60.	158.56	1.5705E-08
SB-122	20.	563.93	4.2998E-07
SB-124	36.	602.71	8.7468E-09
SB-125	26.	427.89	1.8470E-08
TE-125M	55.	109.28	3.3340E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	35.	57.60	2.1779E-05
XE-127	53.	202.84	1.1512E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	27.	695.88	2.8944E-07
XE-129M	57.	196.56	4.2852E-07
I-130	0.	536.09	Half-Life too short
BA-131	43.	123.80	5.2371E-08
I-131	33.	364.48	2.6473E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	45.	163.93	6.7709E-07
I-132	0.	667.69	Half-Life too short
TE-132	57.	228.16	1.9940E-07
BA-133	33.	302.84	2.8928E-08
BA-133M	50.	276.09	2.7613E-05
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	27.	81.00	2.1177E-07
XE-133M	51.	233.22	8.3088E-06
CS-134	31.	604.70	6.9678E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short



Sample ID : EFT-101711-1S

Acquisition date : 2-NOV-2011 09:43:48

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	16.	818.50	1.4593E-08
I-136	0.	1313.02	Half-Life too short
CS-137	20.	661.65	6.8326E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.06	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	47.	165.85	7.2190E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	19.	537.32	4.8455E-08
LA-140	10.	1596.49	5.4442E-06
BA-141	0.	190.22	Half-Life too short
CE-141	50.	145.44	1.6635E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	46.	133.54	5.6077E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	45.	91.10	9.0040E-08
PM-148M	13.	550.27	6.0193E-09
EU-152	25.	344.27	1.8022E-08
EU-154	21.	1004.76	4.6026E-08
EU-155	37.	105.31	3.2647E-08
EU-156	14.	646.29	1.4094E-07
HF-181	32.	482.03	9.6688E-09
TA-182	21.	1221.42	3.6986E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
AU-199	61.	158.38	5.3651E-07
HG-203	44.	279.19	9.2704E-09
BI-207	26.	569.67	6.2285E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	60.	240.98	3.2799E-06
RA-226	61.	186.21	1.8511E-07
AC-228	44.	338.32	5.4869E-08
TH-228	40.	84.37	8.7463E-07
PA-234	0.	131.20	Half-Life too short
TH-234	41.	63.29	1.3144E-06
U-235	43.	143.76	5.1891E-08
NP-239	42.	106.13	3.2004E-06
AM-241	32.	59.54	1.3081E-07

**GEL LAB RESULTS**

**EFT-1S 2010**

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Company : Detroit Edison - Fermi 1  
 Address : PO Box 44440  
 Detroit, Michigan 48244

Report Date: February 17, 2010

Contact: Mr. Tom Mow  
 Project: **Fermi 1 - PO# 4700246055**

Client Sample ID:	EF1-1/S	Project:	ROIT00116
Sample ID:	245517005	Client ID:	ROIT001
Matrix:	Ground Water		
Collect Date:	05-JAN-10 10:15		
Receive Date:	25-JAN-10		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>											
<i>Alphaspec U, Liquid "As Received"</i>											
Pct Uranium-235	U	3.79				percent		MXE1 02/09/10	1349	947744	1
Uranium-233/234		1.55	+/-0.685	0.424	1.00	pCi/L					
Uranium-235/236	U	0.189	+/-0.262	0.284	1.00	pCi/L					
Uranium-238		0.747	+/-0.475	0.367	1.00	pCi/L					
<b>Rad Gas Flow Proportional Counting</b>											
<i>GFPC, Gross A/B, liquid "As Received"</i>											
Alpha	U	0.892	+/-3.17	5.94	5.00	pCi/L		DXF3 02/11/10	1932	945896	2
Beta	U	0.787	+/-2.95	5.15	5.00	pCi/L					
<i>GFPC, Ra228, Liquid "As Received"</i>											
Radium-228	U	0.223	+/-0.993	1.83	3.00	pCi/L		JXC5 02/01/10	0723	945895	3
<b>Rad Radium-226</b>											
<i>Lucas Cell, Ra226, liquid "As Received"</i>											
Radium-226		0.948	+/-0.348	0.383	1.00	pCi/L		KSD1 02/10/10	1440	948312	4

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, U-02-RC Modified	
2	EPA 900.0	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery %	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			99.5	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			76.4	(15%-125%)

**GEL LABORATORIES LLC**

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

**Certificate of Analysis**

Company : Detroit Edison - Fermi 1  
 Address : PO Box 44440  
 Detroit, Michigan 48244  
 Contact: Mr. Tom Mow  
 Project: Fermi 1 - PO# 4700246055

Report Date: December 30, 2010

Client Sample ID: EFT-102510-1/S  
 Sample ID: 268144002  
 Matrix: Water  
 Collect Date: 25-OCT-10 16:05  
 Receive Date: 06-DEC-10  
 Collector: Client

Project: ROIT00116  
 Client ID: ROIT001

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
<b>Rad Gas Flow Proportional Counting</b>											
<i>GFPC, Gross A/B, liquid "As Received"</i>											
Alpha	U	0.852	+/-3.89	7.01	5.00	pCi/L		VXC2 12/27/10	1946	1059089	1
Beta	U	-2.59	+/-3.77	6.75	5.00	pCi/L					

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	EPA 900.0/SW846 9310	

**EFT-1I**

**2010**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EF1-52610-1I

Sample Location (Well Number): 1I

1. Representative sample collected. Date/Time 5/26/10 1 1645

Sample collected by: Southward, Southward Date: 6/23/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward, Southward Date: 6/23/10  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Jean M. Yoxon Date: 6-25-10  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. [Signature] Date: 6-22-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EF1-52610-11
2 . Date Sampled	05/26/2010
3 . Time Sampled	16:45
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

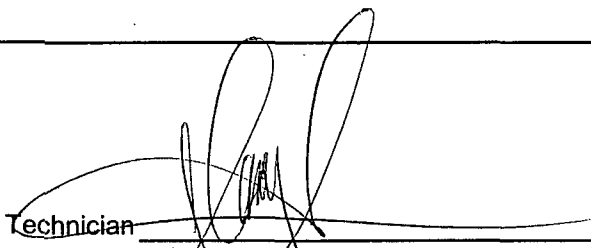
1 . Date Sample Counted	06/24/2010
2 . Time Sample Counted	14:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	6.7 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2671.8 cpm
Net Spike Count Rate (cpm)	2665.1 cpm
H3 Spike Activity (dpm on count date)	6889.0 dpm
Counter Efficiency	0.3869 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	7.7 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	1.0 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	1.9 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.11\text{E}-06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician  Date 6-25-10

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EF1-52610-1I

Sample Location (Well Number): 1I

1. Representative sample collected. Date/Time 5/26/10 1 1645

Sample collected by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Charles Proffit / Charles Proffit Date: 9-15-10  
Fermi 2 RP Printed Name Signature



Sample number: EF1-52610-1I

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by Charles Proffitt (Charles Proffitt) Date: 9-15-10  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by Robert Heg SR1 (Robert Heg) Date: 10-5-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DETOIT EDISON FERMI-2 POWER PLANT

15-SEP-2010 15:48:59.02

RADIATION PROTECTION DEPARTMENT  
GAMMA SPECTROSCOPY ANALYSIS REPORT  
HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1-52610-11

Sample End Time: 26-MAY-2010 16:45:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*Charles Proffitt*  
SIGNATURE

REVIEWED BY:

*[Signature]*  
SIGNATURE/DATE

Sample ID : EF1-52610-11

Acquisition date : 15-SEP-2010 15:03:57

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1-52610-11
Sample collection start date: 26-MAY-2010 16:45:00.00
Sample collection end date : 26-MAY-2010 16:45:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : PELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 15-SEP-2010 15:03:57.25
Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00
Elapsed real time : 0 00:45:00.87 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 23-JUN-2010 12:20:00.00
KeV/channel : 4.99958E-01 Zero offset: 1.16623E-01
Daily cal date : 15-SEP-2010 09:09:58.87

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Table with 11 columns: Pk It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. It contains 5 rows of peak data.

Sample Title : EF1-52610-11  
Decay Time = 111 22:18:57.25

Page : 1  
Acquisition Time = 15-SEP-2010 15:03:57.2

5

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	511.03	240	50	2.44	1021.92	1013	10	9.4	—A00,	
0	550.68	109	28	1.65	1117.22	1112	14	13.7	—HwC	
0	609.36	63	49	1.46	1210.60	1212	13	26.1	—Bi-214	
5	1460.28	46	7	3.78	2920.60	2914	23	23.2	1.65E+00	K-40
5	1461.98	53	8	2.55	2924.00	2914	23	21.6	—K40	

Nuclide Line Activity Report  
Sample ID : EF1-52610-11

Page : 2  
Acquisition date : 15-SEP-2010 15:03:57

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	46	10.67*	2.502E+00	1.728E-07	1.728E-07	23.10

Flag: "\*" = Keyline

Summary of Nuclide Activity

Sample ID : EF1-52610-11

Acquisition date : 15-SEP-2010 15:03:57

Total number of lines in spectrum 5  
 Number of unidentified lines 1  
 Number of lines tentatively identified by NID 4 80.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	1.728E-07	1.728E-07	0.401E-07	23.18	
Total Activity :			1.728E-07	1.728E-07			

Grand Total Activity : 1.728E-07 1.728E-07

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Rejected Report  
 Sample ID : EF1-52610-11

Page : 4  
 Acquisition date : 15-SEP-2010 15:03:57

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
F-18	109.74M	1468.94	511.00*	193.46	1.000E+35	9.42	Decay
				% Abundances Found = 100.00			
AS-76	26.32H	102.00	559.10*	44.70	2.780E+23	13.70	Decay, Abun.
				563.23	1.17	---- Not Found ----	
				571.30	0.14	---- Not Found ----	
				657.03	6.10	---- Not Found ----	
				665.31	0.39	---- Not Found ----	
				740.12	0.12	---- Not Found ----	
				771.76	0.12	---- Not Found ----	
				867.63	0.12	---- Not Found ----	
				1129.87	0.14	---- Not Found ----	
				1212.72	1.63	---- Not Found ----	
				1216.02	3.04	---- Not Found ----	
				1229.52	1.39	---- Not Found ----	
				1439.13	0.33	---- Not Found ----	
				1453.60	0.13	---- Not Found ----	
				1707.67	0.33	---- Not Found ----	
				% Abundances Found = 73.70			
RU-103	39.35D	2.84	497.00*	89.00	---- Not Found ----	----	Abun.
				610.33	5.60	1.789E-06	26.13
				% Abundances Found = 5.92			
XE-135	9.11H	294.92	249.79*	89.90	---- Not Found ----	----	Decay, Abun.
				608.19	2.89	1.000E+35	26.13
				% Abundances Found = 3.11			
BI-214	19.90M	8100.58	609.31*	46.30	1.000E+35	26.13	Decay
				768.36	5.04	---- Not Found ----	
				934.06	3.21	---- Not Found ----	
				1120.29	15.10	---- Not Found ----	
				1238.11	5.94	---- Not Found ----	
				1377.67	4.11	---- Not Found ----	
				1764.49	15.80	---- Not Found ----	
				% Abundances Found = 48.48 (Abn. Limit = 48.48%)			

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EF1-52610-11

Page : 5  
Acquisition date : 15-SEP-2010 15:03:57

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	511.03	240	50	2.44	1021.92	1013	10	8.91E-02	9.4	4.88E+00	T
0	558.68	109	28	1.65	1117.22	1112	14	4.04E-02	13.7	4.69E+00	T
0	609.36	63	49	1.46	1218.60	1212	13	2.33E-02	26.1	4.52E+00	T
5	1461.98	53	8	2.55	2924.00	2914	23	1.95E-02	21.6	2.50E+00	

Flags: "T" = Tentatively associated



\* Detroit Edison Fermi 2 MDA Report, Generated 15-SEP-2010 15:49:03.13 \*  
 \* Sample ID : EF1-52610-1I \*

Minimum Detectable Activity Report

Nuclide	Bckgnd. Sum	Energy (keV)	MDA (uCi/cc)
BE-7	27.	477.59	2.1909E-07
F-18	0.	511.00	Half-Life too short
NA-22	15.	1274.54	8.3506E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	16.	889.25	1.6515E-08
CR-51	54.	320.00	1.0405E-06
MN-54	23.	834.83	9.1630E-09
CO-56	10.	1238.25	3.2410E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	0.	158.38	Half-Life too short
CO-57	68.	122.06	1.1065E-08
CO-58	16.	810.76	1.8792E-08
FE-59	19.	1099.22	7.8770E-08
CO-60	12.	1332.49	7.5473E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1401.84	Half-Life too short
ZN-65	12.	1115.52	1.7221E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	75.	136.00	2.2061E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	70.	513.99	2.0365E-06
KR-85M	0.	151.10	Half-Life too short
SR-85	70.	513.99	2.0619E-08
RB-86	10.	1076.63	5.4983E-06
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	6.	1836.01	1.3314E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	19.	1204.90	1.0200E-05
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1393.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page : 2

Sample ID : EF1-52610-II

Acquisition date : 15-SEP-2010 15:03:57

Nuclide	Bckgrnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	24.	702.63	6.2526E-09
NB-95	20.	765.79	5.7300E-08
NB-95M	0.	235.69	Half-Life too short
ZR-95	19.	756.72	3.6631E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	49.	497.08	5.7684E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	19.	621.84	6.4426E-08
CD-109	62.	88.03	3.5450E-07
AG-110M	27.	937.48	3.3703E-08
SN-113	48.	391.69	1.9292E-08
SN-117M	69.	158.56	2.1575E-06
SB-122	0.	563.93	Half-Life too short
SB-124	20.	602.71	2.2364E-08
SB-125	34.	427.89	2.0704E-08
TE-125M	65.	109.28	1.0743E-05
TE-127	0.	417.90	Half-Life too short
TE-127M	54.	57.60	4.2500E-05
XE-127	61.	202.84	7.3439E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	30.	695.88	2.0654E-06
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	78.	123.80	1.8510E-05
I-131	0.	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	68.	163.93	2.1938E-04
I-132	0.	667.69	Half-Life too short
TE-132	0.	220.16	Half-Life too short
BA-133	44.	302.84	3.1975E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	29.	604.70	6.9469E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page : 3

Sample ID : EF1-52610-1I

Acquisition date : 15-SEP-2010 15:03:57

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	12.	818.50	1.9402E-06
I-136	0.	1313.02	Half-Life too short
CS-137	23.	661.65	6.7447E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	77.	165.85	1.4174E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	25.	537.32	9.3162E-06
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	67.	145.44	1.4127E-07
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	56.	133.54	7.3417E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PM-148M	29.	550.27	4.0300E-08
EU-152	46.	344.27	2.2881E-08
EU-154	22.	1004.76	4.5308E-08
EU-155	55.	105.31	3.8791E-08
EU-156	19.	646.29	1.2268E-05
HF-181	36.	482.03	4.6335E-08
TA-182	16.	1221.42	5.5649E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	74.	279.19	4.7382E-08
BI-207	38.	569.67	6.9992E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	74.	186.21	1.9455E-07
AC-228	50.	338.32	5.6205E-08
TH-228	51.	84.37	1.0400E-06
PA-234	0.	131.20	Half-Life too short
TH-234	61.	63.29	2.3543E-05
U-235	59.	143.76	5.6454E-08
NP-239	0.	106.13	Half-Life too short
AM-241	51.	59.54	1.4671E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-102810-1I

Sample Location (Well Number): 1I

1. Representative sample collected. Date/Time 11-11-10 1 13:15

Sample collected by: C. Proffitt / [Signature] Date: 11-11-10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: C. Proffitt / [Signature] Date: 11-11-10  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: S.R. Dyer / [Signature] Date: 11-12-10  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray / [Signature] Date: 11-15-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_

Tritium Activity Calculation

Sample Information

1 . Sample Location	EAT EPT-102810-1I
2 . Date Sampled	11/15/10 11/11/2010
3 . Time Sampled	13:15
4 . Sample Volume, (ml)	4 ml

Instrument Count Data

1 . Date Sample Counted	11/11/2010
2 . Time Sample Counted	22:08
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.2 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2546.6 cpm
Net Spike Count Rate (cpm)	2539.4 cpm
H3 Spike Activity (dpm on count date)	6741.6 dpm
Counter Efficiency	0.3767 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	8.7 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	1.5 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

Minimum Detectable Activity

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.18\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

Sample Activity

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 uCi/ml x Sample Volume}} < \text{MDA}$$

Technician *J.R. Dyer* Date 11-12-10

Reviewed By: *[Signature]* Date 11/15/10

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-102810-2I

Sample Location (Well Number): 1/I

1. Representative sample collected. Date/Time 10/28/10 109:50

Sample collected by: Thomas Now / [Signature] Date: 11/11/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: C Proffitt / [Signature] Date: 11-17-10  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: C Proffitt / [Signature] Date: 11-22-10  
Fermi 2 RP Printed Name Signature

Sample number: EFT 102810-1F

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".

(Note disposition of unidentified peaks in "Remarks")

Performed by: C. Proffitt 1 [Signature] Date: 11-22-10  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Wey SR [Signature] Date: 11-23-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_





Gamma 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number : EFT100010-1/I  
Sample collection start date : 28-OCT-2010 09:50:00.00  
Sample collection end date : 28-OCT-2010 09:50:00.00  
Type of sample : 1 L Marin. Liquid  
Sample quantity : 1.00000E+03 mL  
Sample geometry : BCLL Operator : CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 22-NOV-2010 12:25:00.00  
Pre-set live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00  
Elapsed real time : 0 00:45:00.59 Percent dead time : 0.00 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 23-JUN-2010 12:20:00.00  
KeV/channel : 5.00119E-01 Zero offset : 1.54040E-01  
Daily cal date : 22-NOV-2010 09:53:53.21

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
Abundance limit : 75.00000 Library : dacmaster.nlb  
Efficiency file : EFTD4\_mcl1 Efficiencies at : Peak energy

PK	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	511.00	132	48	2.48	1022.02	1014	16	4.24E-02	14.5	
2	0	1461.00	96	0	3.00	2921.00	2914	16	3.56E-02	10.2	

Sample Title: EFT100010-171  
Data Time: 09 00:30:00.00

Page: 1  
Acquisition Time: 09 NOV 2010 12:25:02.3

Sub-NID Peak Search Report

Ch	Energy	Area	Height	FWHM	Channel	Left	Right	Area	Fit	Isotope
0	511.20	133	40	2.10	1022.00	1014	1030	14.5	ANN Peak	
0	1461.00	96	9	3.00	2921.00	2914	2928	10.2		K-40

J - 11-23-10

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%EFF	Uncorrected Deca, Corr		1-Sigma
					uCi/cc	uCi/cc	
K-40	1460.01	96	10.07*	2.501E+00	3.001E-07	3.001E-07	10.01

Flags "X" = Ka, line

Summary of Nuclide Activity  
 Sample ID : EFT1002910-1.1

Page : 2  
 Acquisition date : 22-NOV-2010 13:25:30

Total number of lines in spectrum : 2  
 Number of unidentified lines : 0  
 Number of lines tentatively identified by NID : 2 100.00%

Nuclide Type : natural

Nuclide	HLif <sub>2</sub>	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error:	1-Sigma Error	Flags
K-40	1.190E+09Y	1.00	3.601E-07	3.601E-07	0.360E-07	10.01	
Total Activity :			3.601E-07	3.601E-07			

Grand Total Activity : 3.601E-07 3.601E-07

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Rejected Report

Sample ID : EFT10C010-1.T

Acquisition Date : 22 NOV 2010 10:25:00

Nuclide	Half-life	Ratio	Energy	%Abund	Activity (dpm/cc)	1-Sigma %Error	Rejected by
F-19	109.74M	329.67	511.00	193.46	1.000E+05	14.43	Decay
% Abundances Found = 100.00							

Flag: "N" = Keyline

Unidentified Energy Line  
Sample ID : EFT102210 1/1

Page 1 E  
Acquisition date : 22-NOV-2012 12:25:03

ID	Energy	Area	Dkg/d	FWHM	Channel	Left	Pa	Cts/Sec	MErr	SEff	Flag
0	511.28	133	48	2.43	1022.02	1014	16	4.94E-02	14.5	1.00E+00	T

Flag: "T" = Tentatively associated

Minimum Detectable Activity Report

Radclide	Debgnd C/m	Energy (keV)	MDA (uCi/cc)
BE-7	23.	477.50	6.6723E-00
F-18	0.	511.00	Half-Life too short
NA-22	7.	1274.54	5.7501E-00
NA-24	0.	1368.52	Half-Life too short
NO-27	0.	1014.44	Half-Life too short
OL-30	3.	1042.60	Half-Life too short
OR-41	0.	1293.64	Half-Life too short
OS-46	10.	680.25	6.6267E-00
OR-51	20.	320.08	8.9006E-00
MI-54	20.	434.07	7.2005E-00
CO-56	14.	1238.25	1.3651E-00
MI-50	0.	1010.60	Half-Life too short
MI-56	55.	158.38	9.9036E-00
CO-57	30.	122.02	6.7070E-00
CO-58	12.	818.76	6.6701E-00
FE-59	7.	1099.22	1.3413E-00
CO-60	16.	1332.49	3.2423E-00
CU-64	0.	1345.98	Half Life too short
NI-65	0.	1481.84	Half-Life too short
ZH-65	11.	1115.52	1.3337E-00
ZN-69M	0.	439.62	Half-Life too short
SE-75	44.	138.08	1.0444E-00
AS-76	0.	559.10	Half-Life too short
BR-82	0.	770.49	Half-Life too short
BR-83	0.	520.64	Half-Life too short
BR-84	0.	681.56	Half-Life too short
TR-85	0.	802.41	Half-Life too short
KR-85	43.	513.99	1.5087E-00
KR-85M	0.	151.18	Half-Life too short
SR-85	43.	513.99	8.9619E-00
RE-86	12.	1076.62	1.8355E-00
FR-87	0.	482.53	Half-Life too short
OR-87M	0.	308.40	Half-Life too short
RE-88	0.	106.32	Half-Life too short
RE-88	0.	1382.39	Half-Life too short
Y-88	1.	1936.91	1.0656E-00
KR-89	0.	229.90	Half-Life too short
RE-89	0.	1931.02	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RE-90	0.	931.63	Half-Life too short
RE-90M	0.	824.23	Half-Life too short
Y-90M	0.	200.51	Half-Life too short
SR-91	0.	1004.30	Half-Life too short
Y-91	11.	1264.98	2.0140E-00
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1330.74	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT102910-1/T

Acquisition date : 22 NOV 2010 12:25:02

Nuclide	Background Sam.	Energy (keV)	MDA (uCi/cc)
BR-93	0.	500.20	Half-Life too short
Y-92	0.	206.20	Half-Life too short
RE-94	23.	782.22	6.0253E-09
RE-95	21.	745.70	1.0392E-08
RE-95M	72.	235.69	2.5935E-06
ER-95	15.	751.72	1.2821E-08
RE-97	9.	527.90	Half-Life too short
ER-97	0.	743.30	Half-Life too short
HO-99	16.	739.50	2.4113E-05
TC-99M	3.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	27.	497.00	9.5916E-09
TC-104	0.	357.99	Half-Life too short
RII-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	38.	621.84	5.5765E-08
CD-109	38.	93.03	2.4949E-07
AG-110M	14.	937.40	2.0059E-08
SN-113	24.	391.69	9.7103E-09
SN-117M	53.	150.50	2.2794E-03
SB-122	18.	503.93	4.2920E-06
CB-124	34.	602.71	9.0092E-09
SB-125	24.	427.89	1.8766E-08
TE-125M	43.	109.20	3.1220E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	27.	57.60	1.7840E-05
XE-127	45.	292.04	1.2293E-08
TE-129	0.	459.00	Half-Life too short
TE-129M	15.	695.80	2.5632E-07
XE-129M	45.	195.52	7.9161E-07
I-130	0.	536.09	Half-Life too short
BA-131	43.	123.00	0.5003E-00
I-131	28.	364.40	5.2223E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	772.67	Half-Life too short
XE-131M	35.	163.93	9.9463E-07
I-132	0.	567.69	Half-Life too short
TE-132	41.	220.16	1.2113E-06
BA-133	36.	302.04	2.9540E-08
BA-133M	0.	276.00	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	34.	81.00	7.3262E-07
XE-133M	0.	233.22	Half-Life too short
CC-134	21.	604.70	5.5464E-09
I-134	0.	604.00	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	220.24	Half-Life too short
T-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
YE-135M	0.	520.50	Half-Life too short



Sample ID : EFT102010 L.T

Acquisition date : 22 NOV 2010 10:25:00

Radclide	Calcd Sum	Energy (keV)	MDA (uCi/cc)
CS-132	12.	919.50	3.8930E-09
I-132	0.	1313.02	Half-Life too short
CS-137	28.	581.25	7.3531E-09
ND-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XF-138	0.	255.31	Half-Life too short
SA-137	0.	1320.50	Half-Life too short
CE-139	46.	105.85	7.1822E-07
CS-139	0.	1263.23	Half-Life too short
BA-140	19.	537.32	7.5123E-09
LA-140	0.	1506.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	46.	145.44	1.8550E-06
LA-141	0.	1354.73	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	611.17	Half-Life too short
CE-143	0.	292.26	Half-Life too short
CE-144	58.	122.54	5.6515E-08
FR-144	0.	1489.15	Half-Life too short
ND-147	34.	51.16	1.3714E-07
PM-148M	19.	550.27	7.7990E-09
EU-152	31.	341.27	1.8764E-08
EU-154	13.	1904.76	3.5261E-08
EU-155	51.	105.31	3.8034E-08
EU-156	19.	648.29	2.3353E-07
HF-191	21.	482.03	3.7487E-09
TO-192	11.	1221.42	2.8093E-08
W-187	0.	605.31	Half-Life too short
RE-188	0.	155.83	Half-Life too short
HO-207	41.	375.19	9.9897E-07
BI-207	32.	539.67	6.3649E-09
TL-208	0.	562.14	Half-Life too short
PE-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PD-214	0.	351.92	Half-Life too short
RA-224	52.	240.98	1.8035E-05
RA-226	50.	136.21	1.6211E-07
AC-228	42.	338.32	5.0159E-08
TH-232	36.	54.37	8.1244E-07
PA-231	0.	131.28	Half-Life too short
TH-234	48.	53.29	1.7443E-06
U-235	40.	143.76	4.7851E-08
HP-239	0.	100.13	Half-Life too short
AM-241	27.	59.54	1.2671E-07

**EFT-1I**

**2011**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-101711-1.I

Sample Location (Well Number): EFT-1/I

1. Representative sample collected. Date/Time 10/17/11 1 14:10

Sample collected by: Thomas Mow / [Signature] Date: 10/25/11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Thomas Mow / [Signature] Date: 10/25/11  
Printed Name / Signature

3. Sample counted in accordance with 76.000/70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: John M. Goson / [Signature] Date: 11-1-11  
Fermi 2 Chemistry Printed Name / Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate

Performed by: Robert C. Gey SR / [Signature] Date: 11-2-11  
Fermi 2 Printed Name / Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks rv / 14

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-1/I
2 . Date Sampled	10/17/2011
3 . Time Sampled	14:10
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	10/30/2011
2 . Time Sample Counted	12:50
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.5 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2548.6 cpm
Net Spike Count Rate (cpm)	2541.1 cpm
H3 Spike Activity (dpm on count date)	6383.7 dpm
Counter Efficiency	0.3981 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	8.3 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.8 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}}{\text{Efficiency} \times 2.22\text{E6 dpm/uCi} \times \text{Sample Volume}} = 1.14\text{E-06 uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E6 uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician  \_\_\_\_\_

Date 11-1-11

Reviewed  \_\_\_\_\_

Date \_\_\_\_\_

NOV 01 2011

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-101711-2I

Sample Location (Well Number): EFT-4/I

1. Representative sample collected. Date/Time 10/17/11 | 14:10

Sample collected by: Thomas Mow | [Signature] Date: 10/25/11  
Printed Name | Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Thomas Mow | [Signature] Date: 10/25/11  
Printed Name | Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function.

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: C. Protti | [Signature] Date: 11-1-11  
Fermi 2 RP Printed Name | Signature

Sample number: EFT-101711-1I

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: C. Proffitt 1 [Signature] Date: 11-1-11  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Hey Jr. [Signature] Date: 11-1-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_ NA \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-101711-11

Sample End Time: 17-OCT-2011 14:10:00.00

REMARKS *No Plant Related Isotopes*

PERFORMED BY:

*Charles Pappas*  
SIGNATURE

REVIEWED BY:

*[Signature]*  
SIGNATURE/DATE

Sample ID : EFT-101711-11

Acquisition date : 1-NOV-2011 10:46:03

\*\*\*\*\*

## Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-101711-11  
 Sample collection start date: 17-OCT-2011 14:10:00.00  
 Sample collection end date : 17-OCT-2011 14:10:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc ✓  
 Sample geometry : MELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 ✓ Acquire date : 1-NOV-2011 10:46:03.32  
 Preset live time : 0 00:45:00.00 ✓ Elapsed live time : 0 00:45:00.00  
 Elapsed real time : 0 00:45:00.66 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 14-JUN-2011 14:50:56.41  
 Kev/channel : 5.00032E-01 Zero offset: -5.54949E-01  
 Daily cal date : 1-NOV-2011 07:48:09.27

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 ✓ Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	66.96	34	50	1.63	135.03	131	0	1.27E-02	42.6	
2	0	295.76	40	69	1.20	592.60	500	10	1.50E-02	41.2	
3	0	352.20	76	62	1.87	705.40	701	11	2.83E-02	23.1	
4	0	511.41	125	82	3.14	1023.06	1016	15	4.62E-02	10.2	
5	0	558.61	19	29	1.24	1110.26	1116	0	6.07E-03	55.0	
6	0	609.72	104	35	1.21	1220.47	1213	14	3.06E-02	15.5	
7	0	1461.09	02	9	1.79	2923.14	2914	17	3.02E-02	13.0	
8	0	1765.07	31	6	1.90	3531.10	3521	10	1.15E-02	23.9	



Post-MID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err
0	66.96	34	58	1.63	135.03	131	8	42.6
0	295.76	40	69	1.28	592.60	588	10	41.2
0	352.20	76	62	1.07	705.48	701	11	23.1
0	511.41	125	82	3.14	1023.06	1016	15	18.2
0	558.61	19	29	1.24	1118.26	1116	8	55.0
0	609.72	104	35	1.21	1220.47	1213	14	15.5
0	1461.09	82	9	1.79	2923.14	2914	17	13.8
0	1765.07	31	6	1.98	3531.10	3521	18	23.9

Ge-n- $\gamma$   
Pb-214  
Pb-214  
ANN. Peak  
~~Pb-214~~ Cd-n- $\gamma$   
Bi-214  
K-40  
Bi-214

f-11-1-11

Sample ID : EFT-101711-11

Acquisition date : 1-NOV-2011 10:46:03

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	82	10.67*	2.353E+00	3.250E-07	3.250E-07	13.78

Flag: "\*" = Keyline

Sample ID : EFT-101711-1I

Acquisition date : 1-NOV-2011 10:46:03

Total number of lines in spectrum 8  
 Number of unidentified lines 0  
 Number of lines tentatively identified by NID 8 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	3.250E-07	3.250E-07	0.440E-07	13.78	
Total Activity :			3.250E-07	3.250E-07			

Grand Total Activity : 3.250E-07 3.250E-07

Flags: "K" = Keyline not found

"M" = Manually accepted

"E" = Manually edited

"A" = Nuclide specific abn. limit

Nuclide	Half-life	Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	195.18	511.00*	100.46	1.000E+35	18.21	Decay
			% Abundances Found = 100.00				
SE-75	119.78D	0.12	66.05	1.02	2.587E-06	42.59	Abun.
			96.73	3.41	----	Not Found	----
			121.12	16.70	----	Not Found	----
			136.00*	59.20	----	Not Found	----
			198.60	1.45	----	Not Found	----
			264.65	59.80	----	Not Found	----
			279.53	25.20	----	Not Found	----
			303.91	1.32	----	Not Found	----
			400.65	11.40	----	Not Found	----
			% Abundances Found = 0.57				
AS-76	26.32H	13.56	559.10*	44.70	1.141E-04	55.00	Decay, Abun.
			563.23	1.17	----	Not Found	----
			571.30	0.14	----	Not Found	----
			657.03	6.10	----	Not Found	----
			665.31	0.39	----	Not Found	----
			740.12	0.12	----	Not Found	----
			771.76	0.12	----	Not Found	----
			867.63	0.12	----	Not Found	----
			1129.87	0.14	----	Not Found	----
			1212.72	1.63	----	Not Found	----
			1216.02	3.04	----	Not Found	----
			1228.52	1.39	----	Not Found	----
			1439.13	0.33	----	Not Found	----
			1453.60	0.13	----	Not Found	----
			1787.67	0.33	----	Not Found	----
			% Abundances Found = 73.70				
RU-103	39.35D	0.38	497.00*	89.00	----	Not Found	Abun.
			610.33	5.60	5.700E-07	15.51	
			% Abundances Found = 5.92				
XE-135	9.11H	39.19	249.79*	89.90	----	Not Found	Decay, Abun.
			608.19	2.89	5.311E+05	15.51	
			% Abundances Found = 3.11				
CS-136	13.16D	1.13	66.91	12.50	4.241E-07	42.59	Abun.
			86.29	6.30	----	Not Found	----
			153.22	7.46	----	Not Found	----
			163.89	4.61	----	Not Found	----
			176.55	13.56	----	Not Found	----
			273.65	12.66	----	Not Found	----
			340.57	48.50	----	Not Found	----
			818.50*	99.70	----	Not Found	----
			1048.07	79.60	----	Not Found	----
			1235.34	19.70	----	Not Found	----
			% Abundances Found = 4.10				
PM-148M	41.30D	0.36	288.11	12.56	----	Not Found	Abun.

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by	
	Half-life	Ratio			(uCi/cc)	%Error		
PM-148M	41.300	0.36	414.07	18.66	---	Not Found	---	Abun.
			432.78	5.35	---	Not Found	---	
			501.26	6.75	---	Not Found	---	
			550.27*	94.90	---	Not Found	---	
			599.74	12.54	---	Not Found	---	
			611.26	5.48	5.753E-07	15.51		
			629.97	89.00	---	Not Found	---	
			725.70	32.00	---	Not Found	---	
			915.33	17.17	---	Not Found	---	
			1013.81	20.30	---	Not Found	---	
% Abundances Found =			1.74					
TA-182	114.740	0.13	67.75	42.30	6.263E-08	42.59	Abun.	
			100.10	14.10	---	Not Found	---	
			1189.05	16.30	---	Not Found	---	
			1221.42*	27.10	---	Not Found	---	
			1230.97	11.50	---	Not Found	---	
			% Abundances Found =			38.01		
BI-214	19.90M	1076.31	609.31*	46.30	1.000E+35	15.51	Decay	
			768.36	5.04	---	Not Found	---	
			934.06	3.21	---	Not Found	---	
			1120.29	15.10	---	Not Found	---	
			1238.11	5.94	---	Not Found	---	
			1377.67	4.11	---	Not Found	---	
			1764.49	15.80	1.000E+35	23.92		
% Abundances Found =			65.03	(Abn. Limit = 48.48%)				
PB-214	26.80M	799.20	87.30	4.67	---	Not Found	---	Decay
			241.98	7.49	---	Not Found	---	
			295.21	19.20	1.000E+35	41.22		
			351.92*	37.20	1.000E+35	23.13		
			785.91	1.10	---	Not Found	---	
% Abundances Found =			80.96	(Abn. Limit = 37.20%)				

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	66.96	34	58	1.63	135.03	131	0	1.27E-02	42.6	1.41E+00	T
0	295.76	40	69	1.28	592.60	588	10	1.50E-02	41.2	5.62E+00	T
0	352.20	76	62	1.87	705.48	701	11	2.83E-02	23.1	5.38E+00	T
0	511.41	125	82	3.14	1023.86	1016	15	4.62E-02	18.2	4.58E+00	T
0	558.61	19	29	1.24	1118.26	1116	0	6.87E-03	55.0	4.40E+00	T
0	609.72	104	35	1.21	1220.47	1213	14	3.06E-02	15.5	4.25E+00	T
0	1765.07	31	6	1.98	3531.10	3521	10	1.15E-02	23.9	2.14E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	32.	477.59	7.1765E-08
F-18	0.	511.00	Half-Life too short
NA-22	19.	1274.54	9.1218E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-39	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	10.	889.25	6.3696E-09
CR-51	40.	320.00	8.4277E-08
MN-54	30.	834.83	8.7757E-09
CO-56	21.	1238.25	1.5908E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	64.	158.38	3.4539E-08
CO-57	55.	122.06	8.3503E-09
CO-58	16.	810.76	7.3546E-09
FE-59	16.	1099.22	1.7172E-08
CO-60	15.	1332.49	8.4398E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	17.	1115.52	1.6169E-08
ZN-69M	0.	428.63	Half-Life too short
SE-75	39.	136.00	9.9069E-09
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	801.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	75.	513.99	2.1902E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	75.	513.99	1.1093E-08
RB-86	18.	1076.63	1.5739E-07
KR-87	0.	482.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	9.	1836.01	8.8142E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	20.	1204.90	3.5551E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT-101711-II

Acquisition date : 1-NOV-2011 10:46:03

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	21.	702.63	6.1380E-09
NB-95	17.	765.79	8.1348E-09
NB-95M	46.	235.69	3.9271E-07
ZR-95	29.	756.72	1.6266E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	21.	739.58	2.1402E-06
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	30.	497.00	8.8702E-09
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	18.	621.84	5.5371E-08
CD-109	39.	88.03	2.5728E-07
AG-110M	18.	937.48	2.2868E-08
SN-113	34.	391.69	9.7902E-09
SN-117M	64.	158.56	1.5467E-08
SB-122	38.	563.93	4.6331E-07
SB-124	21.	602.71	6.8294E-09
SB-125	32.	427.89	2.0155E-08
TE-125M	53.	109.28	3.2451E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	40.	57.60	2.3179E-05
XE-127	63.	202.84	1.2267E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	17.	695.88	2.2731E-07
XE-129M	63.	196.56	4.1984E-07
I-130	0.	536.09	Half-Life too short
BA-131	44.	123.80	5.0497E-08
I-131	35.	364.48	2.5288E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	59.	163.93	7.3235E-07
I-132	0.	667.69	Half-Life too short
TE-132	55.	228.16	1.6459E-07
BA-133	33.	302.84	2.8816E-08
BA-133M	50.	276.09	1.9300E-05
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	29.	81.00	1.9549E-07
XE-133M	51.	233.22	6.3645E-06
CS-134	28.	604.70	6.6139E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short



Sample ID : EFT-101711-11

Acquisition date : 1-NOV-2011 10:46:03

Nuclide	Eckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	21.	818.50	1.5824E-08
I-136	0.	1313.02	Half-Life too short
CS-137	30.	661.65	8.0522E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	53.	165.85	7.6566E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	37.	537.32	6.2168E-08
LA-140	6.	1596.49	3.1460E-06
BA-141	0.	190.22	Half-Life too short
CE-141	44.	145.44	1.5490E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	55.	133.54	6.1160E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	42.	91.10	8.2587E-08
PM-148M	22.	550.27	7.4298E-09
EU-152	33.	344.27	2.0610E-08
EU-154	23.	1004.76	4.7913E-08
EU-155	41.	105.31	3.4564E-08
EU-156	20.	646.29	1.5616E-07
HF-181	21.	482.03	7.8766E-09
TA-182	14.	1221.42	3.1325E-08
W-187	0.	605.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
AU-199	65.	158.38	4.5627E-07
HG-203	47.	279.19	9.4477E-09
BI-207	34.	569.67	6.9793E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	73.	240.98	3.0753E-06
RA-226	71.	186.21	1.9944E-07
AC-228	42.	338.32	5.3094E-08
TH-228	37.	84.37	8.4701E-07
PA-234	0.	131.20	Half-Life too short
TH-234	36.	63.29	1.2051E-06
U-235	41.	143.76	5.0353E-08
NP-239	37.	106.13	2.3367E-06
AM-241	42.	59.54	1.4852E-07

**GEL LAB RESULTS**

**EFT-1I 2010**

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Company : Detroit Edison - Fermi 1  
 Address : PO Box 44440  
 Detroit, Michigan 48244

Report Date: February 17, 2010

Contact: Mr. Tom Mow  
 Project: **Fermi 1 - PO# 4700246055**

Client Sample ID: EF1-1/I  
 Sample ID: 245517006  
 Matrix: Ground Water  
 Collect Date: 14-JAN-10 15:30  
 Receive Date: 25-JAN-10  
 Collector: Client

Project: ROIT00116  
 Client ID: ROIT001

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>											
<i>Alphaspec Pu, Liquid "As Received"</i>											
Plutonium-238	U	0.00	+/-0.141	0.216	1.00	pCi/L		JXD2 02/09/10 0923	949025	1	
Plutonium-239/240	U	-0.0518	+/-0.153	0.440	1.00	pCi/L					
Plutonium-244	U	0.00	+/-0.141	0.216	1.00	pCi/L					
<i>Alphaspec U, Liquid "As Received"</i>											
Pct Uranium-235	U	0.377				percent		MXE1 02/09/10 1349	947744	2	
Uranium-233/234		3.20	+/-0.964	0.361	1.00	pCi/L					
Uranium-235/236	U	0.093	+/-0.182	0.279	1.00	pCi/L					
Uranium-238		3.82	+/-1.05	0.361	1.00	pCi/L					
<b>Rad Gas Flow Proportional Counting</b>											
<i>GFPC, Gross A/B, liquid "As Received"</i>											
Alpha		5.77	+/-3.52	4.32	5.00	pCi/L		DXF3 02/11/10 1932	945896	3	
Beta	U	1.31	+/-2.16	3.67	5.00	pCi/L					
<i>GFPC, Ra228, Liquid "As Received"</i>											
Radium-228		1.72	+/-0.844	1.12	3.00	pCi/L		JXC5 02/01/10 0723	945895	4	
<i>GFPC, Sr89&amp;Sr90, Liquid "As Received"</i>											
Strontium-89	U	0.272	+/-0.959	1.81	2.00	pCi/L		JXR1 02/03/10 1033	946221	5	
Strontium-90	U	-0.341	+/-0.603	1.96	2.00	pCi/L					
<b>Rad Radium-226</b>											
<i>Lucas Cell, Ra226, liquid "As Received"</i>											
Radium-226	U	0.128	+/-0.133	0.205	1.00	pCi/L		KSD1 02/10/10 1440	948312	6	

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Pu-11-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 900.0	
4	EPA 904.0/SW846 9320 Modified	
5	EPA 905.0 Modified	
6	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Plutonium-242 Tracer	Alphaspec Pu, Liquid "As Received"			77.6	(15%-125%)

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Company : Detroit Edison - Fermi 1  
Address : PO Box 44440  
Detroit, Michigan 48244

Report Date: February 17, 2010

Contact: Mr. Tom Mow  
Project: **Fermi 1 - PO# 4700246055**

Client Sample ID: EF1-1/I  
Sample ID: 245517006  
Project: ROIT00116  
Client ID: ROIT001

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"							99.7			(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"							91.6			(15%-125%)
Yttrium Carrier	GFPC, Sr89&Sr90, Liquid "As Received"							.103			(25%-125%)
Strontium Carrier	GFPC, Sr89&Sr90, Liquid "As Received"							96.4			(25%-125%)

**GEL LABORATORIES LLC**

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

**Certificate of Analysis**

Company : Detroit Edison - Fermi 1  
 Address : PO Box 44440

Report Date: December 30, 2010

Contact: Detroit, Michigan 48244  
 Mr. Tom Mow  
 Project: Fermi 1 - PO# 4700246055

Client Sample ID: EFT-102810-1/I  
 Sample ID: 268144010  
 Matrix: Water  
 Collect Date: 28-OCT-10 09:50  
 Receive Date: 06-DEC-10  
 Collector: Client

Project: ROIT00116  
 Client ID: ROIT001

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
<b>Rad Gas Flow Proportional Counting</b>											
<i>GFPC, Gross A/B, liquid "As Received"</i>											
Alpha		5.19	+/-1.73	1.92	5.00	pCi/L		VXC2 12/27/10 1941	1059089		1
Beta		7.44	+/-1.87	2.84	5.00	pCi/L					

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	EPA 900.0/SW846 9310	

**EFT-1D**

**2006**

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-1D 060906

Sample Location (Well Number): EFT-1D

1. Representative sample collected. Date/Time 06/09/06 / 0840

Sample collected by: Joy Slaback / Jay Slaback Date: 06/09/06  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: Christopher Freiling / Christopher A Freiling Date: 08/02/06  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Abere / Andriana Date: 8-9-06  
Fermi 2 RP Printed Name Signature

Sample number: EFT-1D060906

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Alvarez | Andres Date: 8-9-08  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: R. Lindsey | [Signature] Date: 2-20-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-1D060906 EF1

Sample End Time: 9-JUN-2006 08:40:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*Andrew Stee*  
SIGNATURE

REVIEWED BY:

*Robert* 2-25-04  
SIGNATURE/DATE

Sample ID : EFT-1D060906 EF1

Acquisition date : 9-AUG-2006 15:01:47

## Fermi 2 Radiation Protection Gamma Spectroscopy Report

## \*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-1D060906 EF1  
 Sample collection start date: 9-JUN-2006 08:40:00.00  
 Sample collection end date : 9-JUN-2006 08:40:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.000000E+03 cc  
 Sample geometry : M2LL Operator: AKG

## \*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 9-AUG-2006 15:01:47.15  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:01.01 Percent dead time : 0.05 %

## \*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 26-APR-2006 11:58:00.00  
 Kev/channel : 5.00467E-01 Zero offset: -2.61138E-03  
 Daily cal date : 9-AUG-2006 15:00:39.94

## \*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

## \*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m2ll Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	558.96	42	24	0.98	1117.26	1110	12	2.33E-02	28.0	
2	0	609.83	29	24	1.40	1218.97	1216	8	1.60E-02	34.9	
3	0	1460.73	101	4	1.62	2921.28	2914	15	5.62E-02	10.8	
4	0	1765.10	13	11	1.52	3530.62	3525	11	7.22E-03	56.7	

Sample Title : EFT-1D060906 EF1  
Decay Time = 61 06:21:47.15

Page : 1  
Acquisition Time = 9-AUG-2006 15:01:47.15

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	558.96	42	24	0.98	1117.26	1110	12	28.0		H <sub>2</sub> C
0	609.83	29	24	1.40	1218.97	1216	8	34.9		B-214
0	1460.73	101	4	1.62	2921.28	2914	15	10.8		K-40
0	1765.10	13	11	1.52	3530.62	3525	11	56.7		B-214

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	101	10.67*	2.308E+00	6.167E-07	6.167E-07	10.79

Flag: "\*" = Keyline

Total number of lines in spectrum 4  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 4 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	6.167E-07	6.167E-07	0.665E-07	10.79	
Total Activity :			6.167E-07	6.167E-07			
Grand Total Activity :			6.167E-07	6.167E-07			

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by	
AS-76	26.32H	55.87	559.10*	44.70	2.162E+09	27.97	Decay, Abun.	
			563.23	1.17	----	Not Found	----	
			571.30	0.14	----	Not Found	----	
			657.03	6.10	----	Not Found	----	
			665.31	0.39	----	Not Found	----	
			740.12	0.12	----	Not Found	----	
			771.76	0.12	----	Not Found	----	
			867.63	0.12	----	Not Found	----	
			1129.87	0.14	----	Not Found	----	
			1212.72	1.63	----	Not Found	----	
			1216.02	3.84	----	Not Found	----	
			1228.52	1.39	----	Not Found	----	
			1439.13	0.33	----	Not Found	----	
			1453.60	0.13	----	Not Found	----	
1787.67	0.33	----	Not Found	----				
% Abundances Found =			73.70					
RU-103	39.35D	1.56	497.08*	89.00	----	Not Found	----	Abun.
			610.33	5.60	5.461E-07	34.89		
% Abundances Found =			5.92					
XE-135	9.11H	161.43	249.79*	89.90	----	Not Found	----	Decay, Abun.
			608.19	2.89	1.000E+35	34.89		
% Abundances Found =			3.11					
PM-148M	41.30D	1.48	288.11	12.56	----	Not Found	----	Abun.
			414.07	18.66	----	Not Found	----	
			432.78	5.35	----	Not Found	----	
			501.26	6.75	----	Not Found	----	
			550.27*	94.90	----	Not Found	----	
			599.74	12.54	----	Not Found	----	
			611.26	5.48	5.304E-07	34.89		
			629.97	89.00	----	Not Found	----	
			725.70	32.80	----	Not Found	----	
			915.33	17.17	----	Not Found	----	
			1013.81	20.30	----	Not Found	----	
% Abundances Found =			1.74					
BI-214	19.90M	4434.01	609.31*	46.30	1.000E+35	34.89	Decay	
			768.36	5.04	----	Not Found	----	
			934.06	3.21	----	Not Found	----	
			1120.29	15.10	----	Not Found	----	
			1238.11	5.94	----	Not Found	----	
			1377.67	4.11	----	Not Found	----	
			1764.49	15.80	1.000E+35	56.66		
% Abundances Found =			65.03		(Abn. Limit = 40.40%)			

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	558.96	42	24	0.98	1117.26	1110	12	2.33E-02	28.0	4.31E+00	T
0	609.83	29	24	1.40	1218.97	1216	8	1.60E-02	34.9	4.16E+00	T
0	1765.10	13	11	1.52	3530.62	3525	11	7.22E-03	56.7	2.08E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	27.	477.59	1.8569E-07
F-18	0.	511.00	Half-Life too short
NA-22	18.	1274.54	1.4078E-08
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	15.	889.25	1.7329E-08
CR-51	42.	320.08	4.3376E-07
MN-54	25.	834.83	1.3867E-08
CO-56	10.	1238.25	2.6429E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	0.	158.38	Half-Life too short
CO-57	43.	122.06	1.3039E-08
CO-58	20.	810.76	1.9480E-08
FE-59	15.	1099.22	5.2395E-08
CO-60	5.	1332.49	8.2906E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	17.	1115.52	2.8210E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	47.	136.00	2.1801E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	41.	513.99	2.5554E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	41.	513.99	2.1081E-08
RB-86	14.	1076.63	1.2063E-06
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	7.	1836.01	1.6108E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	17.	1204.90	8.8225E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short



Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NE-94	21.	702.63	9.5819E-09
NE-95	10.	765.79	2.5851E-08
NE-95M	0.	235.69	Half-Life too short
ZR-95	16.	756.72	3.2370E-08
NE-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	386.81	Half-Life too short
RU-103	24.	497.08	2.7722E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	15.	621.84	8.5438E-08
CD-109	35.	88.03	4.2177E-07
AG-110M	13.	937.48	3.4740E-08
SN-113	38.	391.69	2.8921E-08
SN-117M	53.	158.56	2.3431E-07
SB-122	0.	563.93	Half-Life too short
SB-124	22.	602.71	1.8322E-08
SB-125	26.	427.89	2.9813E-08
TE-125M	42.	109.28	7.9942E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	24.	57.60	3.8475E-05
XE-127	48.	282.84	4.1279E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	25.	695.88	1.0859E-06
XE-129M	37.	196.56	1.9158E-05
I-130	0.	536.09	Half-Life too short
BA-131	36.	123.80	1.8872E-06
I-131	25.	364.48	1.8257E-06
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	48.	163.93	1.5735E-05
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	40.	382.84	5.8331E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	31.	604.70	1.1221E-08
I-134	0.	884.09	Half-Life too short
TE-134	0.	218.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT-1D060906 EF1

Acquisition date : 9-AUG-2006 15:01:47

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	16.	818.50	2.4745E-07
I-136	0.	1313.02	Half-Life too short
CS-137	14.	661.65	8.9010E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	39.	165.85	1.3070E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	18.	537.32	8.4464E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	46.	145.44	6.5544E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	48.	133.54	9.9160E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	32.	91.10	2.2063E-06
PM-148M	23.	550.27	2.5540E-08
EU-152	33.	344.27	3.2281E-08
EU-154	9.	1004.76	4.8824E-08
EU-156	22.	646.29	2.1051E-06
HF-181	22.	482.03	2.6413E-08
TA-182	15.	1221.42	6.4132E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	48.	279.19	3.0501E-08
BI-207	23.	569.67	9.0073E-09
TL-208	0.	583.14	Half-Life too short
PE-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PE-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	46.	186.21	2.5574E-07
AC-228	33.	338.32	7.5491E-08
TH-228	37.	84.37	1.4342E-06
PA-234	0.	131.20	Half-Life too short
TH-234	41.	63.29	7.3153E-06
U-235	45.	143.76	8.1487E-08
NP-239	0.	106.13	Half-Life too short
AM-241	28.	59.54	1.6967E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT- 1D 06 09 06

Sample Location (Well Number): EFT-1D

1. Representative sample collected. Date/Time 06/09/06 / 0840

Sample collected by: Joe Stetschinski / Clayton J. Kelly Date: 06/09/06  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Friling / Clayton A Kelly Date: 08/02/06  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Russ Rump / [Signature] Date: 8-7-06  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KD LINDSOY / [Signature] Date: 2-25-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1. Sample Location	EFT-1D	
2. Date Sampled	06/09/2006	
3. Time Sampled	08:40	
4. Sample Volume, (ml)	4	ml

**Instrument Count Data**

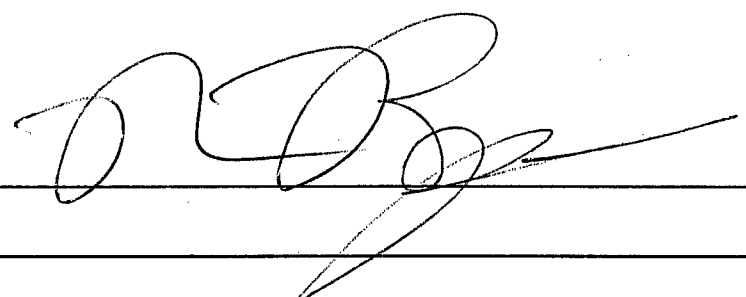
1. Date Sample Counted	08/07/2006	
2. Time Sample Counted	11:00	
3. Background Inf.:		
Minutes Counted	10	min.
Background Count Rate (cpm)	6.8	cpm
4. Efficiency Inf.: (Daily Spike Source ID # 111)		
Gross Spike Count Rate (cpm)	3596.7	cpm
Net Spike Count Rate (cpm)	3589.9	cpm
H3 Spike Activity (dpm on count date)	8575.1	dpm
Counter Efficiency	0.4186	cpm/dpm
5. Sample Info:		
Sample Gross Count Rate (cpm)	8.6	cpm
Sample Count Time (min.)	10.0	min.
Net Sample Count Rate (cpm)	1.8	cpm
6. Critical Level:		
Critical Level Count Rate (cpm)	1.9	cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}}{\text{Efficiency} \times 2.22\text{E6 dpm/uCi} \times \text{Sample Volume}} = 1.04\text{E-06 uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E6 uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 8-7-06

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-1D 060906

Sample Location (Well Number): EFT-1D

1. Representative sample collected. Date/Time 06/09/06 / 0840

Sample collected by: Joy Slaback / Joy Marie Slaback <sup>Collection</sup> Date: 06/09/06  
Printed Name / Signature <sub>Signed 02/01/07</sub>

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christophe Freiling / Christoph A Freiling Date: 08/02/06  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: K.D. Lindsay / K.D. Lindsay Date: 8-21-07  
Fermi 2 RP Printed Name Signature

Sample number: EFT-1D060906

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard / [Signature] Date: 7-10-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: [Signature] / [Signature] Date: 8-21-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT- 1D 06 09 06

Sample Location (Well Number): EFT-1D

1. Representative sample collected. Date/Time 06/09/06 / 0840

Sample collected by: Joey Slaback / Jayman Slaback Collection Date: 06/09/06  
Printed Name / Signature Signed 02/01/07

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Friling / Clitzel A Friling Date: 08/02/06  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Russ Bryant Date: 2-5-7  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: William V. Lipton Date: 2/15/07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks no tritium detected. William V Lipton 48651 2/15/07

**Sample Information**

1 . Sample Location	EFT-1D060906
2 . Date Sampled	06/09/2006
3 . Time Sampled	08:40
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	02/02/2007
2 . Time Sample Counted	10:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.4 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3388.1 cpm
Net Spike Count Rate (cpm)	3380.7 cpm
H3 Spike Activity (dpm on count date)	8340.7 dpm
Counter Efficiency	0.4053 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	8.0 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.6 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

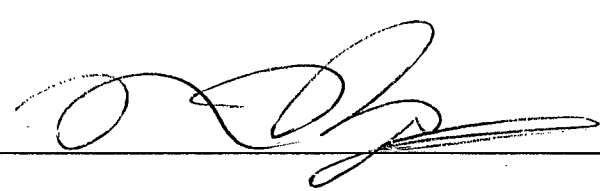
$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.12\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 dpm/uCi x Sample Volume}} < \text{MDA}$$

Technician \_\_\_\_\_



Date

2/5/7



DETOIT EDISON FERMI-2 POWER PLANT

10-JUL-2007 11:34:09.02

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

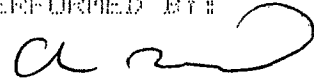
HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1 EFT-10060906

Sample End Time: 9-JUN-2006 00:40:00.00

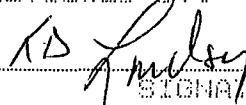
REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:



SIGNATURE

REVIEWED BY:



8-21-07

SIGNATURE/DATE

Sample ID : EF1 EFT-1D060906

Acquisition date : 10-JUL-2007 11:04:05

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-1D060906  
 Sample collection start date: 9-JUN-2006 08:40:00.00  
 Sample collection end date : 9-JUN-2006 08:40:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 CC  
 Sample geometry : MELL Operator: CMH

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 10-JUL-2007 11:04:05.46  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:00.89 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16  
 KeV/channel : 4.99804E-01 Zero offset: -3.08949E-01  
 Daily cal date : 10-JUL-2007 07:47:29.07

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	199.23	25	64	0.66	399.24	394	10	1.30E-02	63.7	750% annihilation
2	0	511.12	160	48	1.01	1023.25	1016	17	8.87E-02	12.6	Huc
3	0	550.78	74	12	2.06	1118.59	1111	16	4.13E-02	15.6	k-40
4	0	1461.34	28	12	2.55	2924.27	2917	12	1.55E-02	31.2	

Sample Title : EF1 EFT-1D060906

Page : 1

Decay Time = 396 02:24:05.46

Acquisition Time = 10-JUL-2007 11:04:05.46

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Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	199.23	25	64	0.66	399.24	394	10	63.7		
0	511.12	160	48	1.81	1023.25	1016	17	12.6		<
0	558.78	74	12	2.06	1118.59	1111	16	15.6		
0	1461.34	28	12	2.55	2924.27	2917	12	31.2		K-40

Nuclide Line Activity Report  
Sample ID : EF1 EFT-1D060906

Page : 2  
Acquisition date : 10-JUL-2007 11:04:05

Nuclide Types: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/CC	Decay Corr uCi/CC	1-Sigma %Error
K-40	1460.81	28	10.67*	2.501E+00	1.573E-07	1.573E-07	31.19

Flag: "\*" = Keyline

Summary of Nuclide Activity  
Sample ID : EF1 EFT-1D060906

Page : 3  
Acquisition date : 10-JUL-2007 11:04:05

Total number of lines in spectrum 4  
Number of unidentified lines 0  
Number of lines tentatively identified by MID 4 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/CC	Decay Corr uCi/CC	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	1.573E-07	1.573E-07	0.491E-07	31.19	
Total Activity :			1.573E-07	1.573E-07			

Grand Total Activity : 1.573E-07 1.573E-07

Flags: "K" = Keyline not found "M" = Manually accepted  
"E" = Manually edited "A" = Nuclide specific abn. limit

Sample ID : EF1 EFT-1D060906

Acquisition date : 10-JUL-2007 11:04:05

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/CC)	1-Sigma %Error	Rejected by
F-18	109.74M	5197.73	511.00*	193.46	1.000E+35	12.63	Decay
			% Abundances Found = 100.00				
SE-75	119.78D	3.31	66.05	1.02	----	Not Found	Abun.
			96.73	3.41	----	Not Found	
			121.12	16.70	----	Not Found	
			136.00*	59.20	----	Not Found	
			190.60	1.45	3.070E-06	63.69	
			264.65	59.00	----	Not Found	
			279.53	25.20	----	Not Found	
			303.91	1.32	----	Not Found	
			400.65	11.40	----	Not Found	
			< % Abundances Found = 0.01				
AS-76	26.32H	361.19	559.10*	44.70	1.000E+35	15.57	Decay, Abun.
			563.23	1.17	----	Not Found	
			571.30	0.14	----	Not Found	
			657.03	6.10	----	Not Found	
			665.31	0.39	----	Not Found	
			740.12	0.12	----	Not Found	
			771.76	0.12	----	Not Found	
			867.63	0.12	----	Not Found	
			1129.07	0.14	----	Not Found	
			1212.72	1.63	----	Not Found	
			1216.02	3.04	----	Not Found	
			1228.52	1.39	----	Not Found	
			1439.13	0.33	----	Not Found	
			1453.60	0.13	----	Not Found	
			1707.67	0.33	----	Not Found	
			< % Abundances Found = 73.70				
TE-131M	30.00H	316.09	102.06	7.90	----	Not Found	Decay, Abun.
			149.72	5.10	----	Not Found	
			200.63	7.56	1.000E+35	63.69	
			240.93	7.59	----	Not Found	
			334.27	9.60	----	Not Found	
			773.67*	30.20	----	Not Found	
			782.49	7.79	----	Not Found	
			793.75	13.90	----	Not Found	
			822.78	6.12	----	Not Found	
			952.21	20.70	----	Not Found	
			1125.46	11.40	----	Not Found	
			1206.60	9.00	----	Not Found	
			% Abundances Found = 5.19				

Unidentified Energy Lines  
Sample ID : EF1 EFT-1D060906

Page : 5  
Acquisition date : 10-JUL-2007 11:04:05

It	Energy	Area	Bkgrd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	199.23	25	64	0.66	399.24	394	10	1.30E-02	63.7	6.59E+00	T
0	511.12	160	48	1.01	1023.25	1016	17	8.07E-02	12.6	4.00E+00	T
0	558.78	74	12	2.06	1118.59	1111	16	4.13E-02	15.6	4.60E+00	T

Flags: "T" = Tentatively associated

\*\*\*\*\*  
 \* Detroit Edison Fermi 2 MDA Report, Generated 10-JUL-2007 11:34:13.70 \*  
 \*\*\*\*\*  
 \* Sample ID : EF18EFT-1D060906 \*  
 \*\*\*\*\*

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
BE-7	19.	477.59	1.1166E-05
F-18	0.	511.00	Half-Life too short
NA-22	10.	1274.54	1.2940E-08
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	10.	889.25	2.1374E-07
CR-51	0.	320.00	Half-Life too short
MN-54	10.	834.83	1.8348E-08
CO-56	10.	1238.25	4.6343E-07
MN-56	0.	1810.69	Half-Life too short
NI-56	0.	158.38	Half-Life too short
CO-57	43.	122.06	2.7701E-08
CO-58	8.	810.76	3.1558E-07
FE-59	11.	1099.22	7.5809E-06
CO-60	9.	1332.49	1.0711E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1401.84	Half-Life too short
ZN-65	13.	1115.52	6.0662E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	44.	136.00	1.3405E-07
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	52.	513.99	2.7790E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	52.	513.99	7.7435E-07
RE-86	0.	1076.63	Half-Life too short
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RE-88	0.	1382.39	Half-Life too short
Y-88	7.	1836.01	1.3493E-07
KR-89	0.	280.90	Half-Life too short
RE-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RE-90	0.	831.69	Half-Life too short
RE-90M	0.	924.23	Half-Life too short
Y-90M	00.	202.51	Half-Life too short
SR-91	0.	1024.38	Half-Life too short
Y-91	5.	1204.90	2.6254E-04
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short



Sample ID : EF1 EFT-1D060906

Acquisition date : 10-JUL-2007 11:04:05

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NE-94	19.	702.63	0.3533E-09
NE-95	0.	765.79	Half-Life too short
NE-95M	0.	235.69	Half-Life too short
ZR-95	12.	756.72	9.7437E-07
NE-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.50	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	0.	497.00	Half-Life too short
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	22.	621.04	1.7651E-07
CD-109	27.	80.03	5.5379E-07
AG-110M	6.	937.40	5.9490E-08
SN-113	29.	391.69	1.2669E-07
SN-117M	0.	150.56	Half-Life too short
SB-122	0.	563.93	Half-Life too short
SB-124	17.	602.71	7.1647E-07
SB-125	24.	427.09	3.2159E-06
TE-125M	30.	109.20	3.7245E-04
TE-127	0.	417.90	Half-Life too short
TE-127M	20.	57.60	2.0718E-04
XE-127	0.	202.04	Half-Life too short
TE-129	0.	459.60	Half-Life too short
TE-129M	0.	695.00	Half-Life too short
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	0.	123.00	Half-Life too short
I-131	0.	364.40	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	0.	163.93	Half-Life too short
I-132	0.	667.69	Half-Life too short
TE-132	0.	220.16	Half-Life too short
BA-133	37.	302.04	4.6453E-06
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.07	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	0	0.	0.
XE-133M	0.	233.22	Half-Life too short
CS-134	21.	604.70	1.1676E-06
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	260.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page : 3

Sample ID : EF1 EFT-1D060906

Acquisition date : 10-JUL-2007 11:04:05

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
CS-136	0.	818.58	Half-Life too short
I-136	0.	1313.02	Half-Life too short
CS-137	10.	661.65	7.2759E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	259.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	48.	165.85	7.1535E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	0.	537.32	Half-Life too short
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	0.	145.44	Half-Life too short
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	44.	133.54	1.9652E-07
PR-144	0.	1409.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PM-148M	17.	550.27	5.6467E-06
EU-152	33.	344.27	3.0762E-08
EU-154	5.	1004.76	3.0512E-08
EU-156	0.	646.29	Half-Life too short
HF-181	18.	482.03	5.2317E-06
TA-182	0.	1221.42	3.4059E-07
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	38.	279.19	3.5675E-06
BI-207	21.	569.67	8.0782E-09
TL-208	0.	583.14	Half-Life too short
PE-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PE-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	40.	106.21	2.1975E-07
AC-228	25.	338.32	6.7015E-08
TH-228	41.	84.87	? 1.8615E-06
PA-234	0.	131.20	Half-Life too short
TH-234	0.	63.29	Half-Life too short
U-235	41.	143.76	7.1804E-08
NP-239	0.	106.13	Half-Life too short
AM-241	30.	59.54	1.7390E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-1D 121806

Sample Location (Well Number): EFT-1D

1. Representative sample collected. Date/Time 12/18/06 1 10/2

Sample collected by: J. Slaback / Jay Mai Slaback Date: 02/01/07  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southard / Jennifer Southard Date: 2/2/07  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: D. Howard / DM Howard Date: APR 20 2007  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KO LINOSEY / KO Lino Date: 11-14-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_



## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-11121806

Sample Location (Well Number): EFT-11

1. Representative sample collected. Date/Time 12/18/06 1 1012

Sample collected by: J. Slaback / Joy Marie Slaback Date: 02/01/07  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 7/11/07  
Printed Name / Signature 7/2/07

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: KD Lindsay / KD Lindsay Date: 8-8-07  
Fermi 2 RP Printed Name Signature

Sample number: EFT-10121806

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: STEPHAN SPIER / Stephan Spier Date: 7-17-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: K. Lindsey / K. Lindsey Date: 8-8-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1-EFT-ID121006

Sample End Time: 10-DEC-2006 10:12:00.00

REMARKS

PERFORMED BY:

*Stephen Spies*

SIGNATURE

REVIEWED BY:

*B. J. [unclear]*

8-8-07

SIGNATURE/DATE

Sample ID : EF1-EFT-ID121006

Acquisition date : 17-JUL-2007 12:20:57

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1-EFT-ID121006
Sample collection start date: 18-DEC-2006 10:12:00.00
Sample collection end date : 18-DEC-2006 10:12:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : PELL Operator: SDS

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 17-JUL-2007 12:20:57.03
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:00.92 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16
Key/channel : 4.9739E-01 Zero offset: -1.87317E-01
Daily cal date : 17-JUL-2007 00:15:42.31

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Table with 11 columns: Pk, It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. Contains 5 rows of peak data with handwritten annotations like 'PA-238', 'annihilation', 'H2O', 'Bi-214', 'K-40'.



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## Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	199.33	39	73	1.18	399.24	393	13	48.6		
0	511.42	129	50	2.17	1023.75	1017	16	16.3		
0	558.59	76	28	2.04	1118.15	1111	14	17.2		
0	610.13	22	34	1.25	1221.29	1217	12	56.0		
0	1460.99	76	7	2.05	2923.97	2918	14	13.0		K-40

Nuclide Types: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	76	10.67*	2.501E+00	4.276E-07	4.276E-07	13.64

Flag: "\*" = Keyline

Total number of lines in spectrum 5  
Number of unidentified lines 0  
Number of lines tentatively identified by MID 5 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	4.276E-07	4.276E-07	0.503E-07	13.64	
Total Activity :			4.276E-07	4.276E-07			
Grand Total Activity :			4.276E-07	4.276E-07			

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	2779.11	511.00*	100.00	1.000E+35	16.20	Decay
		% Abundances	Found =	100.00			
SE-75	119.78D	1.76	66.05	1.02	---	Not Found	---
			96.73	3.41	---	Not Found	---
			121.12	16.70	---	Not Found	---
			136.00*	59.20	---	Not Found	---
			190.60	1.45	2.065E-06	40.62	
			264.65	59.80	---	Not Found	---
			279.53	25.20	---	Not Found	---
			303.91	1.32	---	Not Found	---
			400.65	11.40	---	Not Found	---
		% Abundances	Found =	0.01			
AS-76	26.32H	192.50	559.10*	44.70	1.000E+35	17.16	Decay, Abun.
			563.23	1.17	---	Not Found	---
			571.30	0.14	---	Not Found	---
			657.03	6.10	---	Not Found	---
			665.31	0.39	---	Not Found	---
		0	740.12	0.12	---	Not Found	---
			771.76	0.12	---	Not Found	---
			867.63	0.12	---	Not Found	---
			1129.07	0.14	---	Not Found	---
			1212.72	1.63	---	Not Found	---
			1216.00	3.04	---	Not Found	---
			1220.52	1.39	---	Not Found	---
			1439.13	0.33	---	Not Found	---
			1453.60	0.13	---	Not Found	---
			1787.67	0.33	---	Not Found	---
		% Abundances	Found =	73.70			
RU-103	32.35D	5.36	497.00*	59.00	---	Not Found	---
			610.33	5.60	5.441E-06	35.90	
		% Abundances	Found =	5.92			
TE-131M	30.00H	160.50	102.06	7.90	---	Not Found	---
			149.72	5.10	---	Not Found	---
			200.63	7.55	1.000E+35	40.62	
			240.93	7.59	---	Not Found	---
			334.27	9.60	---	Not Found	---
			773.67*	30.20	---	Not Found	---
			782.49	7.70	---	Not Found	---
			793.75	13.90	---	Not Found	---
			822.70	6.12	---	Not Found	---
			852.21	20.70	---	Not Found	---
			1125.40	11.40	---	Not Found	---
			1206.60	9.00	---	Not Found	---
		% Abundances	Found =	5.19			
TE-134	41.00M	7272.54	79.45	21.00	---	Not Found	---
			100.09	10.00	---	Not Found	---
			201.24	0.70	1.000E+35	40.62	

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by	
	Half-life	Ratio			(uCi/cc)	%Error		
TE-134	41.80M	7272.54	210.47*	21.90	----	Not Found	----	Decay, Abun.
			277.95	21.30	----	Not Found	----	
			435.06	18.60	----	Not Found	----	
			461.00	10.90	----	Not Found	----	
			464.64	5.10	----	Not Found	----	
			565.99	19.90	----	Not Found	----	
			742.59	14.70	----	Not Found	----	
			767.20	30.00	----	Not Found	----	
% Abundances Found =				4.60				
XE-135	9.11H	556.15	249.79*	89.90	----	Not Found	----	Decay, Abun.
			600.19	2.89	1.000E+35	55.90		
			% Abundances Found =				3.11	
PM-140M	41.30D	5.11	200.11	12.56	----	Not Found	----	Abun.
			414.07	10.60	----	Not Found	----	
			432.70	5.35	----	Not Found	----	
			501.26	6.75	----	Not Found	----	
			550.27*	94.90	----	Not Found	----	
			599.74	12.54	----	Not Found	----	
			611.26	5.40	4.664E-06	55.90		
			629.97	89.00	----	Not Found	----	
			725.70	32.00	----	Not Found	----	
			915.33	17.17	----	Not Found	----	
% Abundances Found =				1.74				
BI-214	19.90M	15275.90	609.31*	46.30	1.000E+35	55.90	Decay	
			760.36	5.04	----	Not Found		----
			934.06	3.21	----	Not Found		----
			1120.29	15.10	----	Not Found		----
			1230.11	5.94	----	Not Found		----
			1377.67	4.11	----	Not Found		----
			1764.49	15.00	----	Not Found		----
			% Abundances Found =					40.40

Flags "X" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	199.33	39	73	1.10	399.84	393	13	2.15E-02	40.6	6.59E+00	T
0	511.42	129	55	2.17	1023.75	1017	16	7.10E-02	16.3	4.00E+00	T
0	550.59	70	20	2.04	1118.15	1111	14	4.22E-02	17.2	4.69E+00	T
0	610.13	22	34	1.25	1221.20	1217	12	1.24E-02	56.0	4.52E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	20.	477.59	1.2040E-06
F-19	0.	511.00	Half-Life too short
NA-22	0.	1274.54	9.3654E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-36	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
CC-40	9.	809.25	4.3930E-08
CR-51	33.	320.00	1.4925E-05
MN-54	9.	834.03	1.1451E-08
CO-56	11.	1238.25	9.4259E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	0.	158.38	Half-Life too short
CO-57	37.	122.06	1.6089E-08
CO-58	16.	810.76	7.0464E-08
FE-59	8.	1099.22	3.7648E-07
CO-60	13.	1332.49	1.2187E-08
CU-64	0.	1345.98	Half-Life too short
NI-65	0.	1481.94	Half-Life too short
ZN-65	9.	1115.52	3.1366E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	49.	136.00	4.8243E-08
AS-76	0.	550.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	41.	513.99	2.4009E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	41.	513.99	9.6011E-08
RB-86	0.	1076.63	Half-Life too short
KR-87	0.	402.50	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	7.	1836.01	4.0521E-08
KR-89	0.	220.90	Half-Life too short
RE-89	0.	1031.08	Half-Life too short
KR-90	0.	1119.69	Half-Life too short
RE-90	0.	831.69	Half-Life too short
RE-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	6.	1204.90	3.1593E-05
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EF1-EFT-ID121806

Acquisition date : 17-JUL 2007 12:29:57

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	19.	702.63	8.2907E-09
NB-95	19.	765.79	5.9053E-07
NB-95M	0.	235.67	Half-Life too short
ZR-95	12.	756.72	1.2899E-07
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.50	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	20.	497.00	3.2939E-07
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	13.	621.84	1.1513E-07
CD-109	30.	88.03	4.4060E-07
AG-110M	13.	937.48	4.8510E-08
SN-113	27.	391.69	4.0488E-08
SN-117M	0.	158.56	Half-Life too short
SB-122	0.	563.93	Half-Life too short
SB-124	22.	602.71	9.3307E-09
SB-125	20.	427.89	2.5991E-08
TE-125M	35.	109.20	3.9451E-05
TE-127	0.	417.90	Half-Life too short
TE-127M	29.	57.60	9.0067E-05
XE-127	40.	282.84	5.9939E-07
TE-129	0.	459.60	Half-Life too short
TE-129M	16.	695.80	1.0367E-05
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	0.	123.00	Half-Life too short
I-131	0.	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	0.	163.93	Half-Life too short
I-132	0.	667.09	Half-Life too short
TE-132	0.	220.16	Half-Life too short
BA-133	35.	302.84	4.4133E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.07	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	22.	604.70	1.0177E-08
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short



Sample ID : EF1-EFT-ID121806

Acquisition date : 17-JUL-2007 12:29:57

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	0.	810.50	Half-Life too short
I-136	0.	1313.02	Half-Life too short
CS-137	19.	661.65	9.3495E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1428.50	Half-Life too short
CE-139	39.	165.85	2.5630E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	0.	537.32	Half-Life too short
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	47.	145.44	1.4805E-06
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	39.	133.54	1.1933E-07
PR-144	0.	1489.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PN-148M	16.	550.27	2.4403E-07
EU-152	35.	344.27	3.0609E-08
EU-154	9.	1004.76	4.6866E-08
EU-156	0.	646.29	Half-Life too short
HF-161	13.	402.03	2.2176E-07
TA-182	9.	1221.42	1.1844E-07
W-187	0.	685.81	Half-Life too short
RE-198	0.	155.03	Half-Life too short
HG-203	34.	279.19	2.1754E-07
BI-207	15.	569.67	6.8993E-09
TL-208	0.	503.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	44.	196.21	2.3010E-07
AC-228	23.	330.32	6.1382E-08
TH-228	44.	84.37	1.6091E-06
PA-234	0.	131.20	Half-Life too short
TH-234	30.	63.29	4.3970E-04
U-235	47.	143.76	7.6598E-08
NP-239	0.	106.13	Half-Life too short
AM-241	31.	59.54	1.7472E-07

**EFT-1D**

**2007**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-107307

Sample Location (Well Number): EFT-10

1. Representative sample collected. Date/Time 7/3/07 1 1102

Sample collected by: Joy Marie Stabell / Joy Marie Stabell Date: 12/10/2007  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 12/10/07  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: R. Burnett / [Signature] Date: 12/14/07  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KO LINDSEY / [Signature] Date: 2-26-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1. Sample Location	1D
2. Date Sampled	07/03/2007
3. Time Sampled	11:02
4. Sample Volume, (ml)	4 ml

**Instrument Count Data**

1. Date Sample Counted	12/14/2007
2. Time Sample Counted	08:00
3. Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	8.2 cpm
4. Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3189.3 cpm
Net Spike Count Rate (cpm)	3181.1 cpm
H3 Spike Activity (dpm on count date)	7944.9 dpm
Counter Efficiency	0.4004 cpm/dpm
5. Sample Info:	
Sample Gross Count Rate (cpm)	8.3 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.1 cpm
6. Critical Level:	
Critical Level Count Rate (cpm)	2.1 cpm

**Minimum Detectable Activity**

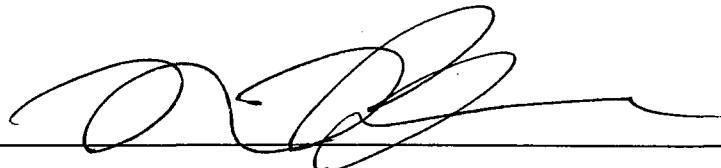
$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.19\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 uCi/ml x Sample Volume}} < \text{MDA}$$

Technician \_\_\_\_\_



Date \_\_\_\_\_

12/14/07

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-1D7307

Sample Location (Well Number): EFT-1D

1. Representative sample collected. Date/Time 07/03/2007 1102

Sample collected by: J. Slaback / Jerry Mouri Slaback Date: 07/16/2007  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 7/16/2007  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: KD LINDSEY / [Signature] Date: 8-8-07  
Fermi 2 RP Printed Name / Signature

Sample number: EFT-ID 7307

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard [Signature] Date: 7-18-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: RD Lindsay [Signature] Date: 8-8-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\*\*\*\*\*  
DETROIT EDISON FERMI-2 POWER PLANT

10 JUL-2007 11:19:12.14  
\*\*\*\*\*

RADIATION PROTECTION DEPARTMENT  
GAMMA SPECTROSCOPY ANALYSIS REPORT  
HIGH EFFICIENCY DETECTOR

.....  
Sample ID Number: EFL EFT-1D7307

Sample End Time: 3-JUL-2007 11:02:00.00

REMARKS .....

PERFORMED BY:

*ce*

.....  
SIGNATURE

REVIEWED BY:

*RO Lindsey 8-8-07*

.....  
SIGNATURE/DATE

Sample ID : EF1 EFT-1D7307

Acquisition date : 18-JUL-2007 10:49:00

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-1D7307
Sample collection start date: 3-JUL-2007 11:02:00.00
Sample collection end date : 3-JUL-2007 11:02:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : M2LL Operator: CMH

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 18-JUL-2007 10:49:00.91
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:00.93 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16
Kev/channel : 4.99749E-01 Zero offset: -1.04251E-01
Daily cal date : 18-JUL-2007 07:51:31.39

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_n211 Efficiencies at : Peak energy

Table with columns: Pk It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. Includes handwritten annotations like 'PB-214', 'annihilation', 'H2C', 'B1-214', 'K40', 'B1-214'.



Sample Title : EF1 EFT-1D7307  
Decay Time = 14 23:47:09.91

Page : 1  
Acquisition Time = 18-JUL-2007 10:49:09.9

1

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	353.12	76	31	2.33	706.95	700	18	20.6		
4	511.09	100	23	2.58	1023.04	1014	23	16.6	1.25E+00	
4	511.47	28	15	1.59	1023.00	1014	23	52.2		
4	513.11	41	21	2.31	1027.10	1014	23	39.1		SR-85 KR-85
0	559.55	61	10	2.01	1119.01	1111	13	16.5		
0	589.59	52	17	1.74	1220.14	1215	10	20.5		
0	1461.20	57	0	2.59	2924.11	2917	10	13.2		K-40
0	1764.62	23	7	1.34	3531.20	3524	14	32.1		

Nuclide Line Activity Report  
Sample ID : EF1 EFF-1D7307

Page : 2  
Acquisition date : 10-JUL-2007 10:49:00

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	57	10.67*	2.501E+00	3.207E-07	3.207E-07	13.25

Nuclide Type: fission gas

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
KR-85	513.99	41	0.43*	4.870E+00	2.935E-06	2.943E-06	39.12

Nuclide Type: activation

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
SR-85	513.99	41	99.27*	4.870E+00	1.271E-00	1.492E-00	39.12

Flag: "\*" = Keyline

Summary of Nuclide Activity  
 Sample ID : EF1 EFT-1D7307

Page : 3  
 Acquisition date : 18-JUL-2007 10:49:00

Total number of lines in spectrum 8  
 Number of unidentified lines 1  
 Number of lines tentatively identified by NID 7 87.50%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	3.207E-07	3.207E-07	0.425E-07	13.25	
Total Activity :			3.207E-07	3.207E-07			

Nuclide Type : fission gas

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
KR-85	10.72Y	1.00	2.935E-06	2.943E-06	1.151E-06	39.12	
Total Activity :			2.935E-06	2.943E-06			

Nuclide Type : activation

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
SR-85	64.84D	1.17	1.271E-08	1.492E-08	0.584E-08	39.12	
Total Activity :			1.271E-08	1.492E-08			

Grand Total Activity : 3.260E-06 3.270E-06

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Rejected Report

Sample ID : EF1 EFT-1D7307

Acquisition date : 18-JUL-2007 10:49:00

Nuclide	Half-life	Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma XError	Rejected by
F-18	109.74M	196.95	511.00*	100.46	1.000E+35	16.63	Decay
% Abundances Found = 100.00							
Ag-76	26.32H	13.68	559.10*	44.70	5.763E-04	16.54	Decay, Abun.
			563.23	1.17	----	Not Found	----
			571.30	0.14	----	Not Found	----
			657.03	6.10	----	Not Found	----
			665.31	0.39	----	Not Found	----
			740.12	0.12	----	Not Found	----
			771.76	0.12	----	Not Found	----
			867.63	0.12	----	Not Found	----
			1129.07	0.14	----	Not Found	----
			1212.72	1.63	----	Not Found	----
			1216.02	3.84	----	Not Found	----
			1228.52	1.39	----	Not Found	----
			1439.13	0.33	----	Not Found	----
			1453.60	0.13	----	Not Found	----
			1787.67	0.33	----	Not Found	----
% Abundances Found = 73.70							
Ru-103	39.35D	0.38	497.00*	89.00	----	Not Found	Abun.
			610.33	5.60	4.009E-07	20.47	
% Abundances Found = 5.92							
Xe-135	9.11H	39.52	249.79*	89.90	----	Not Found	Decay, Abun.
			608.19	2.09	4.705E+05	20.47	
% Abundances Found = 3.11							
Pm-148M	41.30D	0.36	288.11	12.56	----	Not Found	Abun.
			414.07	18.66	----	Not Found	----
			432.70	5.35	----	Not Found	----
			501.26	6.75	----	Not Found	----
			550.27*	94.90	----	Not Found	----
			599.74	12.54	----	Not Found	----
			611.26	5.48	4.046E-07	20.47	
			629.97	89.00	----	Not Found	----
			725.70	32.00	----	Not Found	----
			915.33	17.17	----	Not Found	----
			1013.01	20.30	----	Not Found	----
% Abundances Found = 1.74							
Bi-214	19.90M	1085.54	609.31*	46.30	1.000E+35	20.47	Decay
			768.36	5.04	----	Not Found	----
			934.06	3.21	----	Not Found	----
			1120.29	15.10	----	Not Found	----
			1238.11	5.94	----	Not Found	----
			1377.67	4.11	----	Not Found	----
			1764.49	15.00	1.000E+35	32.10	
% Abundances Found = 65.03 (Abn. Limit = 40.40%)							
Pb-214	26.80M	886.05	87.30	4.67	----	Not Found	Decay
			241.90	7.49	----	Not Found	----

Rejected Report (continued)  
Sample ID : EFL EFT-1D7397

Page : 5  
Acquisition date : 18-JUL-2007 19:49:00

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by	
	Half-life	Ratio			(uCi/cc)	%Error		
PB-214	26.80M	806.05	295.21	19.20	---	Not Found	---	Decay
			351.92*	37.20	1.000E+35	20.63		
			705.91	1.10	---	Not Found	---	
% Abundances Found =				53.40	(Abn. Limit = 37.20%)			

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EF1 EFT-1D7387

Page : 6  
Acquisition date : 10-JUL-2007 10:49:00

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pe	Cts/Sec	%Err	%Eff	Flags
0	353.12	76	31	2.33	706.95	700	10	4.25E-02	20.6	5.69E+00	T
4	511.09	100	23	2.56	1023.04	1014	23	5.54E-02	16.6	4.88E+00	T
4	511.47	28	15	1.59	1023.80	1014	23	1.53E-02	52.2	4.88E+00	T
0	558.58	61	10	2.01	1119.01	1111	13	3.40E-02	16.5	4.69E+00	T
0	600.59	52	17	1.74	1220.14	1215	10	2.80E-02	20.5	4.52E+00	T
0	1764.62	23	7	1.34	3531.20	3524	14	1.20E-02	32.1	2.26E+00	T

Flags: "T" = Tentatively associated

\*\*\*\*\*  
 \* Detroit Edison Fermi 2 MDA Report, Generated 18-JUL-2007 11:19:16.12 \*  
 \*\*\*\*\*  
 \* Sample ID : EF1 EFT-1D7307 \*  
 \*\*\*\*\*

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	24.	477.59	8.8304E-08
F-10	0.	511.00	Half-Life too short
NA-22	11.	1274.54	1.0331E-02
NA-24	0.	1360.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	13.	889.25	9.9300E-09
CR-51	35.	320.00	1.1345E-07
MN-54	0.	834.03	7.3785E-09
CO-56	10.	1230.25	2.0351E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	49.	150.30	4.4200E-08
CO-57	48.	122.00	1.0701E-08
CO-58	16.	910.76	1.0263E-08
FE-59	9.	1099.22	1.0079E-08
CO-60	0.	1332.49	9.3000E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.04	Half-Life too short
ZN-65	9.	1115.52	1.7134E-08
ZN-69M	0.	400.63	Half-Life too short
SE-75	44.	136.00	1.4696E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	801.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85M	0.	151.10	Half-Life too short
RE-86	7.	1076.63	1.5236E-07
KR-87	0.	400.50	Half-Life too short
SR-87M	0.	300.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RE-88	0.	1302.39	Half-Life too short
Y-88	7.	1036.01	1.1201E-08
KR-89	0.	220.90	Half-Life too short
RE-89	0.	1031.00	Half-Life too short
KR-90	0.	1110.69	Half-Life too short
RE-90	0.	831.69	Half-Life too short
RE-90M	0.	024.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	11.	1204.90	3.0524E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1303.04	Half-Life too short
Y-92	0.	934.46	Half-Life too short
OR-93	0.	590.20	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page # 2

Sample ID # EF1 EFT-1D7307

Acquisition date # 18-JUL-2007 10:49:00

Nuclide	Backgnd Sum	Energy/ (keV)	MDA (uCi/cc)
NB-94	15.	702.63	7.4672E-09
NB-95	12.	765.79	1.0088E-08
NB-95M	30.	235.69	4.7425E-07
ZR-95	14.	756.72	1.7015E-09
ND-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MD-99	17.	739.50	2.0700E-06
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	21.	497.08	1.0693E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	18.	621.84	7.0513E-08
CD-109	34.	80.03	3.4822E-07
AG-110M	11.	937.48	2.6526E-08
SN-113	31.	391.69	1.3166E-08
SN-117M	48.	150.56	1.9527E-08
SB-122	15.	563.93	4.4116E-07
SB-124	8.	602.71	6.2286E-09
SB-125	19.	427.89	2.2650E-08
TE-125M	40.	109.28	4.0259E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	29.	57.60	2.5680E-05
XE-127	42.	202.84	1.4629E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	17.	695.88	3.2336E-07
XE-129M	44.	196.56	5.1549E-07
I-130	0.	536.09	Half-Life too short
BA-131	45.	123.00	7.2443E-08
I-131	29.	364.48	3.3067E-08
TE-131	0.	149.72	Half-Life too short
YE-131M	0.	773.67	Half-Life too short
XE-131M	38.	163.93	8.5893E-07
I-132	0.	667.69	Half-Life too short
TE-132	37.	228.16	2.0152E-07
BA-133	34.	302.84	4.1707E-08
BA-133M	38.	276.09	2.5729E-05
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	26.	81.00	2.7106E-07
XE-133M	47.	233.22	9.1367E-06
CS-134	16.	604.70	7.2455E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	269.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short
CS-136	0.	818.50	1.4963E-08
I-136	0.	1313.02	Half-Life too short



## Minimum Detectable Activity Report (continued)

Page : 3

Sample ID : EF1 EFT-1D7307

Acquisition date : 18-JUL-2007 10:49:08

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-137	14.	661.65	8.2570E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	43.	165.85	9.9345E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	17.	537.32	6.2100E-08
LA-140	3.	1596.49	3.5451E-06
BA-141	0.	190.22	Half-Life too short
CE-141	45.	145.44	2.2333E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	39.	133.54	7.3436E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	28.	91.10	9.9960E-08
PM-148M	15.	550.27	8.8682E-09
EU-152	20.	344.27	2.7195E-08
EU-154	0.	1004.76	4.3875E-08
EU-156	15.	646.29	1.9501E-07
HF-181	14.	482.03	9.2824E-09
TA-182	9.	1221.42	3.6515E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	42.	279.19	1.2880E-08
BI-207	14.	569.67	6.5759E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	52.	240.98	3.8662E-06
RA-226	54.	186.21	2.5178E-07
AC-228	39.	338.32	7.2774E-08
TH-230	40.	84.37	1.2686E-06
PA-234	0.	131.20	Half-Life too short
TH-234	35.	63.29	1.6798E-06
U-235	37.	143.76	6.8755E-08
NP-239	36.	106.13	3.4191E-06
AM-241	33.	59.54	1.7944E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-1D7307D

Sample Location (Well Number): EFT-1D

1. Representative sample collected. Date/Time 7/3/07 1 1125

Sample collected by: Joy Marie Slaback / Joy Marie Slaback Date: 12/10/2007  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 12/10/07  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: R. Buzen / [Signature] Date: 12/14/07  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KO Lindsay / [Signature] Date: 2-26-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location 1D - Duplicate  
 2 . Date Sampled 07/03/2007  
 3 . Time Sampled 11:25  
 4 . Sample Volume, (ml) 4 ml

**Instrument Count Data**

1 . Date Sample Counted 12/14/2007  
 2 . Time Sample Counted 08:00  
 3 . Background Inf.:  
     Minutes Counted 10 min.  
     Background Count Rate (cpm) 8.2 cpm  
 4 . Efficiency Inf.: (Daily Spike Source ID # 111)  
     Gross Spike Count Rate (cpm) 3189.3 cpm  
     Net Spike Count Rate (cpm) 3181.1 cpm  
     H3 Spike Activity (dpm on count date) 7944.9 dpm  
     Counter Efficiency 0.4004 cpm/dpm  
 5 . Sample Info:  
     Sample Gross Count Rate (cpm) 8.4 cpm  
     Sample Count Time (min.) 10.0 min.  
     Net Sample Count Rate (cpm) 0.2 cpm  
 6 . Critical Level:  
     Critical Level Count Rate (cpm) 2.1 cpm

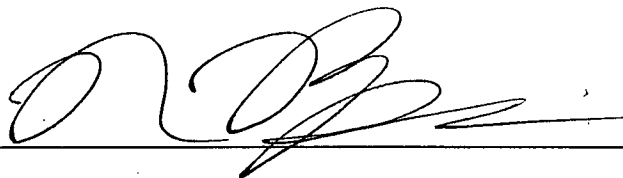
**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\frac{\text{(Bkg cpm)}}{\text{(Bkg min.)}} + \frac{\text{(Bkg cpm)}}{\text{(Smpl min.)}}}{\text{Efficiency} \times 2.22\text{E6 dpm/uCi} \times \text{Sample Volume}} = 1.19\text{E-06 uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E6 uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician



Date

12/14/07

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-1D7307D

Sample Location (Well Number): EFT-1D duplicate

1. Representative sample collected. Date/Time 07/03/2007 1125

Sample collected by: J. Slaback / Joy Marie Slaback Date: 07/16/2007  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Joy Marie Slaback Date: 7/16/2007  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: KD LINDSEY / KD Lindsey Date: 8.8.07  
Fermi 2 RP Printed Name Signature

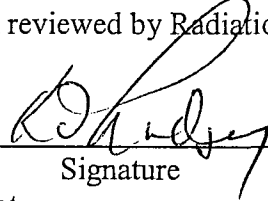
Sample number: EFT-107307D

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard |  Date: 7-18-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: RO Lindsay |  Date: 8-8-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\*\*\*\*\*  
DETROIT EDISON FERMI-2 POWER PLANT

18-JUL-2007 10:40:35.00  
\*\*\*\*\*

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

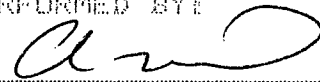
HIGH EFFICIENCY DETECTOR

.....  
Sample ID Number: EF1 EFT-1D7307D

Sample End Time: 3-JUL-2007 11:25:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:



\_\_\_\_\_  
SIGNATURE

REVIEWED BY:



\_\_\_\_\_  
SIGNATURE/DATE

Sample ID : EF1 EFT-1D7307D

Acquisition date : 18-JUL-2007 10:18:23

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-1D7307D  
 Sample collection start date: 3-JUL-2007 11:25:00.00  
 Sample collection end date : 3-JUL-2007 11:25:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : P2LL Operator: CMH

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 18-JUL-2007 10:18:23.20  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:00.00 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16  
 KeV/channel : 4.90749E-01 Zero offset: -1.04251E-01  
 Daily cal date : 18-JUL-2007 07:51:31.39

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_g211 Efficiencies at : Peak energy

PK	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	511.46	158	46	2.11	1023.78	1016	20	8.79E-02	13.1	annihilation
2	0	558.58	82	29	2.43	1117.91	1111	13	4.55E-02	17.5	H <sub>2</sub> C
3	0	609.79	49	30	1.17	1220.55	1214	14	2.72E-02	28.1	Bi-214
4	0	934.11	12	5	1.22	1869.47	1863	11	6.70E-03	47.0	Bi-214
5	0	1461.01	58	8	2.07	2923.74	2916	17	3.22E-02	13.1	K-40

Sample Title : EF1 EFT-107307D

Page : 1

Decay Time = 14 02:53:23.20

Acquisition Time = 10-JUL-2007 10:10:23.0

0

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	511.46	150	46	2.11	1023.70	1016	20	13.1		
0	550.50	62	29	2.43	1117.91	1111	13	17.5		
0	609.79	49	30	1.17	1220.55	1214	14	20.1		
0	934.11	12	5	1.22	1869.47	1863	11	47.0		
0	1461.01	50	0	2.07	2923.74	2916	17	13.1		K-40



Nuclide Line Activity Report  
Sample ID : LF1 CRT-1D7307D

Page : 3  
Acquisition date : 10-JUL-2007 10:10:23

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	58	10.67*	2.501E+00	3.263E-07	3.263E-07	13.13

Flag: "\*" = Keyline

Summary of Nuclide Activity  
Sample ID : EF1 EFT-1D7307D

Page : 3  
Acquisition date : 10-JUL-2007 10:10:23

Total number of lines in spectrum 5  
Number of unidentified lines 0  
Number of lines tentatively identified by MID 5 100.00%

Nuclide Type : natural

Nuclide	HLife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma #Error	Flags
K-40	1.00E+05Y	1.00	3.263E-07	3.263E-07	0.420E-07	13.13	
Total Activity :			3.263E-07	3.263E-07			
Grand Total Activity :			3.263E-07	3.263E-07			

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Sample ID : EF1 EFT-1D7307D

Acquisition date : 10-JUL-2007 10:10:23

Nuclide	Half-life	Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	196.36	511.00*	100.46	1.000E+35	13.11	Decay
				% Abundances Found =	100.00		
AS-76	26.32H	13.65	559.10*	44.70	7.515E-04	17.54	Decay, Abun.
				563.23	1.17	---- Not Found ----	
				571.30	0.14	---- Not Found ----	
				657.03	6.10	---- Not Found ----	
				665.31	0.39	---- Not Found ----	
				740.12	0.12	---- Not Found ----	
				771.76	0.12	---- Not Found ----	
				867.63	0.12	---- Not Found ----	
				1129.07	0.14	---- Not Found ----	
				1212.72	1.63	---- Not Found ----	
				1216.02	3.04	---- Not Found ----	
				1220.52	1.39	---- Not Found ----	
				1439.13	0.33	---- Not Found ----	
				1453.60	0.13	---- Not Found ----	
				1787.67	0.33	---- Not Found ----	
				% Abundances Found =	73.70		
Y-92	3.54H	101.45	448.50	2.30	---- Not Found ----	----	Decay, Abun.
				561.10	2.40	---- Not Found ----	
				844.30	1.25	---- Not Found ----	
				934.46*	13.90	1.421E+23	47.00
				1405.40	4.00	---- Not Found ----	
				% Abundances Found =	56.30		
RU-103	39.35D	0.38	497.00*	89.00	---- Not Found ----	----	Abun.
				610.33	5.60	3.785E-07	20.00
				% Abundances Found =	5.92		
XE-135	9.11H	39.42	249.79*	89.90	---- Not Found ----	----	Decay, Abun.
				600.19	2.89	4.152E+05	20.00
				% Abundances Found =	3.11		
PM-148M	41.30D	0.36	288.11	12.56	---- Not Found ----	----	Abun.
				414.07	10.66	---- Not Found ----	
				432.70	5.35	---- Not Found ----	
				501.26	6.75	---- Not Found ----	
				550.27*	94.90	---- Not Found ----	
				599.74	12.54	---- Not Found ----	
				611.26	5.40	3.020E-07	20.00
				629.97	89.00	---- Not Found ----	
				725.70	32.00	---- Not Found ----	
				915.33	17.17	---- Not Found ----	
				1013.01	20.30	---- Not Found ----	
				% Abundances Found =	1.74		
BI-214	19.90M	1002.03	609.31*	46.30	1.000E+35	20.00	Decay
				760.36	5.04	---- Not Found ----	
				934.06	3.21	1.000E+35	47.00
				1120.29	15.10	---- Not Found ----	

Rejected Report (continued)  
Sample ID : EF1 EFT-1D7307D

Page : 5  
Acquisition date : 18-JUL-2007 10:10:23

Nuclide	Half-life	Ratio	Energy	%Abund	Activity 1-Sigma (uCi/cc)	%Error	Rejected by	
BI-214	19.90M	1000.00	1230.11	5.94	---	Not Found	---	Decay
			1377.67	4.11	---	Not Found	---	
			1764.49	15.00	---	Not Found	---	
% Abundances Found =				51.04	(Abn. Limit = 40.40%)			

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EF1 EFT-1D7307D

Page : 6  
Acquisition date : 18-JUL-2007 10:19:23

IV	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	511.46	158	46	2.11	1023.78	1016	20	0.79E-02	13.1	4.88E+00	T
0	558.50	82	29	2.43	1117.91	1111	13	4.55E-02	17.5	4.09E+00	T
0	609.79	49	30	1.17	1220.55	1214	14	2.72E-02	20.1	4.52E+00	T
0	934.11	12	5	1.22	1869.47	1863	11	6.70E-03	47.0	3.18E+00	T

Flags: "T" = Tentatively associated

\* Detroit Edison Fermi 2 MDA Report, Generated 18-JUL-2007 10:40:29.01 \*  
 \* Sample ID : CF1 EFF-1D7307D \*

Minimum Detectable Activity Report

Nuclide	Backgd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	10.	477.59	7.7537E-08
F-18	0.	511.00	Half-Life too short
NA-22	7.	1274.54	8.2444E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	13.	887.25	1.0230E-08
CR-51	33.	320.08	1.1101E-07
MN-54	16.	834.03	9.3628E-09
CO-56	15.	1238.25	1.9151E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	57.	150.38	4.7045E-08
CO-57	42.	122.06	1.0290E-08
CO-58	12.	810.76	9.3152E-09
FE-59	9.	1009.22	1.0225E-08
CO-60	10.	1332.49	9.9910E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	6.	1115.52	1.4011E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	50.	136.00	1.5660E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	801.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	47.	513.99	2.4706E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	47.	513.99	1.2571E-08
RB-86	7.	1076.63	1.5131E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	308.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1302.39	Half-Life too short
Y-88	4.	1836.01	0.6105E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1110.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	0.	1204.90	3.3977E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1303.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Minimum Detectable Activity Report (continued)

Sample ID : EF1 EFT-107307D

Acquisition date : 10-JUL-2007 10:10:23

Nuclide	Background Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	10.	702.63	0.2243E-09
NB-95	6.	765.79	7.3028E-09
NB-95M	37.	235.69	5.1002E-07
ZR-95	12.	756.72	1.5426E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	6.	739.50	1.8367E-06
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	21.	497.00	1.0604E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	13.	621.04	6.8595E-08
CD-109	36.	00.00	3.5051E-07
AG-110M	7.	937.40	2.2117E-08
SM-113	19.	391.69	1.0677E-08
SM-117M	59.	150.56	2.1359E-08
CD-122	20.	563.93	4.9397E-07
SB-124	24.	602.71	1.0209E-08
SC-125	24.	427.09	2.4934E-08
TE-125M	33.	109.20	3.6706E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	31.	57.60	2.6570E-05
XE-127	49.	202.04	1.5720E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	12.	695.00	2.0112E-07
XE-129M	67.	196.56	6.2796E-07
I-130	0.	536.09	Half-Life too short
BA-131	36.	123.00	6.4679E-08
I-131	21.	364.40	2.0377E-06
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	51.	163.93	9.0192E-07
I-132	0.	667.69	Half-life too short
TE-132	34.	228.16	1.9147E-07
BA-133	29.	302.04	3.0000E-08
BA-133M	34.	276.00	2.4011E-05
I-133	0.	529.07	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	31.	01.00	2.9513E-07
XE-133M	37.	233.22	0.1092E-06
CS-134	27.	604.70	9.2923E-09
I-134	0.	004.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	260.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Minimum Detectable Activity Report (continued)

Sample ID : EF1 EFT-107307D

Acquisition date : 19-JUL-2007 10:19:23

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	5.	818.50	1.2494E-08
I-136	0.	1313.02	Half-Life too short
CS-137	15.	661.65	0.4241E-09
XE-137	0.	485.49	Half-Life too short
CS-138	0.	1435.96	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	41.	165.85	9.7532E-09
CS-139	0.	1203.23	Half-Life too short
BA-140	20.	537.32	6.5893E-08
LA-140	6.	1596.49	4.5553E-06
BA-141	0.	190.22	Half-Life too short
CE-141	42.	145.44	2.1412E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	39.	133.54	7.3711E-08
PR-144	0.	1409.15	Half-Life too short
HD-147	32.	91.10	1.0636E-07
PM-148M	20.	550.27	1.0141E-08
EU-152	20.	344.27	2.7173E-08
EU-154	15.	1004.76	5.6259E-08
EU-156	15.	646.29	1.9783E-07
HF-181	17.	482.83	1.0121E-08
TA-182	6.	1221.42	3.0895E-08
W-187	0.	605.81	Half-Life too short
RE-188	0.	155.83	Half-Life too short
HG-203	45.	279.19	1.3294E-08
BI-207	27.	569.67	0.9004E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	230.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	48.	240.98	3.7832E-06
RA-226	51.	106.21	2.4614E-07
AC-228	29.	330.32	6.3035E-08
TH-228	24.	84.37	9.9540E-07
PA-234	0.	131.20	Half-Life too short
TH-234	37.	63.29	1.7219E-06
P-235	55.	143.76	0.2166E-08
P-239	52.	106.13	3.9895E-06
P-241	25.	59.54	1.5776E-07



**EFT-1D**

**2008**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-1D 41508

Sample Location (Well Number): EFT-1D

1. Representative sample collected. Date/Time 4/15/08 1 1055

Sample collected by: Joy Marie Slaback / Joy Marie Slaback Date: 04/21/2008  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 4/21/08  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: R. SS Beyer / R. SS Beyer Date: 4-22-08  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: R. D. Lindsey / R. D. Lindsey Date: 4-24-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-1D41508
2 . Date Sampled	04/15/2008
3 . Time Sampled	10:55
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	04/21/2008
2 . Time Sample Counted	21:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.8 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3020.9 cpm
Net Spike Count Rate (cpm)	3013.1 cpm
H3 Spike Activity (dpm on count date)	7788.2 dpm
Counter Efficiency	0.3869 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	9.0 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	1.2 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

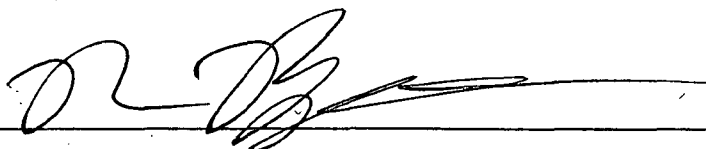
$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.20\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 uCi/ml x Sample Volume}} < \text{MDA}$$

Technician



Date 4-22-08

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-1D41508

Sample Location (Well Number): EFT-1D

1. Representative sample collected. Date/Time 4/15/08 1 1055

Sample collected by: Joy Marie Staback / Joy Marie Staback Date: 04/21/2008  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 4/21/08  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: J. Southward / J. Southward Date: 4/22/08  
Fermi 2 RP Printed Name Signature

Sample number: EFT-1D41508

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: J. Southward / J. Southward Date: 4/22/08  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: K.O. Lindsey / K.O. Lindsey Date: 4-24-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DETROIT EDISON FERMI-2 POWER PLANT

23-APR-2008 11:03:02.57

RADIATION PROTECTION DEPARTMENT  
GAMMA SPECTROSCOPY ANALYSIS REPORT  
HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT 1D1500

Sample End Time: 15-APR-2008 10:55:00.00

REMARKS

PERFORMED BY:

*J. Southard*  
SIGNATURE

REVIEWED BY:

*KO Rudy* 4-24-08  
SIGNATURE DATE

Sample ID : EFT-1041500

Acquisition date : 22-APR-2008 10:13:00

Germi 2 Radiation Protection, Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-1041500
Sample collection start date: 15-APR-2008 10:55:00.00
Sample collection end date : 15-APR-2008 10:55:00.00
Type of sample : 1 L Marin. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : BELL Operator: JMS

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 22-APR-2008 10:13:10.40
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:01.91 Percent dead time : 3.11 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date: 20-JUN-2007 12:16:46.16
KeV/channel : 5.00100E 01 Zero offset: -1.47000E 01
Daily cal date : 22-APR-2008 06:30:50.32

\*\*\*\*\* Peak Region Parameters \*\*\*\*\*

Start channel : 100 End channel : 4006
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFTD4\_m211 Efficiencies at : Peak energy

Table with 11 columns: Pk, It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts./sec, KEff, Fit. It contains 3 rows of peak data.

Sample Title : EFT-1D41506  
Decay Time : 0 23:39.50.40

Page : 1  
Acquisition Time : 22-APR 2003 15:33:56.1

g

Post-MID Peak Search Report

It	Energy	Area	Bkgrd	FWHM	Channel	Left	Pw	%Err	Fit	nuclides
0	511.20	151	52	1.61	1025.32	1015	16	13.4		<i>Ann</i>
0	550.35	74	20	1.40	1116.55	1109	13	16.9		<i>Ann</i>
0	1406.92	45	6	1.32	2920.91	2914	14	19.5		<i>K-40</i>



Nuclide Line Activity Report  
Sample ID : EFT-1D-41500

Page : 2  
Acquisition date : 22-APR-2000 10:22:55

Nuclide type: natural

Nuclide	Energy	Area	CPM	%EFF	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	45	19.67*	2.501E+00	2.506E-07	2.500E-07	19.59

Flag: "\*" = Peakline

Summary of Nuclide Activity  
Sample ID : EFT 1241500

Page # 3  
Acquisition date : 22-APR-2000 10:33:50

Total number of lines in spectrum 3  
Number of unidentified lines 0  
Number of lines tentatively identified by HID 0 100.00%

Nuclide Type : natural

Nuclide	HLife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma Error Flays
K-40	1.00E+05Y	1.00	2.506E-07	2.506E-07	0.469E-07	19.50
Total Activity :			2.506E-07	2.506E-07		

Grand Total Activity : 2.506E-07 2.506E-07

Flag: "K" = Keyline not found  
"E" = manually edited

"M" = Manually accepted  
"A" = Nuclide specific abs. limit

Rejected Report

Sample ID : EFT-1011508

Acquisition date : 22-APR-2003 15:33:50

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma SE Error	Rejected by
F-18	109.74M	91.80	511.00	100.00	1.035E+00	13.30	Delay
% Abundances Found = 100.00							
AS-76	26.32H	6.30	559.10	44.70	4.480E-06	16.93	Blank
			583.23	1.17	---	---	Not Found
			571.30	0.14	---	---	Not Found
			657.03	6.10	---	---	Not Found
			665.31	0.39	---	---	Not Found
			740.12	0.12	---	---	Not Found
			771.76	0.12	---	---	Not Found
			867.63	0.12	---	---	Not Found
			1129.07	0.14	---	---	Not Found
			1212.72	1.03	---	---	Not Found
			1216.02	3.84	---	---	Not Found
			1328.52	1.39	---	---	Not Found
			1439.13	0.33	---	---	Not Found
			1453.60	0.12	---	---	Not Found
			1787.67	0.33	---	---	Not Found
% Abundances Found = 73.70							

Flag: "N" = Rejected

Unidentified Energy Lines  
Sample ID : EFT-1D41500

Page : 5  
Acquisition date : 22-APR-2000 10:33:52

It	Energy	Area	Blknd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
6	511.22	151	52	1.01	1022.32	1015	10	0.410-02	13.4	4.00E+00	T
8	550.35	74	20	1.48	1116.55	1100	13	4.12E-02	16.0	4.00E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Isotope	Weighted Sum	Energy (keV)	MDA (uCi/cc)
BE-7	15.	477.59	6.5432E-00
F-18	0.	511.00	Half-Life too short
NA-22	4.	1274.84	6.7170E-00
NA-24	0.	1360.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-36	0.	1042.42	Half-Life too short
AR-41	0.	1203.04	Half-Life too short
SC-46	10.	809.05	1.0207E-00
CR-51	37.	320.00	9.5009E-00
MN-54	11.	834.03	8.0220E-00
CO-56	12.	1230.25	1.6450E-00
MN-56	0.	1610.69	Half-Life too short
NI-56	44.	158.38	1.0097E-00
CO-57	45.	122.06	1.0460E-00
CO-58	15.	810.76	9.3473E-00
FE-59	7.	1079.02	1.4770E-00
CO-60	9.	1332.49	9.6500E-00
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1401.04	Half-Life too short
ZN-65	0.	1115.52	1.0774E-00
ZN-69M	0.	430.63	Half-Life too short
SE-75	46.	136.00	1.4436E-00
AS-76	75.	559.10	2.5640E-00
BR-82	13.	776.49	2.5252E-00
BR-83	0.	529.64	Half-Life too short
BR-84	0.	901.50	Half-Life too short
BR-85	0.	902.41	Half-Life too short
KR-85	53.	513.99	2.6130E-00
KR-85M	0.	151.10	Half-Life too short
SR-88	53.	513.99	1.2192E-00
RD-88	0.	1076.63	1.0716E-00
KR-87	0.	402.50	Half-Life too short
SR-87M	2.	300.40	Half-Life too short
KR-90	0.	196.32	Half-Life too short
RB-90	0.	1302.39	Half-Life too short
Y-90	1.	1030.01	5.7270E-00
KR-90	3.	200.90	Half-Life too short
RD-90	0.	1031.03	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	531.00	Half-Life too short
RB-90M	0.	054.23	Half-Life too short
Y-90M	0.	302.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	11.	1264.96	3.5301E-00

## Minimum Detectable Activity Report (continued)

Page : 2

Sample ID : EFT-1D41508

Acquisition date : 22-APR-2008 10:33:50

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
CR-93	0.	598.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NR-94	15.	782.63	7.5210E-09
NR-95	11.	765.79	8.2987E-09
NR-95M	40.	235.69	1.1784E-07
ZR-96	20.	756.72	1.8183E-08
NR-97	0.	657.90	Half-Life too short
ZR-97	15.	743.36	7.0833E-06
NO-99	14.	739.58	3.5870E-07
TC-99M	0.	149.58	Half-Life too short
TC-101	0.	386.81	Half-Life too short
RU-103	17.	477.88	8.5582E-09
TC-104	0.	357.99	Half-Life too short
RH-105	32.	318.90	1.8341E-06
RU-105	0.	724.58	Half-Life too short
RU-106	22.	621.94	8.4676E-08
CD-109	37.	88.83	3.5769E-07
AO-110M	11.	937.48	2.5242E-08
OH-113	23.	391.69	1.1819E-08
SN-117M	46.	158.56	1.2741E-08
SB-122	0.	563.93	4.2475E-08
SB-124	15.	602.71	7.5275E-09
SB-125	19.	427.89	2.2493E-08
TE-125M	31.	169.28	3.2423E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	20.	57.68	2.4813E-05
XE-127	31.	202.04	1.8949E-08
TE-129	0.	459.08	Half-Life too short
TE-129M	15.	695.88	2.5986E-07
XE-129M	44.	196.56	2.7761E-07
I-130	0.	536.09	Half-Life too short
BA-131	47.	123.88	4.6238E-08
I-131	29.	364.48	1.6683E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	19.	773.67	1.1581E-06
XE-131M	39.	163.03	5.4739E-07
I-132	0.	667.69	Half-Life too short
TE-132	39.	225.16	3.7730E-08
BA-133	38.	382.81	4.4884E-08
BA-133M	46.	276.09	9.1715E-07
I-133	15.	529.87	2.8281E-06
TE-133M	0.	912.58	Half-Life too short
XE-133	38.	81.80	1.1289E-07
XL-133M	38.	135.22	6.6831E-07
CS-134	21.	684.78	8.2232E-09
I-134	0.	884.89	Half-Life too short
TE-134	0.	218.17	Half-Life too short
DA-135M	33.	268.24	2.5420E-06
I-135	0.	1268.41	Half-Life too short
Y-135	0.	848.78	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page 1 of 3

Sample ID : EFT-1041500

Acquisition date : 22-APR-2008 10:33:50

Nuclide	Bkgnd Cm	Energy (keV)	MDA (uCi/cc)
CS-130	9.	818.50	1.0233E-08
I-136	0.	1313.02	Half-Life too short
CS-137	13.	661.65	7.8305E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.06	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	36.	165.05	8.7949E-09
CO-139	0.	1283.23	Half-Life too short
BA-140	10.	537.32	3.1596E-08
LA-140	0.	1500.40	1.6301E-07
BR-141	0.	190.22	Half-Life too short
CE-141	42.	145.44	1.8151E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.10	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	35.	293.20	6.0404E-07
CE-144	30.	133.54	7.1200E-08
PR-144	0.	1469.15	Half-Life too short
ND-147	31.	91.10	6.3303E-08
PM-148M	20.	550.27	0.8007E-09
EU-152	27.	344.27	2.6568E-08
EU-154	10.	1004.76	4.0155E-08
EU-156	11.	646.29	1.1020E-07
HF-181	19.	482.03	9.4145E-09
TA-182	0.	1221.42	3.3106E-08
W-187	9.	685.01	2.6534E-06
RE-188	43.	155.03	4.7477E-05
NO-200	45.	270.19	1.1797E-08
BI-207	17.	569.67	3.2360E-09
TL-200	0.	503.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	45.	240.98	7.8220E-07
RA-226	44.	180.51	2.2864E-07
AC-228	40.	330.32	7.3314E-08
TH-228	37.	84.37	1.2071E-06
PA-234	0.	131.20	Half-Life too short
TH-234	42.	63.29	1.4509E-06
U-235	45.	143.76	7.5123E-08
NP-239	39.	100.13	3.3462E-07
AM-241	33.	59.54	1.7970E-07

**EFT-1D**

**2009**



## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-1D030309<sup>9</sup>  
15 10/10/09  
Sample Location (Well Number): EFT-1D

1. Representative sample collected. Date/Time 3-9-09 1 1430

Sample collected by: Brian Jordan / [Signature] Date: 3-9-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Prutkin / Prutkin Date: 4-17-09  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Prutkin / Prutkin Date: 4-21-09  
Fermi 2 RP Printed Name Signature

Sample number: EFT-15030909

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Proffitt | Proffitt Date: 4-21-09  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: KLindsay | KLindsay Date: 4-22-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: ~~EFT-15~~ <sup>ID</sup> ~~EFT-15~~ 030909  
CP4-17-01

Sample Location (Well Number): EFT-15

1. Representative sample collected. Date/Time 3-9-09 1/14:30

Sample collected by: Brian Jordan / [Signature] Date: 3-9-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: D. Rott / [Signature] Date: 4-17-09  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: D. Howard / [Signature] Date: 4-22-09  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: R. Boyer / [Signature] Date: 4-22-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer.

Remarks \_\_\_\_\_  
\_\_\_\_\_



DETROIT EDISON FERRI-2 POWER PLANT

21 APR 2009 17:55:07.00

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-10030/09

9  
NT 10/10/09

Sample End Time: 9-MAR-2009 14:30:00.00

REMARKS

Ky0

PERFORMED BY:

*Charles Proffitt*  
SIGNATURE

REVIEWED BY:

*RD Rulvey*  
SIGNATURE/DATE

Sample ID : EFT-10030/09

Acquisition date : 21-APR-2009 17:25:52.14

9  
nr 10/15/09

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-10030/09  
Sample collection start date: 9-MAR-2009 14:30:00.00  
Sample collection end date : 9-MAR-2009 14:30:00.00  
Type of sample : 1 L Mari. Liquid  
Sample quantity : 1.00000E+03 cc  
Sample geometry : BELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 21-APR-2009 17:25:52.14  
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
Elapsed real time : 0 00:30:00.98 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2008 12:00:00.00  
KeV/channel : 4.99002E-01 Zero offset: 7.45979E-02  
Daily cal date : 21-APR-2009 06:54:02.66

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
Abundance limit : 75.00000 Library : dacmaster.nlb  
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	XErr	Fit
1	0	510.91	98	38	2.30	1021.91	1014	15	5.42E-02	17.0	
2	0	558.33	23	14	3.43	1116.75	1110	11	1.20E-02	37.5	
3	0	1460.70	66	0	1.91	2921.05	2915	14	3.67E-02	12.3	

Sample Title : EFT-10030/09 <sup>9</sup> AT 10/15/09  
Decay Time = 43 00:53:52.14

Page : 1  
Acquisition Time = 21-APR-2007 17:25:52.1

Post-NID Peak Search Report

It	Energy	Area	Bgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	510.91	98	30	2.30	1021.91	1014	15	17.0		<i>Am-241 Peak</i>
0	550.33	23	14	3.43	1116.75	1110	11	37.5		<i>Here</i>
0	1460.70	66	0	1.91	2921.95	2915	14	12.3		<i>K-40</i>

Nuclide Line Activity Report

Sample ID : EFT-10008/09

Acquisition date : 21-APR-2009 17:35:52

9 75  
10/15/09

Nuclide Types: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	66	10.67*	2.501E+00	3.713E-07	3.713E-07	12.91

Flags "\*" = Keyline



Summary of Nuclide Activity

Sample ID : EFT-10038/02

Acquisition date : 21-APR-2009 17:25:51

9 Apr 10/15/09

Total number of lines in spectrum 3  
 Number of unidentified lines 0  
 Number of lines tentatively identified by NID 3 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma Error	Flags
K-40	1.09E+05Y	1.00	3.713E-07	3.713E-07	0.457E-07	12.31	
Total Activity :			3.713E-07	3.713E-07			
Grand Total Activity :			3.713E-07	3.713E-07			

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Rejected Report

9

Page : 4

Sample ID : EFT-10030/09

Acquisition date : 21-APR-2009 17:25:52

7r 10/15/09

Nuclide	Half-life	Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	565.98	511.00*	193.46	1.000E+35	17.03	Decay
% Abundances Found = 100.00							
AS-76 0	26.32H	39.33	559.10*	44.70	1.142E+04	37.54	Decay, Abun.
			563.23	1.17	---	Not Found	---
			571.30	0.14	---	Not Found	---
			657.03	6.10	---	Not Found	---
			665.31	0.39	---	Not Found	---
			740.12	0.12	---	Not Found	---
			771.76	0.12	---	Not Found	---
			867.63	0.12	---	Not Found	---
			1129.07	0.14	---	Not Found	---
			1212.72	1.63	---	Not Found	---
			1216.02	3.04	---	Not Found	---
			1220.52	1.39	---	Not Found	---
			1439.13	0.33	---	Not Found	---
			1453.60	0.13	---	Not Found	---
			1787.67	0.33	---	Not Found	---
% Abundances Found = 73.70							

Flag: "\*" = Keyline

Unidentified Energy Lines

Sample ID : EFT-10030/09

Acquisition date : 21 APR 2009 17:25:32

9 7/13/15/09

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	510.91	99	30	2.30	1021.91	1014	15	5.42E-02	17.0	4.08E+00	T
0	550.33	23	14	3.43	1116.75	1110	11	1.29E-02	37.5	4.69E+00	T

Flag: "T" = tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	RDA (uCi/cc)
BE-7	20.	477.59	1.1664E-07
F-18	0.	511.00	Half-Life too short
NA-22	4.	1274.54	7.2134E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1914.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	12.	899.25	1.2107E-08
CR-51	23.	320.08	1.9185E-07
MN-54	12.	834.83	8.7892E-09
CO-56 0	5.	1238.25	1.5906E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	37.	158.38	9.5309E-07
CO-57	37.	122.06	1.0530E-08
CO-58	6.	810.76	9.3887E-09
FE-59	10.	1099.22	3.1296E-08
CO-60	11.	1332.49	1.0387E-08
CU-64	0.	1345.90?	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	14.	1115.52	2.3087E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	30.	136.00	1.4504E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
ER-85	0. 0	802.41	Half-Life too short
KR-85	42.	513.99	2.3711E-06
KR-85M	0.	151.10	Half-Life too short
SR-85	42.	513.99	1.6163E-06
RB-86	6.	1076.63	4.1732E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	3.	1836.01	1.0264E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.00	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	9.	1204.90	4.9949E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Minimum Detectable Activity Report (continued)

Sample ID : EFT-10030709

Acquisition date : 21-APR-2009 17:25:52

9 nr 10/15/09

Nuclide	Bckgnd Sum	?	Energy Δ (keV)	MDA (uCi/cc)
SR-93	0.		598.20	Half-Life too short
Y-93	0.		266.90	Half-Life too short
NB-94	21.		702.63	3.7926E-09
NB-95	12.		765.79	1.7555E-08
NB-95M	0.		235.69	Half-Life too short
ZR-95	17.		756.72	2.5097E-08
NB-97	0.		657.90	Half-Life too short
ZR-97	0.		743.36	Half-Life too short
NO-99	0.		739.50	Half-Life too short
TC-99M	0.		140.50	Half-Life too short
TC-101	0.		306.81	Half-Life too short
RU-103	13.		497.03	1.4056E-08
TC-104	0.		357.99	Half-Life too short
RH-105	0.		310.90	Half-Life too short
RU-105	0.		724.50	Half-Life too short
RU-106	26.		621.04	9.8371E-08
CD-109	33.		80.03	3.5756E-07
AG-110M	10.		937.40	2.6974E-08
SN-113	14.		391.69	1.1047E-08
SN-117M	30.		150.56	7.3347E-08
SD-122	0.		563.93	Half-Life too short
SB-124	16.		602.71	1.1717E-08
SB-125	10.		427.09	2.2523E-08
TE-125M	26.		109.20	5.3496E-06
TE-127	0.		417.90	Half-Life too short
TE-127M	19.		57.60	2.5621E-05
XE-127	35.		202.84	2.3052E-08
TE-129	0.		459.60	Half-Life too short
TE-129M	21.		695.00	6.4169E-07
XE-129M	39.		196.56	4.4129E-06
I-130	0.		536.09	Half-Life too short
BA-131	36.		123.00	3.4209E-07
I-131	14.		364.40	2.7053E-07
TE-131	0.		149.72	Half-Life too short
TE-131M	0.		773.67	Half-Life too short
XE-131M	37.		163.93	4.3956E-06
I-132	0.		667.69	Half-Life too short
TE-132	0.		220.16	Half-Life too short
BA-133	26.		302.84	3.6906E-08
BA-133M	0.		276.09	Half-Life too short
I-133	0.		529.87	Half-Life too short
TE-133M	0.		912.50	Half-Life too short
XE-133	34.		81.00	1.2646E-05
XE-133M	0.		233.22	Half-Life too short
CS-134	12.		604.70	6.7593E-09
I-134	0.		804.09	Half-Life too short
TE-134	0.		210.47	Half-Life too short
BA-135M	0.		268.24	Half-Life too short
I-135	0.		1260.41	Half-Life too short
XE-135	0.		249.79	Half-Life too short
XE-135M	0.		526.56	Half-Life too short

Minimum Detectable Activity Report (continued)

Sample ID : EFT-10930709

Acquisition date : 21-APR-2009 17:25:02

9 nr 10/15/09

Nuclide	Bckgrnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	10.	819.50	7.0002E-08
I-136	0.	1313.02	Half-Life too short
CS-137	14.	661.65	8.1651E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	26.	165.95	9.1232E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	19.	537.32	2.9657E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.32	Half-Life too short
CE-141	37.	145.44	3.7216E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	29.	133.54	6.9942E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	26.	91.10	5.7201E-07
PM-148M	15.	550.27	1.4135E-08
EU-152	28.	344.27	2.7266E-08
EU-154	16.	1004.76	5.8621E-08
EU-155	40.	105.31	4.8831E-08
EU-156	15.	646.29	7.2096E-07
HF-181	14.	482.03	1.4899E-08
TA-182	4.	1221.42	3.1276E-08
W-187	0.	605.01	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	25.	279.19	1.5593E-08
BI-207	19.	569.67	7.6026E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	37.	196.21	2.1128E-07
AC-228	24.	330.32	? 5.8759E-08
TH-228	30.	94.37	1.1303E-06
PA-234	0.	131.20	Half-Life too short
TH-234	41.	63.29	4.0563E-06
U-235	38.	143.76	6.9522E-08
NP-239	0.	106.13	Half-Life too short
AM-241	31.	59.54	1.7554E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT ID 91009

Sample Location (Well Number): EFT ID  
9/17/09

1. Representative sample collected. Date/Time 9/10/09 1 15:10

Sample collected by: Thomas Mowal Thomas Date: 9-10-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Saithward, Saithward Date: 9/21/09  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: [Signature] Date: 9-21-09  
Fermi 2 Chemistry Printed Name / Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray & [Signature] Date: 10-13-09  
Fermi 2 Printed Name / Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT1D91009
2 . Date Sampled	09/10/2009
3 . Time Sampled	15:10
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	09/21/2009
2 . Time Sample Counted	14:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.7 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2763.5 cpm
Net Spike Count Rate (cpm)	2755.8 cpm
H3 Spike Activity (dpm on count date)	7189.1 dpm
Counter Efficiency	0.3833 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	8.1 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.4 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.20\text{E}-06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician \_\_\_\_\_

Date 9-22-9



## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT ID 91009

Sample Location (Well Number): 1D

1. Representative sample collected. Date/Time 9/10/09 1 1510

Sample collected by: Thomas Moore / [Signature] Date: 9-10-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward / [Signature] Date: 9/24/09  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Southward / [Signature] Date: 10/13/09  
Fermi 2 RP Printed Name Signature

Sample number: EFT 1D 91009

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Southward 1 / Southward Date: 10/13/09  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: \_\_\_\_\_ / \_\_\_\_\_ Date: \_\_\_\_\_  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT1D91009

Sample End Time: 10-SEP-2009 15:10:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*Southward*  
\_\_\_\_\_  
SIGNATURE

REVIEWED BY:

*Robert S. J...*  
\_\_\_\_\_  
SIGNATURE / DATE

Sample ID : EFT1D91009

Acquisition date : 13-OCT-2009 12:11:27

\*\*\*\*\*  
 Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT1D91009  
 Sample collection start date: 10-SEP-2009 15:10:00.00  
 Sample collection end date : 10-SEP-2009 15:10:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : MELL Operator: JNS

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 13-OCT-2009 12:11:27.54  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:00.86 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 3-JUN-2009 17:37:00.00  
 Key/channel : 4.99961E-01 Zero offset: <7.82024E-02  
 Daily cal date : 13-OCT-2009 06:21:56.95

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	511.41	135	20	2.51	1022.71	1013	19	7.52E-02	12.0	
2	0	609.01	34	26	0.70	1217.92	1210	15	1.00E-02	37.1	
3	0	1461.23	46	3	1.73	2922.30	2917	12	2.50E-02	16.4	

Sample Title : EFT1D91009  
Decay Time = 32 21:01:27.54

Page : 1  
Acquisition Time = 13-OCT-2009 12:11:27.5

4

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	511.41	135	20	2.51	1022.71	1013	19	12.0		<i>Ann.</i>
0	609.01	34	26	0.70	1217.92	1210	15	37.1		<i>Bi-214</i>
0	1461.23	46	3	1.73	2922.30	2917	12	16.4		<i>K-40</i>

*for 10-14-09*

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	46	10.67*	2.501E+00	2.612E-07	2.612E-07	16.41

Flag: "\*" = Keyline

Summary of Nuclide Activity

Sample ID : EFT1D91009

Acquisition date : 13-OCT-2009 12:11:27

Total number of lines in spectrum 3  
 Number of unidentified lines 0  
 Number of lines tentatively identified by NID 3 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.612E-07	2.612E-07	0.429E-07	16.41	
Total Activity :			2.612E-07	2.612E-07			

Grand Total Activity : 2.612E-07 2.612E-07

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
F-18	109.74M	431.53	511.00*	193.46	1.000E+35	12.76	Decay
	% Abundances Found = 100.00						
RU-103	39.35D	0.04	497.00*	89.00	-----	Not Found	-----
			610.33	5.60	3.590E-07	37.12	Abun.
	% Abundances Found = 5.92						
XE-135	9.11H	86.64	249.79*	89.90	-----	Not Found	-----
			600.19	2.89	4.694E+19	37.12	Decay, Abun.
	% Abundances Found = 3.11						
BI-214	19.90M	2379.72	609.31*	46.30	1.000E+35	37.12	Decay
			768.36	5.04	-----	Not Found	-----
			934.06	3.21	-----	Not Found	-----
			1120.29	15.10	-----	Not Found	-----
			1238.11	5.94	-----	Not Found	-----
			1377.67	4.11	-----	Not Found	-----
			1764.49	15.00	-----	Not Found	-----
	% Abundances Found = 48.48 (Abn. Limit = 48.48%)						

Flag: "\*" = Keyline





Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	14.	477.59	8.9344E-08
F-18	0.	511.00	Half-Life too short
NA-22	12.	1274.54	1.0735E-08
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	12.	889.25	1.1364E-08
CR-51	20.	320.08	1.3962E-07
MN-54	14.	834.83	9.2446E-09
CO-56	7.	1238.25	1.6447E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	39.	158.38	3.0197E-07
CO-57	29.	122.06	9.1723E-09
CO-58	17.	810.76	1.2545E-08
FE-59	8.	1099.22	2.3414E-08
CO-60	7.	1332.49	8.5320E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	9.	1115.52	1.8579E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	30.	136.00	1.3809E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	?	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	43.	513.99	2.3944E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	43.	513.99	1.4656E-08
RB-86	9.	1076.63	3.2147E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RE-88	0.	1382.39	Half-Life too short
Y-88	5.	1836.01	1.1103E-08
KR-89	0.	220.90	Half-Life too short
RE-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RE-90	0.	831.69	Half-Life too short
RE-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	9.	1204.90	4.3584E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
---------	------------	--------------	--------------

Y-93	0.	266.90	Half-Life too short
NB-94	13.	702.63	7.1779E-09
NB-95	13.	765.79	1.4882E-08
NB-95M	37.	235.69	1.6361E-05
ZR-95	9.	756.72	1.7207E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	14.	497.00	1.2427E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	14.	621.84	7.2724E-08
CD-109	30.	88.03	3.3789E-07
AG-110M A	6.	937.48	2.1487E-08
SN-113	12.	391.69	9.7642E-09
SN-117M	38.	158.56	4.3595E-08
SB-122	0.	563.93	Half-Life too short
SB-124	16.	602.71	1.0639E-08
SB-125	19.	427.89	2.2938E-08
TE-125M	19.	109.28	3.6012E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	21.	57.60	2.4800E-05
XE-127	32.	202.84	1.8349E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	15.	695.88	4.5852E-07
XE-129M	38.	196.56	1.9447E-06
I-130	0.	536.09	Half-Life too short
BA-131	32.	123.80	1.7597E-07
I-131	23.	364.48	1.3969E-07
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	33.	163.93	2.2889E-06
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	29.	302.84	3.8839E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	21.	81.00	2.6456E-06
XE-133M	0.	233.22	Half-Life too short
CS-134	18.	604.70	7.8454E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

I-136	0.	1313.02	Half-Life too short
CS-137	19.	661.65	9.3764E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	34.	165.85	9.8249E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	19.	537.32	1.7327E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	31.	145.44	2.7395E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	38.	133.54	7.6214E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	30.	91.10	3.2002E-07
PM-148M	13.	550.27	1.1185E-08
EU-152	25.	344.27	2.5715E-08
EU-154	7.	1004.76	4.1557E-08
EU-155	20.	105.31	3.5946E-08
EU-156	18.	646.29	4.8710E-07
HF-181	13.	482.03	1.1878E-08
TA-182	7.	1221.42	& 3.6050E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	25.	279.19	1.3335E-08
BI-207	17.	569.67	7.1679E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	40.	240.98	1.0451E-04
RA-226	34.	186.21	2.0445E-07
AC-228	20.	338.32	5.4234E-08
TH-228	22.	84.37	9.8582E-07
PA-234	0.	131.20	Half-Life too short
TH-234	22.	63.29	2.3082E-06
U-235	26.	143.76	? 5.8403E-08
NP-239	0.	106.13	Half-Life too short
AM-241	18.	59.54	1.3860E-07

**EFT-1D**

**2010**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EF1-52610-10

Sample Location (Well Number): 10

1. Representative sample collected. Date/Time 5/26/10 1 1535

Sample collected by: Southward, Southward Date: 6/23/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward, Southward Date: 6/23/10  
Printed Name / Signature

3. Sample counted in accordance with 76,000,70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: John M. York /  Date: 6-25-10  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert G. J. [Signature] Date: 6-30-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EF1-52610-1D
2 . Date Sampled	05/26/2010
3 . Time Sampled	15:35
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	06/25/2010
2 . Time Sample Counted	08:35
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.3 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2683.2 cpm
Net Spike Count Rate (cpm)	2675.9 cpm
H3 Spike Activity (dpm on count date)	6887.9 dpm
Counter Efficiency	0.3885 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	7.8 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.5 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.16\text{E}-06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 6-25-10

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EF1-52610-1D

Sample Location (Well Number): 1D

1. Representative sample collected. Date/Time 5/26/10 11535

Sample collected by: Southward, Southward Date: 6/23/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward, Southward Date: 6/23/10  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Charles Proffitt, Charles Proffitt Date: 9-15-10  
Fermi 2 RP Printed Name Signature



Sample number: EF1-52610-1D

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by Charles Proffitt / Charles Proffitt Date: 9-15-10  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray / [Signature] Date: 10-5-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1-52610-1D

Sample End Time: 26-MAY-2010 15:35:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*Charles P. Papp*  
SIGNATURE

REVIEWED BY:

*Robert J. [Signature]*  
SIGNATURE DATE

Sample ID : EF1-52610-1D

Acquisition date : 15-SEP-2010 11:30:44

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1-52610-1D
Sample collection start date: 26-MAY-2010 15:35:00.00
Sample collection end date : 26-MAY-2010 15:35:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.000000E+03 cc
Sample geometry : M2LL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 15-SEP-2010 11:30:44.53
Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00
Elapsed real time : 0 00:45:00.85 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 23-JUN-2010 12:28:00.00
Kev/channel : 4.99958E-01 Zero offset: 1.16623E-01
Daily cal date : 15-SEP-2010 09:09:58.87

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m2ll Efficiencies at : Peak energy

Table with 11 columns: Pk, It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, XErr, Fit. It lists 6 peaks with their respective energy, area, and other parameters.

Sample Title : EF1-52610-1D

Page : 1

Decay Time = 111 19:55:44.53

Acquisition Time = 15-SEP-2010 11:30:44.5

3

Post-MID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	66.36	69	102	1.38	132.50	127	10	30.1	— H <sub>2</sub> O	
0	190.26	56	83	1.69	396.33	391	11	34.2	— H <sub>2</sub> O	
0	511.53	246	59	3.49	1022.91	1015	16	9.5	— AWW.	
0	550.90	94	44	2.19	1117.67	1112	13	10.4	— H <sub>2</sub> O	
0	609.84	48	37	1.53	1219.55	1212	15	32.0	— Bi-214	
0	1461.28	69	15	2.00	2922.59	2915	15	17.1		K-40

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	69	10.67*	2.501E+00	2.605E-07	2.605E-07	17.05

Flags: "\*" = Keyline

Summary of Nuclide Activity

Sample ID : EF1-52610-1D

Acquisition date : 15-SEP-2010 11:30:44

Total number of lines in spectrum	6	
Number of unidentified lines	0	
Number of lines tentatively identified by NID	6	100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.605E-07	2.605E-07	0.444E-07	17.05	
Total Activity :			2.605E-07	2.605E-07			

Grand Total Activity : 2.605E-07 2.605E-07

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	1467.63	511.00*	193.46	1.000E+35	9.49	Decay
		% Abundances	Found =	100.00			
SE-75	119.78D	0.93	66.05	1.02	9.068E-06	30.12	Abun.
			96.73	3.41	-----	Not Found	-----
			121.12	16.70	-----	Not Found	-----
			136.00*	59.20	-----	Not Found	-----
			190.60	1.45	1.119E-06	34.16	
			264.65	59.90	-----	Not Found	-----
			279.53	25.20	-----	Not Found	-----
			303.91	1.32	-----	Not Found	-----
			400.65	11.40	-----	Not Found	-----
		% Abundances	Found =	1.38			
AS-76	26.32H	101.99	559.10*	44.70	2.252E+23	10.37	Decay, Abun.
			563.23	1.17	-----	Not Found	-----
			571.30	0.14	-----	Not Found	-----
			657.03	6.10	-----	Not Found	-----
			665.31	0.39	-----	Not Found	-----
			740.12	0.12	-----	Not Found	-----
			771.76	0.12	-----	Not Found	-----
			867.63	0.12	-----	Not Found	-----
			1129.07	0.14	-----	Not Found	-----
			1212.72	1.63	-----	Not Found	-----
			1216.02	3.04	-----	Not Found	-----
			1220.52	1.39	-----	Not Found	-----
			1439.13	0.33	-----	Not Found	-----
			1453.60	0.13	-----	Not Found	-----
			1707.67	0.33	-----	Not Found	-----
		% Abundances	Found =	73.70			
RU-103	39.35D	2.04	497.00*	09.00	-----	Not Found	-----
			610.33	5.60	1.373E-06	32.00	Abun.
		% Abundances	Found =	5.92			
XE-129M	8.89D	12.50	196.56*	4.74	1.090E-03	34.16	Decay
		% Abundances	Found =	100.00			
XE-135	9.11H	294.65	249.79*	09.90	-----	Not Found	-----
			600.19	2.09	1.000E+35	32.00	Decay, Abun.
		% Abundances	Found =	3.11			
CS-136	13.16D	0.50	66.91	12.50	1.401E-04	30.12	Abun.
			86.29	6.30	-----	Not Found	-----
			153.22	7.46	-----	Not Found	-----
			163.09	4.61	-----	Not Found	-----
			176.55	13.56	-----	Not Found	-----
			273.65	12.66	-----	Not Found	-----
			340.57	40.50	-----	Not Found	-----
			010.50*	99.70	-----	Not Found	-----
			1048.07	79.60	-----	Not Found	-----
			1235.34	19.70	-----	Not Found	-----
		% Abundances	Found =	4.10			

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by	
	Half-life	Ratio			(uCi/cc)	%Error		
PM-140M	41.300	2.71	209.11	12.56	----	Not Found	----	Abun.
			414.07	10.66	----	Not Found	----	
			432.78	5.35	----	Not Found	----	
			501.26	6.75	----	Not Found	----	
			550.27*	94.90	----	Not Found	----	
			599.74	12.54	----	Not Found	----	
			611.26	5.48	1.278E-06	32.00		
			629.97	89.00	----	Not Found	----	
			725.70	32.00	----	Not Found	----	
			915.33	17.17	----	Not Found	----	
		1013.01	20.30	----	Not Found	----		
% Abundances Found =			1.74					
TA-182	114.740	0.97	67.75	42.30	2.250E-07	30.12	Abun.	
			100.10	14.10	----	Not Found	----	
			1109.05	16.30	----	Not Found	----	
			1221.42*	27.10	----	Not Found	----	
			1230.97	11.50	----	Not Found	----	
% Abundances Found =			38.01					
BI-214	19.90M	8093.38	609.31*	46.30	1.000E+35	32.00	Decay	
			768.36	5.04	----	Not Found	----	
			934.06	3.21	----	Not Found	----	
			1120.29	15.10	----	Not Found	----	
			1230.11	5.94	----	Not Found	----	
			1377.67	4.11	----	Not Found	----	
		1764.49	15.80	----	Not Found	----		
% Abundances Found =			48.48	(Abn. Limit = 48.48%)				

Flag: "\*" = Keyline



Unidentified Energy Lines  
Sample ID : EF1-52610-1D

Page : 6  
Acquisition date : 15-SEP-2010 11:30:44

It	Energy	Area	Bkgrd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	66.36	69	102	1.38	132.50	127	10	2.54E-02	30.1	1.42E+00	T
0	198.26	56	83	1.69	396.33	391	11	2.07E-02	34.2	6.60E+00	T
0	511.53	246	59	3.49	1022.91	1015	16	9.11E-02	9.5	4.08E+00	T
0	558.90	94	44	2.19	1117.67	1112	13	3.47E-02	18.4	4.60E+00	T
0	609.84	48	37	1.53	1219.55	1212	15	1.79E-02	32.0	4.52E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	27.	477.59	2.2014E-07
F-18	0.	511.00	Half-Life too short
NA-22	7.	1274.54	6.1461E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	21.	889.25	1.8512E-08
CR-51	40.	320.08	9.1056E-07
MN-54	13.	834.83	7.2521E-09
CO-56	15.	1238.25	3.0317E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	0.	158.38	Half-Life too short
CO-57	56.	122.06	1.0001E-08
CO-58	19.	810.76	1.9182E-08
FE-59	17.	1099.22	7.4305E-08
CO-60	16.	1332.49	8.3912E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	19.	1115.52	2.1572E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	73.	136.00	2.1793E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	98.	513.99	2.3757E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	98.	513.99	3.3351E-08
RB-86	12.	1076.63	4.6373E-06
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	9.	1036.01	1.5634E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	14.	1204.90	8.9260E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EF1-52610-1D

Acquisition date : 15-SEP-2010 11:30:44

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	22.	702.63	5.9106E-09
NB-95	16.	765.79	5.1631E-08
NB-95M	0.	235.69	Half-Life too short
ZR-95	26.	756.72	4.2000E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	25.	497.08	4.2032E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	27.	621.84	7.5711E-08
CD-109	54.	88.03	3.3371E-07
AG-110M	13.	937.48	2.4540E-08
SN-113	39.	391.69	1.7434E-08
SN-117M	54.	158.56	1.9199E-06
SB-122	0.	563.93	Half-Life too short
SB-124	22.	602.71	2.0059E-08
SB-125	32.	427.89	2.0111E-08
TE-125M	54.	109.20	9.8289E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	55.	57.60	4.2663E-05
XE-127	60.	202.84	7.2924E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	30.	695.88	2.0784E-06
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	62.	123.80	1.6562E-05
I-131	0.	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	62.	163.93	2.0002E-04
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	40.	302.84	3.3348E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	30.	604.70	7.1119E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page : 3

Sample ID : EF1-52610-1D

Acquisition date : 15-SEP-2010 11:30:44

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	10.	810.50	2.2086E-06
I-136	0.	1313.02	Half-Life too short
CS-137	23.	661.65	6.7933E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	68.	165.85	1.3392E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	28.	537.32	9.8380E-06
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	56.	145.44	1.2958E-07
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	64.	133.54	7.7944E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PM-148M	24.	550.27	3.7522E-08
EU-152	46.	344.27	2.2773E-08
EU-154	24.	1004.76	4.7135E-08
EU-155	52.	105.31	3.7730E-08
EU-156	23.	646.29	1.3047E-05
HF-181	30.	482.03	4.2085E-08
TA-182	20.	1221.42	6.1048E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	62.	279.19	4.3374E-08
BI-207	28.	569.67	6.0364E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	76.	186.21	1.9766E-07
AC-228	46.	338.32	5.3629E-08
TH-228	47.	84.37	9.9988E-07
PA-234	0.	131.20	Half-Life too short
TH-234	48.	63.29	2.1076E-05
U-235	49.	143.76	5.1939E-08
NP-239	0.	106.13	Half-Life too short
AM-241	46.	59.54	1.3978E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-102710-1/D

Sample Location (Well Number): 1D

1. Representative sample collected. Date/Time 11-11-10 1 11:55

Sample collected by: C. Proffitt / C. Proffitt Date: 11-11-10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample ≥ 50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: C. Proffitt / C. Proffitt Date: 11-11-10  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: L.R. Dyer / [Signature] Date: 11-12-10  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Biggs / [Signature] Date: 11-15-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT EPF 102710-1/D
2 . Date Sampled	11/11/2010
3 . Time Sampled	11:55
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	11/11/2010
2 . Time Sample Counted	22:08
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.2 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2546.6 cpm
Net Spike Count Rate (cpm)	2539.4 cpm
H3 Spike Activity (dpm on count date)	6741.6 dpm
Counter Efficiency	0.3767 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	7.0 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

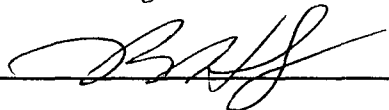
**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.18\text{E}-06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician  Date 11-12-10

Reviewed By:  Date 11/15/10

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-102710-1/D

Sample Location (Well Number): 1/D

1. Representative sample collected. Date/Time 10/27/10 1 08:20

Sample collected by: THOMAS MOWI / [Signature] Date: 11-11-10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: Prothitt / [Signature] Date: 11-17-10  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Prothitt / [Signature] Date: 11-22-10  
Fermi 2 RP Printed Name Signature

Sample number: EFT-102710 - 1/D

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: C Proffitt | [Signature] Date: 11-22-10  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gey | [Signature] Date: 11-23-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



DETROIT EDISON FERMI-2 POWER PLANT

22-NOV-2010 15:05:05.00

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-10E710-1/D

Sample End Time: 27-OCT-2010 00:20:00.00

REMARKS

PERFORMED BY:

*Charles Pappas*  
SIGNATURE

REVIEWED BY:

*Robert J. [Signature]*  
SIGNATURE/DATE

Sample ID : EFT-102710-1/D

Acquisition date : 22-NOV-2010 14:19:52

Farm 2 Radiation Protection Gamma Spectroscopy Report

Sample Parameters

Sample ID Number: EFT-102710-1/D
Sample collection start date: 27-OCT-2010 00:20:00.00
Sample collection end date : 27-OCT-2010 00:20:00.00
Type of sample : 1 L Mar. Liquid
Sample quantity : 1.00000E+03 L
Sample geometry : BELL Operator: CLP

Acquisition Parameters

Detector number : DET 4 Acquire date : 22-NOV-2010 14:19:52.00
Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00
Elapsed real time : 0 00:45:00.60 Percent dead time : 0.00 %

Calibration Parameters

Detector number : DET 4 Yearly cal date : 23-JUN-2010 12:00.00
KeV/channel : 5.00113E-01 Zero offset: 1.54046E-01
Daily cal date : 22-NOV-2010 09:53:53.21

Peak Search Parameters

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

Nuclide Identification Parameters

Energy tolerance : 1.75000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFTD4\_m211 Efficiencies at : Peak energy

Table with 10 columns: Pl, It, Energy, Area, Skgnd, FWHM, Channel, Left, Po, Cts/Sec, %Err, Fit. It lists 5 peaks with their respective energy, area, and error values.

Sample Title : EFT 100713-1.D  
Acq. Time : 20 05.59.57.00

Page : 1  
Acquisition Time : 20 11.23.2010 11:19:00.0

Post-NID Peak Search Report

It	Energy	Area	Bl.gnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	105.62	41	73	3.04	370.85	365	11	42.0		<u>RA 220</u>
1	352.94	57	40	2.87	795.41	690	15	31.0		<u>Pb-214</u>
2	511.87	172	51	2.30	1683.23	1616	20	13.0		<u>Low FWHM</u>
3	100.58	44	48	3.90	1210.58	1211	15	30.0		
4	1462.57	57	4	1.60	2620.22	2713	15	15.0		<u>K-40</u>

11-23-10

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected	Decay Corr	1-Sigma
					uCi/cc	uCi/cc	
K-40	1460.81	57	10.07*	2.502E+00	2.143E-07	2.143E-07	15.16
Ra-226	186.21	41	3.80*	6.606E+00	1.822E-07	1.822E-07	43.05

Flag: "X" = Keyline

Summary of Nuclide Activity  
Sample ID : EFT-102710-1/D

Page : 3  
Acquisition date : 22-NOV-2010 14:19:59

Total number of lines in spectrum : 5  
Number of unidentified lines : 0  
Number of lines tentatively identified by NID : 5 100.00%

Nuclide Type : natural

Nuclide	Half-life	Decay	Uncorrected uCi/sec	Decay Corr uCi/sec	Decay Corr 1 Sigma Error	1-Sigma SE/val	Flags
K-40	1.00E+05Y	1.00	2.143E-07	2.143E-07	0.323E-07	15.11	
Ra-226	1600.00Y	1.00	1.892E-07	1.892E-07	0.814E-07	13.03	
Total Activity :			4.035E-07	4.035E-07			

Grand Total Activity : 4.035E-07 4.035E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"N" = Nuclide specific abn. limit

Rejected Report

Sample ID : EFT 102710 1/T

Acquisition date : 22 NOV 2010 14:19:50

Isotope	Half-life	Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-19	120.74M	344.63	511.20*	100.00	1.0000E+35	13.64	Decay
% Abundances Found = 100.00							
TC-991	14.20M	2667.53	127.24	2.32	---	Not Found	Decay, Aban.
			194.11	1.62	---	1.0000E+35 43.03	
			300.01*	39.90	---	Not Found	
			531.49	1.00	---	Not Found	
			545.14	2.00	---	Not Found	
% Abundances Found = 1.61							
RU-102	39.35D	0.67	497.83*	39.90	---	Not Found	Aban.
			610.33	5.60	---	2.744E-07 37.97	
% Abundances Found = 5.92							
XE-135	9.11H	69.00	240.79*	39.90	---	Not Found	Decay, Aban.
			600.10	2.89	---	2.263E+14 37.97	
% Abundances Found = 3.11							
PM-148M	41.20D	0.64	280.11	12.50	---	Not Found	Aban.
			414.07	10.56	---	Not Found	
			432.78	5.35	---	Not Found	
			501.26	6.75	---	Not Found	
			550.27*	94.90	---	Not Found	
			599.74	12.54	---	Not Found	
			611.26	5.10	---	2.743E-07 37.97	
			629.97	39.00	---	Not Found	
			725.70	32.90	---	Not Found	
915.33	17.17	---	Not Found				
1013.61	20.30	---	Not Found				
% Abundances Found = 1.74							
DI-214	10.99M	1900.63	609.31*	46.30	---	1.0000E+35 37.97	Decay
			708.36	5.04	---	Not Found	
			934.06	3.21	---	Not Found	
			1120.29	15.19	---	Not Found	
			1238.11	5.94	---	Not Found	
			1377.07	4.11	---	Not Found	
			1734.40	15.00	---	Not Found	
% Abundances Found = 48.48 (Abn. Limit = 48.48%)							
PB-214	20.99M	1411.37	87.30	4.67	---	Not Found	Decay
			241.98	7.49	---	Not Found	
			295.21	19.20	---	Not Found	
			351.92*	37.20	---	1.0000E+35 31.63	
			725.91	1.10	---	Not Found	
% Abundances Found = 53.49 (Abn. Limit = 37.20%)							
U-235	9000.20Y	0.00	102.14	1.50	---	Not Found	Aban.
			143.76*	10.50	---	Not Found	
			163.25	4.70	---	Not Found	
			185.72	54.00	---	1.149E-06 42.85	

Rejected Report (continued)  
Sample ID : EFT 102710 1.D

Page : 5  
Acquisition Date : 22 NOV-2010 11:10:39

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by	
	Half-life	Ratio			(uCi/cc)	%Error		
U-235	9999.99Y	0.00	202.12	1.00	---	Not Found	---	Aband.
			205.31	4.70	---	Not Found	---	
% Abundances Found =				78.68				

Flags "W" = Warning

Unidentified Energy Lines  
Sample ID : EFT-102710 1.D

Page : 6  
Acquisition date : 22-NOV-2010 14:19:57

ID	Energy	Area	Degrd	FWHM	Channel	Left	P0	Cts/Sec	MErr	NEff	Flags
0	552.24	57	46	3.07	705.41	690	15	1.96E-02	31.6	5.67E+00	T
0	511.00	172	51	2.39	1020.23	1010	20	5.35E-02	13.6	4.09E+00	T
2	609.58	44	46	0.96	1210.50	1211	15	1.62E-02	30.8	4.52E+00	T

Flags: "T" = Tentatively associated



Sample ID : EFT-102710-1.0

Minimum Detectable Activity, Report

Radclide	Bkgnd Cts	Energy, (keV)	MCA (uCi/Lit)
Be-7	27.	477.50	7.2515E-00
F-18	0.	511.00	Half-Life too short
Na-22	0.	1274.54	5.3008E-00
Na-24	0.	1369.52	Half-Life too short
Ne-27	0.	1014.44	Half-Life too short
Cl-36	0.	1642.42	Half-Life too short
Ar-41	0.	1200.54	Half-Life too short
Ar-40	15.	660.35	7.7910E-00
Cr-51	34.	320.00	9.0045E-00
Mn-54	22.	834.02	7.5312E-00
Co-56	11.	1238.25	1.2434E-00
Mn-50	0.	1810.69	Half Life too short
Fe-50	63.	150.00	1.1930E-07
Co-57	24.	122.00	6.4291E-00
Co-58	10.	910.70	7.0794E-00
Fe-59	12.	1099.22	1.7705E-00
Co-60	11.	1332.40	6.9431E-00
Cu-64	0.	1345.30	Half-Life too short
Ni-65	0.	1481.54	Half-Life too short
Zn-65	7.	1115.52	1.1230E-00
Zn-69m	0.	430.00	Half-Life too short
Ge-70	40.	130.00	1.1003E-00
As-76	0.	529.10	Half-Life too short
Br-82	0.	776.40	Half-Life too short
Br-83	0.	529.64	Half-Life too short
Br-84	0.	981.50	Half-Life too short
Br-85	0.	602.41	Half-Life too short
Kr-85	01.	513.00	1.8742E-00
Kr-85m	0.	151.10	Half-Life too short
Cr-85	01.	513.00	1.0700E-00
Rb-86	3.	1076.63	1.6204E-07
Kr-87	0.	402.50	Half-Life too short
Br-87m	0.	300.40	Half-Life too short
Kr-88	0.	196.00	Half-Life too short
Rb-88	0.	1362.30	Half-Life too short
Y-88	7.	1200.01	0.1304E-00
Kr-89	0.	320.00	Half-Life too short
Fe-89	0.	1931.00	Half-Life too short
Kr-90	0.	1110.00	Half-Life too short
Rb-90	0.	931.00	Half-Life too short
Rb-90m	0.	324.20	Half-Life too short
Y-90m	0.	302.51	Half-Life too short
Cr-91	0.	1004.30	Half-Life too short
Y-91	13.	1201.90	3.2372E-00
Y-91m	0.	522.00	Half-Life too short
Sc-92	0.	1362.01	Half-Life too short
Y-92	0.	934.00	Half-Life too short

Minimum Detectable Activity Report (continued)

Sample ID : EFT 102710 1/D

Acquisition date : 22 NOV 2010 14:19:52

Nuclide	Bkgdnd. / Sec	Energy / (keV)	MDC / (uCi/cc)
OR-92	0.	599.26	Half-Life too short
Y-93	0.	266.98	Half-Life too short
NE-94	23.	702.03	6.8701E-09
NE-95	17.	765.79	9.7305E-09
ND-95M	46.	235.69	8.3502E-08
ZR-95	21.	755.72	1.5252E-09
IB-97	0.	657.90	Half-Life too short
ZP-97	0.	743.26	Half-Life too short
MC-99	15.	739.58	3.1040E-05
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-102	27.	427.06	9.6592E-09
TC-104	0.	357.99	Half-Life too short
RH-105	0.	316.96	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	20.	301.84	5.6110E-08
CD-109	37.	98.03	2.4567E-07
AO-110M	14.	927.40	2.0114E-09
SN-113	29.	391.69	9.9036E-09
SN-117M	24.	158.56	2.6374E-08
SB-122	27.	583.93	6.9293E-06
SB-124	45.	602.71	1.8349E-08
SB-125	24.	427.89	1.6609E-08
TE-125M	40.	109.00	3.8606E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	24.	57.60	1.9771E-05
XE-127	47.	202.84	1.2734E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	22.	605.88	3.0709E-07
XE-129M	52.	196.56	8.9493E-07
I-130	0.	536.00	Half-Life too short
BA-131	39.	183.30	9.5435E-09
I-131	29.	264.48	5.8013E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	41.	163.93	1.1550E-06
I-132	0.	667.69	Half-Life too short
TE-132	46.	326.16	1.6304E-08
BA-133	39.	302.84	2.9801E-08
BA-133M	0.	278.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	43.	81.00	1.0143E-08
XE-133M	0.	203.22	Half-Life too short
SB-134	25.	604.70	7.8406E-09
I-134	0.	204.09	Half-Life too short
TE-134	0.	310.37	Half-Life too short
BA-135M	0.	255.24	Half-Life too short
I-135	0.	1250.41	Half-Life too short
XE-135	0.	243.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Minimum Detectable Activity Report (continued)

Sample ID : EFT-102710 1.0

Acquisition date : 22 NOV 2010 14:10:00

Radionuclide	Background Count	Energy (keV)	MCA (uCi/cc)
CS-136	13.	818.50	2.2205E-08
I-136	0.	1212.02	Half-Life too short
CS-137	19.	661.65	6.1747E-09
XE-137	0.	455.49	Half-Life too short
CS-138	3.	1428.36	Half-Life too short
XE-138	0.	259.31	Half-Life too short
BA-139	0.	1408.50	Half-Life too short
CE-139	44.	105.05	7.0755E-08
CS-139	0.	1203.23	Half-Life too short
BA-140	10.	537.32	0.8832E-08
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	198.22	Half-Life too short
CE-141	56.	145.44	2.2893E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	45.	132.54	5.4040E-08
CS-144	0.	1489.15	Half-Life too short
HD-147	33.	91.18	1.5764E-07
PM-148M	25.	558.27	9.9313E-09
EU-152	32.	344.27	1.9155E-08
EU-154	13.	1004.76	3.5669E-08
EU-155	37.	105.31	3.1106E-08
EU-156	17.	646.29	2.3391E-07
HF-181	22.	402.03	2.1163E-09
TA-182	13.	1221.42	3.0416E-08
W-187	0.	693.01	Half-Life too short
RE-188	0.	195.03	Half-Life too short
HO-200	34.	279.19	9.2306E-09
BT-207	29.	209.37	0.8993E-09
TL-208	0.	263.14	Half-Life too short
PE-212	0.	230.63	Half-Life too short
ET-214	0.	203.31	Half-Life too short
PO-214	0.	351.92	Half-Life too short
RA-224	58.	248.96	0.3295E-08
AC-228	51.	338.32	5.4982E-08
TU-228	36.	84.37	8.1435E-07
PO-232	0.	131.20	Half-Life too short
TH-232	41.	63.29	1.6695E-08
U-235	57.	113.76	3.2495E-08
HO-230	0.	100.13	Half-Life too short
AM-241	35.	59.54	1.2347E-07

**GEL LAB RESULTS**

**EFT-1D 2010**

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Company : Detroit Edison - Fermi 1  
 Address : PO Box 44440  
 Detroit, Michigan 48244

Report Date: February 17, 2010

Contact: Mr. Tom Mow  
 Project: **Fermi 1 - PO# 4700246055**

Client Sample ID: EF1-1/D  
 Sample ID: 245517004  
 Matrix: Ground Water  
 Collect Date: 05-JAN-10 08:50  
 Receive Date: 25-JAN-10  
 Collector: Client

Project: ROIT00116  
 Client ID: ROIT001

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>											
<i>Alphaspec U, Liquid "As Received"</i>											
Pct Uranium-235	U	3.47				percent		MXE1 02/09/10 1349	947744	1	
Uranium-233/234		2.04	+/-0.727	0.321	1.00	pCi/L					
Uranium-235/236	U	0.228	+/-0.283	0.396	1.00	pCi/L					
Uranium-238		0.987	+/-0.508	0.321	1.00	pCi/L					
<b>Rad Gas Flow Proportional Counting</b>											
<i>GFPC, Gross A/B, liquid "As Received"</i>											
Alpha	U	2.51	+/-2.52	3.95	5.00	pCi/L		DXF3 02/11/10 1932	945896	2	
Beta	U	2.44	+/-1.87	2.95	5.00	pCi/L					
<i>GFPC, Ra228, Liquid "As Received"</i>											
Radium-228	U	1.58	+/-1.14	1.76	3.00	pCi/L		JXC5 02/01/10 0723	945895	3	
<b>Rad Radium-226</b>											
<i>Lucas Cell, Ra226, liquid "As Received"</i>											
Radium-226		0.568	+/-0.244	0.259	1.00	pCi/L		KSD1 02/10/10 1410	948312	4	

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, U-02-RC Modified	
2	EPA 900.0	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			108	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			79.5	(15%-125%)

**GEL LABORATORIES LLC**

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

**Certificate of Analysis**

Company : Detroit Edison - Fermi 1  
Address : PO Box 44440

Report Date: December 30, 2010

Contact: Detroit, Michigan 48244  
Mr. Tom Mow  
Project: Fermi 1 - PO# 4700246055

Client Sample ID: EFT-102710-1/D  
Sample ID: 268144003  
Matrix: Water  
Collect Date: 27-OCT-10 08:20  
Receive Date: 06-DEC-10  
Collector: Client

Project: ROIT00116  
Client ID: ROIT001

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
<b>Rad Gas Flow Proportional Counting</b>											
<i>GFPC, Gross A/B, liquid "As Received"</i>											
Alpha		10.1	+/-4.18	3.41	5.00	pCi/L		VXC2 12/27/10	1248	1059089	1
Beta		9.78	+/-3.45	4.92	5.00	pCi/L					

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	EPA 900.0/SW846 9310	

**EFT-1D**

**2011**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-6131111

Sample Location (Well Number): 1D

1. Representative sample collected. Date/Time: 6/13/11 1 10:40

Sample collected by: C Proffitt / [Signature] Date: 6-13-11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: C Proffitt / [Signature] Date: 6-21-11  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: S. A. Dyer / [Signature] Date: 6-22-11  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Roberta Regan / [Signature] Date: 6-23-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks ~~n/A 6-23-11~~



Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT61311-1D
2 . Date Sampled	06/13/2011
3 . Time Sampled	10:40
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	06/22/2011
2 . Time Sample Counted	06:42
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.5 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2306.3 cpm
Net Spike Count Rate (cpm)	2298.8 cpm
H3 Spike Activity (dpm on count date)	6513.3 dpm
Counter Efficiency	0.3529 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	6.4 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

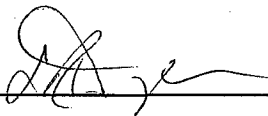
**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.29\text{E-}06 \text{ uCi/ml}$$

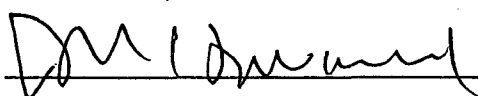
Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 6-22-11

Reviewed By: 

Date 6-22-11

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-61311-1D

Sample End Time: 13-JUN-2011 10:40:00.00

REMARKS *Retical*

PERFORMED BY:

*Charles Pappas*  
SIGNATURE

REVIEWED BY:

*[Signature]*  
SIGNATURE DATE

Sample ID : EFT-61311-1D

Acquisition date : 17-JUN-2011 11:47:20

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-61311-1D
Sample collection start date: 13-JUN-2011 10:40:00.00
Sample collection end date : 13-JUN-2011 10:40:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : PELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 17-JUN-2011 11:47:20.57
Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00
Elapsed real time : 0 00:45:00.63 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 14-JUN-2011 14:50:56.41
Kev/channel : 4.99954E-01 Zero offset: 2.10996E-01
Daily cal date : 17-JUN-2011 10:07:38.66

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Table with 11 columns: Pk It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. It contains 7 rows of peak data.

7

Post-MID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	353.52	52	90	2.32	706.67	698	10	45.0		
0	511.16	149	60	2.31	1021.98	1014	15	14.0		
0	609.37	56	34	1.58	1218.41	1214	10	23.9		
0	1120.44	23	9	1.33	2240.67	2235	12	33.7		
5	1459.53	86	4	3.26	2918.95	2914	15	9.3	2.46E+01	
5	1460.56	6	4	2.70	2921.00	2914	15	161.5		
5	1461.71	51	2	1.77	2923.31	2914	15	17.1		

Pb-214  
ANN. Peak  
Bi-214  
Bi-214  
K-40  
K-40  
K-40  
fr. 6-17-11

Nuclide Type: natural.

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	6	10.67*	2.353E+00	2.200E-08	2.200E-08	161.47

Flag: "\*" = Keyline

Sample ID : EFT-61311-1D

Acquisition date : 17-JUN-2011 11:47:20

Total number of lines in spectrum 7  
 Number of unidentified lines 2  
 Number of lines tentatively identified by NID 5 71.43%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.200E-08	2.200E-08	3.601E-08	161.47	
Total Activity :			2.200E-08	2.200E-08			
Grand Total Activity :			2.200E-08	2.200E-08			

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "G" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	53.31	511.00*	100.00	1.867E+08	13.97	Decay
% Abundances Found = 100.00							
SC-46	83.83D	0.05	142.53	62.70	---	Not Found	---
			889.25*	99.98	---	Not Found	---
			1120.51	99.99	8.592E-09	33.74	Abun.
% Abundances Found = 38.07							
KR-90	32.32S	10059.87	121.82	32.00	---	Not Found	---
			539.49	29.00	---	Not Found	---
			1118.69*	37.00	1.000E+35	33.74	Decay, Abun.
% Abundances Found = 37.76							
RU-103	39.35D	0.10	497.08*	89.00	---	Not Found	---
			610.33	5.60	2.516E-07	23.93	Abun.
% Abundances Found = 5.92							
XE-135	9.11H	10.70	249.79*	89.90	---	Not Found	---
			608.19	2.09	7.560E-04	23.93	Decay, Abun.
% Abundances Found = 3.11							
BI-214	19.90M	293.96	609.31*	46.30	1.000E+35	23.93	Decay
			768.36	5.04	---	Not Found	---
			934.06	3.21	---	Not Found	---
			1120.29	15.10	1.000E+35	33.74	
			1238.11	5.94	---	Not Found	---
			1377.67	4.11	---	Not Found	---
			1764.49	15.80	---	Not Found	---
% Abundances Found = 64.29 (Abn. Limit = 48.48%)							
PB-214	26.80M	218.28	87.30	4.67	---	Not Found	---
			241.98	7.49	---	Not Found	---
			295.21	19.20	---	Not Found	---
			351.92*	37.20	1.000E+35	44.98	
			785.91	1.10	---	Not Found	---
% Abundances Found = 53.40 (Abn. Limit = 37.20%)							

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EFT-61311-1D

Page : 5  
Acquisition date : 17-JUN-2011 11:47:20

It	Energy	Area	Bkgrnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	353.52	52	90	2.32	706.67	690	10	1.93E-02	45.0	5.37E+00	T
0	511.16	149	60	2.31	1021.98	1014	15	5.52E-02	14.0	4.59E+00	T
0	609.37	56	34	1.58	1210.41	1214	10	2.06E-02	23.9	4.25E+00	T
0	1120.44	23	9	1.33	2240.67	2235	12	0.43E-03	33.7	2.74E+00	T
5	1459.53	86	4	3.26	2910.95	2914	15	3.19E-02	9.3	2.35E+00	
5	1461.71	51	2	1.77	2923.31	2914	15	1.90E-02	17.1	2.35E+00	

Flags: "T" = Tentatively associated



Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	28.	477.59	5.8580E-08
F-18	0.	511.00	Half-Life too short
NA-22	7.	1274.54	5.7848E-09
NA-24	14.	1368.53	7.3936E-07
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	13.	889.25	6.4850E-09
CR-51	29.	320.00	5.5983E-08
MN-54	25.	834.83	7.9119E-09
CO-56	19.	1238.25	1.3776E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	47.	158.38	8.6950E-09
CO-57	45.	122.06	7.3779E-09
CO-58	18.	810.76	6.8787E-09
FE-59	13.	1099.22	1.3137E-08
CO-60	22.	1332.49	9.9226E-09
CU-64	3.	1345.90	2.8980E-04
NI-65	0.	1481.84	Half-Life too short
ZN-65	15.	1115.52	1.5215E-08
ZN-69M	29.	438.63	8.1419E-07
SE-75	50.	136.00	1.0394E-08
AS-76	48.	559.10	2.3230E-07
BR-82	16.	776.49	4.9614E-08
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	55.	513.99	1.8926E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	55.	513.99	8.5558E-09
RB-86	10.	1076.63	8.3349E-08
KR-87	0.	482.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	4.	1836.01	6.1349E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	13.	1204.90	2.5939E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT-61311-1D

Acquisition date : 17-JUN-2011 11:47:20

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	36.	266.90	5.9732E-05
NB-94	30.	702.63	7.3112E-09
NB-95	17.	765.79	6.6913E-09
NB-95M	42.	235.69	4.7176E-08
ZR-95	14.	756.72	1.0674E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	20.	743.36	3.5204E-07
MO-99	18.	739.58	1.3221E-07
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	32.	497.00	7.5099E-09
TC-104	0.	357.99	Half-Life too short
RH-105	30.	318.90	1.7604E-07
RU-105	0.	724.50	Half-Life too short
RU-106	22.	621.04	6.0130E-08
CD-109	43.	88.03	2.6630E-07
AG-110M	14.	937.48	1.9761E-08
SN-113	26.	391.69	8.0401E-09
SN-117M	43.	150.56	7.4557E-09
SB-122	28.	563.93	2.5013E-08
SB-124	28.	602.71	6.0643E-09
SB-125	31.	427.89	1.9678E-08
TE-125M	47.	109.28	2.7044E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	29.	57.60	1.8394E-05
XE-127	54.	202.04	9.3003E-09
TE-129	0.	459.60	Half-Life too short
TE-129M	31.	695.88	2.4254E-07
XE-129M	64.	196.56	1.0190E-07
I-130	28.	536.09	1.4604E-06
BA-131	56.	123.90	2.9779E-08
I-131	43.	364.40	1.0912E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	23.	773.67	1.7630E-07
XE-131M	40.	163.93	3.2430E-07
I-132	0.	667.69	Half-Life too short
TE-132	56.	228.16	1.6590E-08
BA-133	39.	302.84	3.0941E-08
BA-133M	43.	276.09	1.7707E-07
I-133	23.	529.87	1.6461E-07
TE-133M	0.	912.58	Half-Life too short
XE-133	30.	01.00	4.7590E-08
XE-133M	32.	233.22	1.6097E-07
CS-134	33.	604.70	7.0600E-09
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	39.	260.24	3.4973E-07
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT-61311-1D

Acquisition date : 17-JUN-2011 11:47:20

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	10.	818.50	6.4106E-09
I-136	0.	1313.02	Half-Life too short
CS-137	22.	661.65	7.0985E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.06	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	45.	165.85	6.6869E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	29.	537.32	3.1114E-08
LA-140	8.	1596.49	4.0389E-08
BA-141	0.	190.22	Half-Life too short
CE-141	57.	145.44	1.3825E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	46.	293.26	1.0865E-07
CE-144	40.	133.54	5.1291E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	27.	91.10	3.4040E-08
PM-148M	21.	550.27	6.1273E-09
EU-152	35.	344.27	2.1102E-08
EU-154	16.	1004.76	4.0696E-08
EU-155	52.	105.31	3.8193E-08
EU-156	26.	646.29	1.0864E-07
HF-181	28.	482.03	7.5345E-09
TA-182	9.	1221.42	2.4275E-08
W-187	18.	685.81	3.3170E-07
RE-188	45.	155.03	1.9081E-06
AU-199	47.	158.38	3.6104E-08
HG-203	50.	279.19	8.2887E-09
BI-207	22.	569.67	5.7687E-09
TL-208	0.	583.14	Half-Life too short
PB-212	66.	238.63	8.6011E-06
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	59.	240.98	3.4995E-07
RA-226	76.	186.21	2.0517E-07
AC-228	43.	338.32	5.3055E-08
TH-228	39.	84.37	8.5273E-07
PA-234	0.	131.20	Half-Life too short
TH-234	38.	63.29	9.0935E-07
U-235	45.	143.76	5.2778E-08
NP-239	55.	106.13	1.1699E-07
AM-241	26.	59.54	1.2037E-07

# FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-101711-1D

Sample Location (Well Number): EFT-~~1D~~<sup>10/25/11</sup> 1/D

1. Representative sample collected. Date/Time 10/17/11 1:17:10

Sample collected by: Thomas Mow 1 [Signature] Date: 10/25/11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample ≥ 50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Thomas Mow 1 [Signature] Date: 10/25/11  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: L. McCoy 1 [Signature] Date: 11-1-11  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert Gray SR 1 [Signature] Date: 11-3-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks [Signature]

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-101711-1D
2 . Date Sampled	10/17/2011
3 . Time Sampled	17:10
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	11/01/2011
2 . Time Sample Counted	15:11
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.2 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2521.9 cpm
Net Spike Count Rate (cpm)	2514.7 cpm
H3 Spike Activity (dpm on count date)	6381.8 dpm
Counter Efficiency	0.3940 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	9.1 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	1.9 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.13\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician *J.M.J.* Date 11-1-11

Reviewed By: *[Signature]* Date 11-1-11

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-101711-1D

Sample Location (Well Number): EFT-11D

1. Representative sample collected. Date/Time 10/17/11 1 17:10

Sample collected by: Thomas Mow / [Signature] Date: 10/25/11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Thomas Mow / [Signature] Date: 10/25/11  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function.

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 21

Performed by: Charles Patton / [Signature] Date: 11-2-11  
Fermi 2 RP Printed Name Signature

Sample number: EFT101711-1D

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: C. Proffitt | [Signature] Date: 11-2-11  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray, JR. | [Signature] Date: 11-3-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

*n/a*

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-101711-1D

Sample End Time: 17-OCT-2011 17:10:00.00

REMARKS *Re Plant Related Issues*

PERFORMED BY:

*Charles J. ...*  
SIGNATURE

REVIEWED BY:

*[Signature]*  
SIGNATURE DATE



Sample ID : EFT-101711-ID

Acquisition date : 2-NOV-2011 11:45:55

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-101711-ID
Sample collection start date: 17-OCT-2011 17:10:00.00
Sample collection end date : 17-OCT-2011 17:10:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : MELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 2-NOV-2011 11:45:55.45
Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00
Elapsed real time : 0 00:45:00.63 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 14-JUN-2011 14:50:56.41
KeV/channel : 5.00053E-01 Zero offset: -5.47137E-01
Daily cal date : 2-NOV-2011 08:42:06.40

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Table with 11 columns: Pk It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. It contains 5 rows of peak data.

Post-MID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	66.74	40	74	2.41	134.55	129	11	44.0		<i>Ge-76</i>
0	352.98	47	79	1.40	706.99	701	14	42.5		<i>Pb-214</i>
0	511.08	191	41	1.09	1023.16	1016	17	11.1		<i>ANN. Peak</i>
0	609.45	49	61	1.09	1219.08	1211	20	41.3		<i>Bi-214</i>
0	1461.44	66	10	2.35	2923.77	2915	14	18.3		<i>K-40</i>

*f - 11 - 3 - 11*

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	66	10.67*	2.353E+00	2.632E-07	2.632E-07	10.26

Flag: "\*" = Keyline

Total number of lines in spectrum 5  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 5 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.632E-07	2.632E-07	0.481E-07	18.26	
Total Activity :			2.632E-07	2.632E-07			

Grand Total Activity : 2.632E-07 2.632E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
F-18	109.74M	207.20	511.00*	193.46	1.000E+35	11.09	Decay
			% Abundances Found = 100.00				
SE-75	119.78D	0.13	66.05	1.02	3.099E-06	44.01	Abun.
			96.73	3.41	----	Not Found	----
			121.12	16.70	----	Not Found	----
			136.00*	59.20	----	Not Found	----
			198.60	1.45	----	Not Found	----
			264.65	59.80	----	Not Found	----
			279.53	25.20	----	Not Found	----
			303.91	1.32	----	Not Found	----
			400.65	11.40	----	Not Found	----
			% Abundances Found = 0.57				
RU-103	39.35D	0.40	497.00*	89.00	----	Not Found	----
			610.33	5.60	2.727E-07	41.25	Abun.
			% Abundances Found = 5.92				
XE-135	9.11H	41.60	249.79*	89.90	----	Not Found	----
			600.19	2.89	1.333E+06	41.25	Decay, Abun.
			% Abundances Found = 3.11				
CS-136	13.16D	1.20	66.91	12.50	5.302E-07	44.01	Abun.
			86.29	6.30	----	Not Found	----
			153.22	7.46	----	Not Found	----
			163.99	4.61	----	Not Found	----
			176.55	13.56	----	Not Found	----
			273.65	12.66	----	Not Found	----
			340.57	48.50	----	Not Found	----
			818.50*	99.70	----	Not Found	----
			1048.07	79.60	----	Not Found	----
			1235.34	19.70	----	Not Found	----
			% Abundances Found = 4.10				
TA-182	114.74D	0.14	67.75	42.30	7.503E-08	44.01	Abun.
			100.10	14.10	----	Not Found	----
			1189.05	16.30	----	Not Found	----
			1221.42*	27.10	----	Not Found	----
			1230.97	11.50	----	Not Found	----
			% Abundances Found = 38.01				
BI-214	19.90M	1142.63	609.31*	46.30	1.000E+35	41.25	Decay
			768.36	5.04	----	Not Found	----
			934.06	3.21	----	Not Found	----
			1120.29	15.10	----	Not Found	----
			1230.11	5.94	----	Not Found	----
			1377.67	4.11	----	Not Found	----
			1764.49	15.80	----	Not Found	----
			% Abundances Found = 48.48 (Abn. Limit = 48.48%)				
PB-214	26.90M	848.45	87.30	4.67	----	Not Found	----
			241.98	7.49	----	Not Found	----

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by	
	Half-life	Ratio			(uCi/cc)	%Error		
PB-214	26.80N	848.45	295.21	19.20	---	Not Found	---	Decay
			351.92*	37.20	1.000E+35	42.47		
			785.91	1.10	---	Not Found	---	

% Abundances Found = 53.40 (Abn. Limit = 37.20%)

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	66.74	40	74	2.41	134.55	129	11	1.40E-02	44.0	1.39E+00	T
0	352.98	47	79	1.40	706.99	701	14	1.73E-02	42.5	5.30E+00	T
0	511.00	181	41	1.09	1023.16	1016	17	6.70E-02	11.1	4.59E+00	T
0	609.45	49	61	1.09	1219.88	1211	20	1.02E-02	41.3	4.25E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Backgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	32.	477.59	7.2029E-08
F-18	0.	511.00	Half-Life too short
NA-22	10.	1274.54	6.0594E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	17.	889.25	7.9400E-09
CR-51	43.	320.00	0.9534E-08
MN-54	27.	834.83	0.4060E-09
CO-56	12.	1238.25	1.2542E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	42.	158.38	3.1336E-08
CO-57	41.	122.06	7.2724E-09
CO-58	26.	810.76	9.0046E-09
FE-59	10.	1059.22	1.4237E-08
CO-60	15.	1332.49	0.4112E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	14.	1115.52	1.5190E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	46.	136.00	1.0710E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	801.50	Half-Life too short
BR-85	0.	002.41	Half-Life too short
KR-85	53.	513.99	1.0614E-06
KR-85M	0.	151.10	Half-Life too short
SR-85	53.	513.99	9.5190E-09
RB-86	10.	1076.63	1.2753E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	7.	1836.01	7.7631E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.00	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	17.	1204.90	3.3597E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short



Sample ID : EFT-101711-1D

Acquisition date : 2-NOV-2011 11:45:55

Nuclide	Bckgrnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	23.	702.63	6.5125E-09
NB-95	23.	765.79	9.5434E-09
NB-95M	51.	235.69	4.9259E-07
ZR-95	16.	756.72	1.2580E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	16.	739.58	2.4008E-06
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	22.	497.00	7.9173E-09
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	28.	621.84	6.8290E-08
CD-109	27.	88.03	2.1861E-07
AG-110M	13.	937.48	1.9451E-08
SN-113	30.	391.69	9.3145E-09
SN-117M	43.	158.56	1.3529E-08
SB-122	21.	563.93	4.5118E-07
SB-124	18.	602.71	6.4166E-09
SB-125	30.	427.89	1.9448E-08
TE-125M	40.	109.28	2.8792E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	23.	57.60	1.8155E-05
XE-127	53.	202.84	1.1529E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	24.	695.88	2.7545E-07
XE-129M	51.	196.56	4.1058E-07
I-130	0.	536.09	Half-Life too short
BA-131	41.	123.80	5.1705E-08
I-131	36.	364.48	2.7711E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	64.	163.93	7.9937E-07
I-132	0.	667.69	Half-Life too short
TE-132	51.	220.16	1.9207E-07
BA-133	37.	302.84	3.0174E-08
BA-133M	49.	276.09	2.8248E-05
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	31.	81.00	2.2564E-07
XE-133M	54.	233.22	8.7084E-06
CS-134	22.	604.70	6.0369E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1268.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT-101711-1D

Acquisition date : 2-NOV-2011 11:45:55

Nuclide	Bckgrnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	20.	810.50	1.6171E-08
I-136	0.	1313.02	Half-Life too short
CS-137	10.	661.65	6.5142E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.06	Half-Life too short
XE-138	0.	250.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	50.	165.05	7.4997E-09
CS-139	0.	1203.23	Half-Life too short
BA-140	39.	537.32	6.6924E-08
LA-140	0.	1596.49	5.0696E-06
BA-141	0.	190.22	Half-Life too short
CE-141	50.	145.44	1.6668E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	39.	133.54	5.2306E-08
PR-144	0.	1409.15	Half-Life too short
ND-147	30.	91.10	0.3390E-08
PM-148M	24.	550.27	7.0966E-09
EU-152	45.	344.27	2.3704E-08
EU-154	13.	1004.76	3.7037E-08
EU-155	43.	105.31	3.5295E-08
EU-156	21.	646.29	1.6614E-07
HF-151	25.	402.03	0.6691E-09
TA-182	12.	1221.42	2.9297E-08
W-187	0.	605.01	Half-Life too short
RE-188	0.	155.03	Half-Life too short
AU-199	42.	150.30	4.5640E-07
HG-203	41.	279.19	0.9949E-09
BI-207	22.	569.67	5.7720E-09
TL-208	0.	503.14	Half-Life too short
PB-212	0.	230.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	50.	240.90	3.0531E-06
RA-226	67.	106.21	1.9341E-07
AC-228	43.	330.32	5.3252E-08
TH-228	36.	04.37	0.4029E-07
PA-234	0.	131.20	Half-Life too short
TH-234	22.	63.29	9.9980E-07
U-235	51.	143.76	5.5097E-08
NP-239	39.	106.13	3.1559E-06
AM-241	42.	59.54	1.4834E-07

**EFT-2S**

**2006**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-2S060606

Sample Location (Well Number): EFT-2S

1. Representative sample collected. Date/Time 06/06/06 / 1130

Sample collected by: Joy Slaback / Joy Marie Slaback <sup>Collection</sup> Date: 06/06/06  
Printed Name / Signature Signed 02/01/07

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Freiling / Christy A. Freiling Date: 08/07/06  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Russ Boyer [Signature] Date: 2-5-7  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: William V. Lipton / William V. Lipton Date: 2/15/07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks No tritium detected, William V. Lipton 48651 2/15/2007

**Sample Information**

1. Sample Location	EFT-2S060606
2. Date Sampled	06/06/2006
3. Time Sampled	11:30
4. Sample Volume, (ml)	4 ml

**Instrument Count Data**

1. Date Sample Counted	02/02/2007
2. Time Sample Counted	10:00
3. Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.4 cpm
4. Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3388.1 cpm
Net Spike Count Rate (cpm)	3380.7 cpm
H3 Spike Activity (dpm on count date)	8340.7 dpm
Counter Efficiency	0.4053 cpm/dpm
5. Sample Info:	
Sample Gross Count Rate (cpm)	6.4 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6. Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

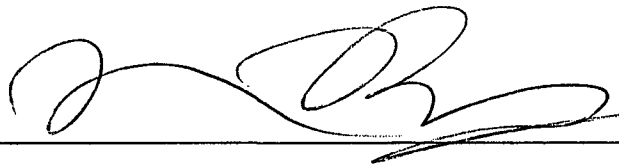
$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.12\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} < \text{MDA}$$

Technician \_\_\_\_\_



Date 2-5-7

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-25060606

Sample Location (Well Number): EFT 25

1. Representative sample collected. Date/Time 06/06/06 / 1130

Sample collected by: Jay Slaback / Jay Marie Slaback <sup>Collection</sup> Date: 06/06/06  
Printed Name / Signature <sub>Signed 02/01/07</sub>

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Freiling / Christopher A Freiling Date: 8/2/06  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Kid Lindsey / Kid Lindsey Date: 8-21-07  
Fermi 2 RP Printed Name Signature

Sample number: EFT-25060606

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard [Signature] Date: 7-10-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: KD Lindsey [Signature] Date: 8-21-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DETOIT EDISON FERMI-2 POWER PLANT

10-JUL-2007 12:19:30.01

RADIATION PROTECTION DEPARTMENT  
GAMMA SPECTROSCOPY ANALYSIS REPORT  
HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1-EFT-25060606

Sample End Time: 6-JUN-2006 11:30:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*Ce [Signature]*

SIGNATURE

REVIEWED BY:

*Kohler 8-2107*

SIGNATURE/DATE



Sample ID : EF1-EFT-25060606.

Acquisition date : 10-JUL-2007 11:49:16

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*  
 Sample ID Number: EF1-EFT-25060606  
 Sample collection start date: 6-JUN-2006 11:30:00.00  
 Sample collection end date : 6-JUN-2006 11:30:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 CC  
 Sample geometry : M2LL Operator: CMH

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*  
 Detector number : DET 4 Acquire date : 10-JUL-2007 11:49:16.97  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:00.91 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*  
 Detector number : DET 4 Yearly caldate : 20-JUN-2007 12:16:46.16  
 Kev/channel : 4.99004E-01 Zero offset: -3.00949E-01  
 Daily cal date : 10-JUL-2007 07:47:29.07

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*  
 Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*  
 Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m2ll Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	66.32	29	59	2.10	133.31	129	9	1.63E-02	51.1	>502
2	0	511.05	172	9	2.04	1023.10	1014	10	9.57E-02	8.6	annihilation
3	0	559.67	66	47	1.01	1110.30	1112	17	3.69E-02	25.0	HWC
4	0	610.31	40	33	1.00	1221.70	1213	19	2.24E-02	37.6	B1-214
5	0	1460.83	40	7	2.47	2923.26	2917	13	2.69E-02	10.0	K-40

Sample Title : EF1-EFT-25060606

Page : 1

Decay Time = 399 00:19:16.97

Acquisition Time = 10-JUL-2007 11:49:16.9

7

Post-MID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	66.32	29	59	2.10	133.31	129	9	51.1		
0	511.05	172	9	2.84	1023.10	1014	18	8.6		
0	550.67	66	47	1.01	1119.30	1112	17	25.0		
0	610.31	40	33	1.00	1221.70	1213	19	37.6		
0	1460.83	40	7	2.47	2923.26	2917	13	10.0		K-40

Nuclide Line Activity Report  
Sample ID : EF1-EFT-25060606

Page : 2  
Acquisition date : 10-JUL-2007 11:49:16

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/CC	Decay Corr uCi/CC	1-Sigma %Error
K-40	1460.81	48	10.67*	2.501E+00	2.720E-07	2.720E-07	10.05

Flag: "\*" = Keyline

Summary of Nuclide Activity  
Sample ID : EF1-EFT-25060606

Page : 3  
Acquisition date : 10-JUL-2007 11:49:16

Total number of lines in spectrum 5  
Number of unidentified lines 0  
Number of lines tentatively identified?by NID 5 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/CC	Decay Corr uCi/CC	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.720E-07	2.720E-07	0.491E-07	18.05	
Total Activity :			2.720E-07	2.720E-07			
Grand Total Activity :			2.720E-07	2.720E-07			

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Rejected Report  
 Sample ID : EF1-EFT-28060606

Page # 4  
 Acquisition date : 10-JUL-2007 11:49:16

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/CC)	1-Sigma %Error	Rejected by
F-18	109.74M	5235.96	511.00*	193.46	1.000E+35	9.64	Decay
% Abundances Found = 100.00							
SE-75	119.78D	3.33	66.05	1.02	3.075E-05	51.07	Abun.
			96.73	3.41	----	Not Found	----
			121.12	16.70	----	Not Found	----
			? 136.00*	59.20	----	Not Found	----
			198.60	1.45	----	Not Found	----
			264.65	59.90	----	Not Found	----
			279.53	25.20	----	Not Found	----
			303.91	1.32	----	Not Found	----
			400.65	11.40	----	Not Found	----
% Abundances Found = 0.57							
AS-76	26.32H	363.95	559.10*	44.70	1.000E+35	25.79	Decay, Abun.
			563.23	1.17	----	Not Found	----
			571.30	0.14	----	Not Found	----
			657.03	6.10	----	Not Found	----
			665.31	0.39	----	Not Found	----
			740.12	0.12	----	Not Found	----
			771.76	0.12	----	Not Found	----
			867.63	0.12	----	Not Found	----
			1129.97	0.14	----	Not Found	----
			1212.72	1.63	----	Not Found	----
			1216.02	3.04	----	Not Found	----
			1220.52	1.39	----	Not Found	----
			1439.13	0.33	----	Not Found	----
			1453.60	0.13	----	Not Found	----
			1707.67	0.33	----	Not Found	----
% Abundances Found = 73.70							
RJ-103	39.35D	10.14	497.00*	09.00	----	Not Found	Decay, Abun.
			610.33	5.60	2.707E-04	37.61	
% Abundances Found = 5.92							
CS-136	13.16D	30.32	66.91	12.50	3.344E+02	51.07	Decay, Abun.
			86.29	6.30	----	Not Found	----
			153.22	7.46	----	Not Found	----
			163.89	4.61	----	Not Found	----
			176.55	13.56	----	Not Found	----
			273.65	12.66	----	Not Found	----
			340.57	48.50	----	Not Found	----
			010.50*	99.70	----	Not Found	----
			1040.07	79.60	----	Not Found	----
			1235.34	19.70	----	Not Found	----
% Abundances Found = 4.10							
PM-140M	41.30D	9.66	280.11	12.56	----	Not Found	Abun.
			414.07	18.66	----	Not Found	----
			432.78	5.35	----	Not Found	----
			501.26	6.75	----	Not Found	----
			550.27*	94.90	----	Not Found	----

Rejected Report (continued)  
 Sample ID : EF1-EFT-2S060606

Page : 5  
 Acquisition date : 10-JUL-2007 11:49:16

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by	
	Half-life	Ratio			(uCi/CC)	%Error		
PM-148M	41.300	9.66	599.74	12.54	----	Not Found	Abun.	
			611.26	5.48	1.985E-04	37.61		
			629.97	89.00	----	Not Found		----
			725.70	32.00	----	Not Found		----
			915.33	17.17	----	Not Found		----
			1013.81	20.30	----	Not Found		----
% Abundances Found =				1.74				
TA-182	114.740	3.40	67.75	42.30	8.206E-07	51.07	Abun.	
			100.10	14.10	----	Not Found		----
			1109.05	16.30	----	Not Found		----
			1221.42*	27.10	----	Not Found		----
			1230.97	11.50	----	Not Found		----
% Abundances Found =				38.01				
BI-214	19.90M	28974.00	609.31*	46.30	1.000E+35	37.61	Decay	
			768.36	5.04	----	Not Found		----
			934.06	3.21	----	Not Found		----
			1120.29	15.10	----	Not Found		----
			1239.11	5.94	----	Not Found		----
			1377.67	4.11	----	Not Found		----
1764.49	15.00	----	Not Found	----				
% Abundances Found =				48.48	(Abn. Limit = 49.48%)			

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EF1-EFT-25060606

Page : 6  
Acquisition date : 10-JUL-2007 11:49:16

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	66.32	29	59	2.10	133.31	129	9	1.63E-02	51.1	1.41E+00	T
0	511.05	172	9	2.94	1023.10	1014	10	9.57E-02	8.6	4.80E+00	T
0	550.67	66	47	1.01	1110.30	1112	17	3.69E-02	25.0	4.69E+00	T
0	610.31	40	33	1.00	1221.70	1213	19	2.24E-02	37.6	4.52E+00	T

Flags: "T" = Tentatively associated

\* Sample ID : EF1-EFT-25060606 \*\*\*\*\*

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
BE-7	29.	477.59	1.4043E-05
F-18	0.	511.00	Half-Life too short
NA-22	7.	1274.54	1.1379E-06
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	5.	809.25	1.9023E-07
CR-51	0.	320.80	Half-Life too short
MN-54	17.	834.03	2.2697E-06
CO-56	12.0	1230.25	5.0716E-07
MN-56	0.	1010.69	Half-Life too short
NI-56	0.	150.30	Half-Life too short
CO-57	44.	122.06	2.0169E-06
CO-58	13.	810.76	4.1270E-07
FE-59	11.	1099.22	7.9419E-06
CO-60	11.	1332.49	1.1956E-06
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1401.04	Half-Life too short
ZN-65	0.	1115.52	5.0671E-06
ZN-69M	0.	430.63	Half-Life too short
SE-75	49.	136.00	1.4244E-07
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	801.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	45.	513.99	2.5997E-06
KR-85M	0.	151.10	Half-Life too short
SR-85	45.	513.99	7.4717E-07
RB-86	0.	1076.63	Half-Life too short
KR-87	0.	402.50	Half-Life too short
SR-87M	0.	300.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1302.39	Half-Life too short
Y-88	5.	1036.01	1.2006E-07
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.00	Half-Life too short
KR-90	0.	1110.69	Half-Life too short
RB-90	0.	031.69	Half-Life too short
RB-90M	0.	024.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	13.	1204.90	3.9190E-04
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1303.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short



## Minimum Detectable Activity Report (continued)

Page : 2

Sample ID : EF1-EFT-29060606

Acquisition date : 10-JUL-2007 11:49:16

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	15.	702.63	7.6453E-09
NB-95	0.	765.79	Half-Life too short
NB-95M	0.	235.69	Half-Life too short
ZR-95	19.	756.72	1.2350E-06
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.50	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	0.	497.00	Half-Life too short
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	17.	621.04	1.5634E-07
CD-109	33.	80.03	6.1013E-07
AO-110M	10.	937.48	7.2917E-08
SN-113	30.	391.69	1.3101E-07
SN-117M	0.	150.56	Half-Life too short
SB-122	0.	563.93	Half-Life too short
SB-124	26.	602.71	9.0090E-07
SB-125	24.	427.09	3.2145E-08
TE-125M	30.	109.20	3.0770E-04
TE-127	0.	417.90	Half-Life too short
TE-127M	32.	57.60	3.0947E-04
XE-127	0.	202.04	Half-Life too short
TE-129	0.	459.60	Half-Life too short
TE-129M	0.	695.00	Half-Life too short
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	0.	123.00	Half-Life too short
I-131	0.	364.48	Half-Life too short
TE-131 ?	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	0.	163.93	Half-Life too short
I-132	0.	667.69	Half-Life too short
TE-132	0.	220.16	Half-Life too short
BA-133	31.	302.04	4.3000E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.07	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	20.	604.70	1.1514E-08/7
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	260.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

## Minimum Detectable Activity Report (continued)

?

Page #: 3

Sample ID : EF1-EFT-29060606

Acquisition date : 10-JUL-2007 11:49:16

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
CS-136	0.	818.50	Half-Life too short
I-136	0.	1313.02	Half-Life too short
CS-137	5.	661.65	5.2764E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.06	Half-Life too short
XE-138	0.	358.31	Half-Life too short
BA-139	0.	1428.50	Half-Life too short
CE-139	52.	165.95	7.5006E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	0.	537.32	Half-Life too short
LA-140	0.	1596.49	Half-Life too short
BA-141	60.	198.22	Half-Life too short
CE-141	0.	145.44	Half-Life too short
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	35.	133.54	1.7819E-07
PR-144	0.	1489.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PM-148M	12.	558.27	5.0627E-06
EU-152	30.	344.27	2.9420E-08
EU-154	9.	1004.76	4.9576E-08
EU-156	0.	646.29	Half-Life too short
HF-181	26.	482.03	6.5501E-06
TA-182	9.	1221.42	3.7506E-07
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HO-203	41.	279.19	3.8709E-06
BI-207	23.	569.67	8.3901E-09
TL-200	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	43.	186.21	2.2860E-07
AC-228	25.	338.32	6.6768E-08
TH-228	37.	84.37	1.7927E-06
PA-234	0.	131.20	Half-Life too short
TH-234	0.	63.29	Half-Life too short
U-235	44.	143.76	7.3930E-08
NP-239	0.	106.13	Half-Life too short
AM-241	33.	59.54	1.7981E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-25060606

Sample Location (Well Number): EFT-25

1. Representative sample collected. Date/Time 06/06/06 / 1130

Sample collected by: Joy Slaback for J. Slaback Date: 06/06/06  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Freiling / Clitish A. J. J. Date: 08/02/06  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Ross Bunge Date: 8-7-06  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: R. King Date: 7-25-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-2S
2 . Date Sampled	06/06/2006
3 . Time Sampled	11:30
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	08/07/2006
2 . Time Sample Counted	11:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	6.8 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3596.7 cpm
Net Spike Count Rate (cpm)	3589.9 cpm
H3 Spike Activity (dpm on count date)	8575.1 dpm
Counter Efficiency	0.4186 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	7.6 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.8 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	1.9 cpm

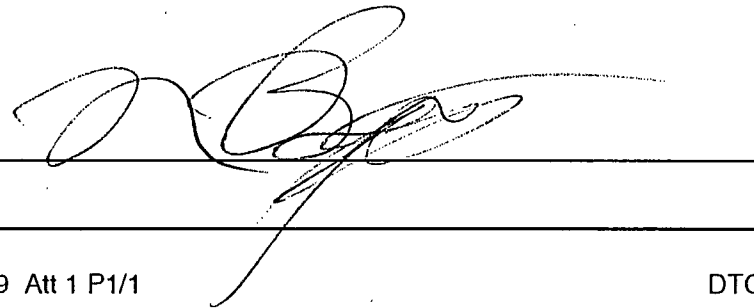
**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.04\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 uCi/ml x Sample Volume}} < \text{MDA}$$

Technician 

Date 8-7-06

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-25060606

Sample Location (Well Number): EFT 25

1. Representative sample collected. Date/Time 06/06/06 / 1130

Sample collected by: Jay Slaback / Jay Slaback Date: 06/06/06  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Freilich / Chris A Freilich Date: 8/2/06  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function.

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Abere / Andrew Aber Date: 8-5-06  
Fermi 2 RP Printed Name Signature

Sample number: EFT-25060606

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Above, Andrew Date: 8-5-06  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: RD Lindsay, K. O'Leary Date: 2-25-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION DETECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-25060606 EF1

Sample End Time: 6-JUN-2006 11:30:00.00

REMARKS

PERFORMED BY:

SIGNATURE

REVIEWED BY:

SIGNATURE/DATE

*R. D. Kelly* 2-25-08

Sample ID : EFT-25060606 EF1

Acquisition date : 5-AUG-2006 10:14:27

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-25060606 EF1
Sample collection start date: 6-JUN-2006 11:30:00.00
Sample collection end date : 6-JUN-2006 11:30:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : M2LL Operator: AKG

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 5-AUG-2006 10:14:27.03
Pre-set live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:01.10 Percent dead time : 0.00 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 26-APR-2006 11:56:00.00
Kev/channel : 5.00143E-01 Zero offset: -2.30456E-03
Daily cal date : 5-AUG-2006 00:20:12.42

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m2ll Efficiencies at : Peak energy

Table with 11 columns: Pk, It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. Contains 4 rows of peak data.



Post-NID Peak Search Report

It	Energy	Area	Bgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	510.77	126	45	2.52	1021.56	1014	14	14.4		<i>Am-241</i>
0	550.43	65	19	1.21	1116.92	1111	11	10.1		<i>Ac</i>
0	1461.10	85	9	2.40	2983.00	2915	17	13.4		<i>K-40</i>
0	1764.51	33	3	2.00	3531.60	3523	15	21.5		<i>Bi, 214</i>

Nuclide Type: natural

Nuclide	Energy	Area	%Aln	CF	Uncorrected µCi/cc	Decay Co. f. µCi/cc	1-Sigma %Error
K-40	1460.81	85	10.67*	2.300E+00	5.152E-07	5.152E-07	13.45

Flag: "\*" = Keylet

Sample ID : EFT-2500019, EFT

Run date: 11/10/10

Run # 1111111

Number of lines	4
Number of unidentified lines	0
Number of lines tentatively identified by NLD	4

100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flag
K-40	1.06E+05Y	1.00	5.152E-07	5.152E-07	0.693E-07	13.45	
Total Activity :			5.152E-07	5.152E-07			

Grand Total Activity : 5.152E-07 5.152E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half-life	Ratio	Energy	%Abund	Activity (uCi/cc)	1 Sigma %Error	Rejected by
F-18	109.74M	786.76	511.00*	100.46	1.000E+35	14.44	Decay
% Abundances Found =			100.00				
AS-76	26.32H	54.67	559.10*	44.70	1.448E+09	18.08	Decay, Abun.
			563.23	1.17	----	Not Found	----
			571.30	0.14	----	Not Found	----
			657.03	6.10	----	Not Found	----
			665.31	0.39	----	Not Found	----
			740.12	0.12	----	Not Found	----
			771.76	0.12	----	Not Found	----
			867.63	0.12	----	Not Found	----
			1129.87	0.14	----	Not Found	----
			1212.72	1.63	----	Not Found	----
			1216.02	3.84	----	Not Found	----
			1228.52	1.39	----	Not Found	----
			1439.13	0.33	----	Not Found	----
			1453.63	0.12	----	Not Found	----
			1787.67	0.33	----	Not Found	----
% Abundances Found =			73.70				
BI-214	19.90M	4338.67	609.31*	46.30	----	Not Found	Decay, Abun.
			768.36	5.04	----	Not Found	----
			934.06	3.21	----	Not Found	----
			1120.29	15.10	----	Not Found	----
			1238.11	5.94	----	Not Found	----
			1377.67	4.11	----	Not Found	----
			1764.49	15.80	1.000E+35	21.55	
% Abundances Found =			16.54 (Abn. Limit = 40.40%)				

Flag: "\*" - Byline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Ev	Cts/Sec	%Err	%Eff	Flag
0	510.77	100	17	2.52	1021.06	1014	17	8.00E-02	11.4	4.49E+00	T
0	558.43	05	19	1.21	1116.92	1111	11	3.60E-02	10.1	4.31E+00	T
0	1764.51	33	3	2.00	3531.60	3523	15	1.82E-02	21.5	2.00E+00	T

Flags: "T" = Tentatively associated

\* Sample ID : EFF-29060606 EFF1

Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	25.	477.59	1.7642E-07
F-18	0.	511.00	Half-Life too short
NA-22	0.	1274.54	9.0233E-09
NA-24	0.	1368.53	Half-Life too short
MG-17	0.	1014.44	Half-Life too short
CL-36	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	13.	889.25	1.5952E-08
CR-51	35.	379.00	3.0633E-07
MN-54	17.	834.83	1.1675E-08
CO-56	14.	1238.25	2.9703E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	52.	158.38	8.1332E-06
CO-57	58.	122.06	1.4910E-08
CO-58	18.	810.76	1.8341E-08
FE-59	15.	1099.22	5.1605E-08
CO-60	12.	1332.49	1.1786E-08
CU-64	0.	1349.90	Half-Life too short
NI-65	0.	1401.84	Half-Life too short
ZN-65	10.	1115.52	2.2266E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	41.	136.00	2.0333E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	42.	513.99	2.5797E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	42.	513.99	2.0988E-08
RB-86	15.	1076.63	1.1966E-06
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	10.	1836.01	1.9046E-08
KR-89	0.	220.90	Half-Life too short
RD-89	0.	1031.88	Half-Life too short
RB-90	0.	1118.09	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	9.	1204.90	6.5357E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1333.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Radionuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
Sr-93	0.	598.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
Nb-94	16.	702.63	8.4522E-09
Nb-95	23.	765.79	3.5504E-08
Nb-95M	0.	235.69	Half-Life too short
Zr-95	16.	756.72	3.1609E-08
Nb-97	0.	657.98	Half-Life too short
Zr-97	0.	743.36	Half-Life too short
Rb-99	0.	739.58	Half-Life too short
Tc-99M	0.	140.50	Half-Life too short
Tc-101	0.	306.81	Half-Life too short
Ti-102	26.	497.08	2.8102E-08
Tc-104	0.	757.99	Half-Life too short
Rh-105	0.	318.90	Half-Life too short
Ru-105	0.	724.58	Half-Life too short
Ru-106	24.	621.84	1.0651E-07
Cd-109	44.	88.83	4.7827E-07
Ag-110M	15.	937.48	3.7251E-08
Sn-113	36.	391.69	2.0281E-08
Sn-117M	51.	158.56	3.1572E-07
Nb-122	0.	563.93	Half-Life too short
Sb-124	25.	692.71	1.9273E-08
Sb-125	38.	427.89	3.1062E-08
Te-125M	50.	109.28	8.4876E-06
Te-127	0.	417.98	Half-Life too short
Te-127M	20.	57.60	3.3834E-05
Xe-127	56.	202.84	4.3361E-08
Te-129	0.	459.60	Half-Life too short
Te-129M	27.	695.88	1.0071E-08
Xe-129M	68.	196.56	2.2976E-05
I-130	0.	536.89	Half-Life too short
Ba-131	51.	123.88	1.1858E-06
I-131	38.	364.48	1.7758E-06
Te-131	0.	149.72	Half-Life too short
Te-131M	0.	773.67	Half-Life too short
Xe-131M	57.	163.93	1.5764E-05
I-132	0.	667.69	Half-Life too short
Te-132	0.	228.16	Half-Life too short
Ba-133	35.	382.84	4.7239E-08
Ba-133M	0.	276.89	Half-Life too short
I-133	0.	529.87	Half-Life too short
Te-133M	0.	912.58	Half-Life too short
Xe-133	0.	81.00	Half-Life too short
Xe-133M	0.	233.22	Half-Life too short
Cs-134	23.	604.70	9.6796E-09
I-134	0.	884.89	Half-Life too short
Te-134	0.	218.47	Half-Life too short
Ba-135M	0.	268.24	Half-Life too short
I-135	0.	1268.41	Half-Life too short
Xe-135	0.	249.79	Half-Life too short
Xe-135M	0.	526.56	Half-Life too short

Sample ID : 11-250600000 CRT

Acquisition date : 5-AUG-2006 10:14:17

Nuclide	Weight Sum	Energy (keV)	Rate (dCi/cc)
CS-136	17.	918.50	2.3578E-07
I-136	0.	1313.02	Half-Life too short
CS-137	20.	661.67	1.2007E-06
Xe-137	0.	435.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	259.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	50.	165.05	1.5609E-08
CS-139	0.	1203.23	Half-Life too short
BO-140	23.	537.32	8.7495E-07
LA-140	0.	1590.77	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	56.	140.94	6.9800E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-143	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	66.	133.54	1.1489E-07
PR-144	0.	1409.15	Half-Life too short
ND-147	42.	91.10	2.2910E-06
PM-148M	12.	550.27	1.0427E-06
EU-152	39.	344.27	3.4811E-08
EU-154	9.	1004.76	5.0369E-08
EU-155	23.	646.29	2.0152E-06
HO-181	21.	482.01	2.8537E-06
YO-182	15.	1221.42	6.4833E-08
W-187	0.	603.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	50.	279.19	3.0476E-08
SI-207	31.	569.67	1.0241E-08
TL-208	0.	503.14	Half-Life too short
PO-212	0.	230.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PO-214	0.	351.92	Half-Life too short
RA-224	0.	248.98	Half-Life too short
RA-226	45.	186.21	2.5403E-07
AC-228	43.	338.32	8.4490E-08
TH-228	36.	84.37	1.4002E-06
PA-234	0.	131.20	Half-Life too short
TH-234	35.	63.29	6.4906E-06
U-235	50.	143.76	8.5567E-08
NP-239	0.	106.13	Half-Life too short
AM-241	33.	59.54	1.8349E-07



## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-25 121406

Sample Location (Well Number): EFT-25

1. Representative sample collected. Date/Time 12/14/06 1 1635

Sample collected by: J. Slaback / Jerry Main Slaback Date: 02/01/07  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 2/2/07  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: D. Howard / Am Howard Date: APR 20 2007  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KO LINDSEY / KO Lindsey Date: 11-14-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_



## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-25121406

Sample Location (Well Number): EFT-25

1. Representative sample collected. Date/Time 12/14/06 1 1635

Sample collected by: J. Slaback / Jay Main Slaback Date: 02/01/07  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 2/2/07  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: AD LINDSEY / AD Lindsey Date: 8-8-07  
Fermi 2 RP Printed Name Signature

Sample number: EFT-25121406

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard CL Hubbard Date: 7-16-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: KPHINDSON 1 KPHINDSON Date: 8-9-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DETOIT EDISON FERMI-2 POWER PLANT

16-JUL-2007 13:44:52.34

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

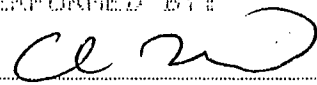
HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1 EFT-26121406

Sample End Time: 14-DEC-2006 16:35:00.00

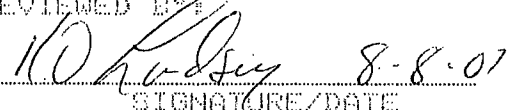
REMARKS

PERFORMED BY:



SIGNATURE

REVIEWED BY:



SIGNATURE/DATE

Sample ID : EF1 EFT-2S121406

Acquisition date : 16-JUL-2007 13:14:47

\*\*\*\*\*  
 Fermi 2 Radiation Protection Gamma Spectroscopy Report  
 \*\*\*\*\*

## \*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-2S121406  
 Sample collection start date: 14-DEC-2006 16:35:00.00  
 Sample collection end date : 14-DEC-2006 16:35:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03-CC  
 Sample geometry : PELL Operator: CMH

## \*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 16-JUL-2007 13:14:47.69  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:00.00 Percent dead time : 0.05 %

## \*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16  
 Kev/channel : 4.09730E-01 Zero offset: -1.95000E-01  
 Daily cal date : 16-JUL-2007 00:37:10.01

## \*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

## \*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

PK	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	511.36	140	54	2.15	1023.63	1015	21	0.23E-02	14.0	annihilation
2	0	550.58	75	29	1.40	1118.11	1110	13	4.18E-02	18.7	H <sub>2</sub> O
3	0	1460.96	60	0	1.99	2923.67	2917	13	3.33E-02	12.9	K-40

Sample Title : EF1 EFT-29121406  
Decay Time = 213 20:39:47.69

Page : 1  
Acquisition Time = 16-JUL-2007 13:14:47.6

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Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	511.36	149	54	2.15	1023.63	1015	21	14.9		
0	558.58	75	28	1.40	1116.11	1110	13	18.7		
0	1460.96	60	0	1.99	2923.67	2917	13	12.9		K-40

Nuclide Line Activity Report  
Sample ID : EF1 EFT-23121496

Page : 2  
Acquisition date : 16-JUL-2007 13:14:47

Nuclide Types: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/CC	Decay Corr uCi/CC	1-Sigma %Error
K-40	1460.81	60	10.67*	2.501E+00	3.376E-07	3.376E-07	12.91

Flag: "\*" = Keyline



Summary of Nuclide Activity  
Sample ID : EF1 EFT-2S121406

Page : 3  
Acquisition date : 16-JUL-2007 13:14:47

Total number of lines in spectrum 3  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 3 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/CC	Decay Corr uCi/CC	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	3.376E-07	3.376E-07	0.436E-07	12.91	
Total Activity :			3.376E-07	3.376E-07			
Grand Total Activity :			3.376E-07	3.376E-07			

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Rejected Report  
 Sample ID : EF1 EFT-29121406

Page : 4  
 Acquisition date : 16-JUL-2007 13:14:47

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/CC)	1-Sigma %Error	Rejected by
F-18	109.74M	2806.40	511.00*	100.46	1.000E+35	14.76	Decay
% Abundances Found = 100.00							
AS-76	26.32H	195.02	559.10*	44.70	1.000E+35	18.72	Decay, Abun.
			563.23	1.17	---	Not Found	---
			571.30	0.14	---	Not Found	---
			657.03	6.10	---	Not Found	---
			665.31	0.39	---	Not Found	---
			740.12	0.12	---	Not Found	---
			771.76	0.12	---	Not Found	---
			867.63	0.12	---	Not Found	---
			1129.87	0.14	---	Not Found	---
			1212.72	1.63	---	Not Found	---
			1216.02	3.84	---	Not Found	---
			1228.52	1.39	---	Not Found	---
			1439.13	0.33	---	Not Found	---
			1453.60	0.13	---	Not Found	---
			1787.67	0.33	---	Not Found	---
% Abundances Found = 73.70							

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EF1 EFT-23121406

Page : 5  
Acquisition date : 16-JUL-2007 13:14:47

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	511.36	140	54	2.15	1023.63	1015	21	8.23E-02	14.9	4.98E+00	T
0	550.58	75	28	1.40	1110.11	1110	13	4.18E-02	10.7	4.69E+00	T

Flags: "T" = Tentatively associated

\* Detroit Edison Fermi 2 MDA Report, Generated 16-JUL-2007 13:44:56.13 \*

\* Sample ID : EF1 EFT-26121406 \*

Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/CC)
BE-7	19.	477.59	1.0470E-06
F-18	0.	511.00	Half-Life too short
NA-22	1.	1274.54	4.7055E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	7.	889.25	4.0092E-08
CR-51	28.	320.00	1.4911E-05
MN-54	11.	834.83	1.2339E-08
CO-56	14.	1238.25	1.0058E-07
MN-56	0.	1810.69	Half-Life too short
NI-56	0.	158.38	Half-Life too short
CO-57	43.	122.06	1.7439E-00
CO-58	10.	810.76	6.0049E-08
FE-59	11.	1099.22	4.6014E-07
CO-60	0.	1332.49	9.5573E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.04	Half-Life too short
ZN-65	15.	1115.52	3.8959E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	36.	136.00	4.2646E-00
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	801.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	50.	513.99	2.6431E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	50.	513.99	1.0046E-07
RE-86	0.	1076.63	Half-Life too short
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RE-88	0.	1382.39	Half-Life too short
Y-88	5.	1836.01	3.5448E-08
KR-89	0.	228.90	Half-Life too short
RE-89	0.	1031.00	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RE-90	0.	831.69	Half-Life too short
RE-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	10.	1204.90	3.8889E-05
Y-91M	0.	555.60	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page : 2

Sample ID : EF1 EFT-28121406

Acquisition date : 16-JUL-2007 13:14:47

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/CC)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	20.	702.63	8.5245E-09
NB-95	16.	765.79	5.8173E-07
NB-95M	0.	235.69	Half-Life too short
ZR-95	15.	756.72	1.5015E-07
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	22.	497.00	3.6203E-07
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.00	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	22.	621.04	1.2623E-07
CD-109	52.	88.03	5.7237E-07
AG-110M	11.	937.40	4.5002E-08
SN-113	27.	391.69	4.1127E-08
SN-117M	0.	150.56	Half-Life too short
SB-122	0.	563.93	Half-Life too short
SD-124	14.	602.71	0.0373E-08
SB-125	24.	427.09	2.0527E-08
TE-125M	38.	100.20	4.2252E-05
TE-127	0.	417.90	Half-Life too short
TE-127M	23.	57.60	0.2505E-05
XE-127	36.	202.04	5.9950E-07
TE-129	0.	459.60	Half-Life too short
TE-129M	15.	695.00	1.0607E-05
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	0.	123.00	Half-Life too short
I-131	0.	364.40	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	0.	163.93	Half-Life too short
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	30.	302.04	4.5631E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.07	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.32	Half-Life too short
CS-134	16.	604.70	0.0767E-09
I-134	0.	004.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	260.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page : 3

Sample ID : EF1 EFT-28121406

Acquisition date : 16-JUL-2007 13:14:47

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
CS-136	0.	819.59	Half-Life too short
I-136	0.	1313.02	Half-Life too short
CS-137	19.	661.65	9.5321E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	250.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	44.	165.85	2.7516E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	0.	537.32	Half-Life too short
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	47.	145.44	1.5720E-06
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.36	Half-Life too short
CE-144	41.	133.54	1.2203E-07
PR-144	0.	1489.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PM-148M	13.	550.27	2.3461E-07
EU-152	31.	344.27	2.8900E-08
EU-154	13.	1004.76	5.5317E-08
EU-156	0.	646.29	Half-Life too short
HF-181	14.	482.03	2.4045E-07
TA-182	9.	1221.42	1.1998E-07
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	43.	279.19	2.5006E-07
BI-207	16.	569.67	7.0863E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	36.	186.21	2.8986E-07
AC-228	29.	330.32	6.7953E-08
TH-228	37.	84.37	1.4800E-06
PA-234	0.	131.20	Half-Life too short
TH-234	31.	63.29	4.8814E-04
U-235	40.	143.76	7.0788E-00
NP-239	0.	106.13	Half-Life too short
AM-241	25.	59.54	1.5984E-07

**EFT-2S**

**2007**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-257507

Sample Location (Well Number): EFT-25

1. Representative sample collected. Date/Time 7/5/07 1 1229

Sample collected by: Joy Marie Slaback / Joy Marie Slaback Date: 12/10/2007  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J Southward / J Southward Date: 12/10/07  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: R. Berger / [Signature] Date: 12/14/07  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KO Kinosey / [Signature] Date: 2.26.08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_



Tritium Activity Calculation

**Sample Information**

1 . Sample Location 2S  
 2 . Date Sampled 07/05/2007  
 3 . Time Sampled 12:29  
 4 . Sample Volume, (ml) 4 ml

**Instrument Count Data**

1 . Date Sample Counted 12/14/2007  
 2 . Time Sample Counted 08:00  
 3 . Background Inf.:  
 Minutes Counted 10 min.  
 Background Count Rate (cpm) 8.2 cpm  
 4 . Efficiency Inf.: (Daily Spike Source ID # 111)  
 Gross Spike Count Rate (cpm) 3189.3 cpm  
 Net Spike Count Rate (cpm) 3181.1 cpm  
 H3 Spike Activity (dpm on count date) 7944.9 dpm  
 Counter Efficiency 0.4004 cpm/dpm  
 5 . Sample Info:  
 Sample Gross Count Rate (cpm) 9.0 cpm  
 Sample Count Time (min.) 10.0 min.  
 Net Sample Count Rate (cpm) 0.8 cpm  
 6 . Critical Level:  
 Critical Level Count Rate (cpm) 2.1 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.19\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician



Date

12-14-07

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-257507

Sample Location (Well Number): EFT-25

1. Representative sample collected. Date/Time 07/05/2007 1229

Sample collected by: J. Slaback / J. Slaback Date: 07/16/2007  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 08/08/07  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: RD Lindsay / RD Lindsay Date: 8-8-07  
Fermi 2 RP Printed Name Signature

Sample number: EFT-257507

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard ce 20 Date: 7-19-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: KD LINDSEY KD Lindsey Date: 8-8-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EF10EFT-257507

Sample End Time: 5-JUL-2007 12:29:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*[Handwritten Signature]*

SIGNATURE

REVIEWED BY:

*[Handwritten Signature]* 5-8-07

SIGNATURE/DATE

Sample ID : EF1 EFT-267507

Acquisition date : 19-JUL-2007 10:53:05

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-267507
Sample collection start date: 5-JUL-2007 12:29:00.00
Sample collection end date : 5-JUL-2007 12:29:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : MALL Operator: CMH

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 19-JUL-2007 10:53:05.93
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:00.91 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16
Kev/channel : 4.99741E-01 Zero offset: -1.77476E-01
Daily cal date : 19-JUL-2007 08:20:24.04

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at r Peak energy

Table with 11 columns: Pk It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. Contains 3 rows of peak data with handwritten annotations for 'annihilation', 'HwC', and 'K-40'.

3

## Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	511.59	149	34	3.17	1024.06	1014	20	12.7		
0	558.78	53	18	1.46	1110.48	1113	12	21.1		
0	1461.07	54	12	1.14	2923.06	2915	16	19.8		K-40

Nuclide Type: natural

Nuclide	Energy	Area	%bn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	54	10.67*	2.501E+00	3.031E-07	3.031E-07	19.82

Flags "\*" = Keyline

Summary of Nuclide Activity  
Sample ID : EPI EFT-257507

Page : 3  
Acquisition date : 19-JUL-2007 10:53:05

Total number of lines in spectrum 3  
Number of unidentified lines 2  
Number of lines tentatively identified by NID 3 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	3.031E-07	3.031E-07	0.601E-07	19.82	
Total Activity :			3.031E-07	3.031E-07			
Grand Total Activity :			3.031E-07	3.031E-07			

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit



Sample ID : EF1 EFT-297507

Acquisition date : 13-JUL-2007 10:53:00

Nuclide	Half-life	Ratio	Energy	%Abund	Activity (uCi/cc)	%Error	Rejected by
F-18	109.74M	182.97	511.00	100.46	1.000E+35	12.72	Decay
				% Abundances Found = 100.00			
AS-76	26.32H	12.71	559.10	44.70	2.555E-04	21.09	Decay, Abun.
			563.23	1.17	----	----	Not Found
			571.30	0.14	----	----	Not Found
			657.03	6.10	----	----	Not Found
			665.31	0.39	----	----	Not Found
			740.12	0.12	----	----	Not Found
			771.76	0.12	----	----	Not Found
			867.63	0.12	----	----	Not Found
			1129.87	0.14	----	----	Not Found
			1212.72	1.63	----	----	Not Found
			1216.02	3.84	----	----	Not Found
			1220.52	1.39	----	----	Not Found
			1439.13	0.33	----	----	Not Found
			1453.60	0.13	----	----	Not Found
			1787.67	0.33	----	----	Not Found
				% Abundances Found = 73.70			

Flags "w" = Keyline

Unidentified Energy Lines  
Sample ID : UFI EFT 207507

Page # 5  
Acquisition date : 19-JUL-2007 10:53:05

It	Energy	Area	Elignd	FWHM	Channel	Left	Pe	Cts/Sec	%Err	%Eff	Flags
0	511.59	149	34	3.17	1024.06	1014	20	0.26E-02	10.7	4.00E+00	T
0	550.70	53	18	1.46	1110.40	1113	12	2.94E-02	21.1	4.60E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	27.	477.59	9.1516E-03
F-18	0.	511.00	Half-Life too short
NA-22	5.	1274.54	7.4184E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-30	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-40	12.	899.25	9.6604E-09
CR-51	27.	320.00	9.8623E-08
MN-54	13.	834.83	8.5773E-09
CO-56	0.	1230.25	1.4553E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	38.	158.38	3.4981E-08
CO-57	46.	122.06	1.0002E-08
CO-58	18.	810.76	8.4785E-09
FE-59	9.	1099.22	1.0015E-08
CO-60	11.	1332.49	1.0316E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	9.	1115.52	1.7949E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	39.	136.00	1.3882E-08
AS-76	0.	559.18	Half-Life too short
BR-82	12.	770.49	6.5582E-06
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	59.	513.99	2.7538E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	59.	513.99	1.3812E-08
RB-86	9.	1076.63	1.5990E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	5.	1936.01	9.4631E-09
KR-89	0.	220.98	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RD-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.38	Half-Life too short
Y-91	10.	1204.90	3.6677E-06
Y-91M	0.	555.68	Half-Life too short
SR-92	0.	1303.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EF1 EFT-207507

Acquisition date : 10-JUL-2007 10:53:05

Nuclide	Bckgrnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	21.	702.63	8.7390E-09
NB-95	10.	765.79	9.1224E-09
NB-95M	41.	235.69	4.4691E-07
ZR-95	15.	756.72	1.7060E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	13.	739.58	1.9764E-06
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	20.	497.00	1.1901E-08
TC-104	0.	357.99	Half-Life too short
RH-105	32.	310.90	2.2010E-05
RU-105	0.	724.50	Half-Life too short
RU-106	12.	621.04	6.5451E-08
CD-109	40.	80.03	3.7660E-07
AG-110M	10.	937.40	2.4807E-08
SM-113	22.	391.69	1.1178E-08
SM-117M	40.	150.56	1.6997E-08
SB-122	10.	563.93	3.6006E-07
SB-124	21.	602.71	9.4551E-09
SB-125	30.	427.89	2.7709E-08
TE-125M	30.	109.20	3.0033E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	34.	57.60	2.7426E-05
XE-127	37.	202.04	1.3556E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	10.	695.08	3.2596E-07
XE-129M	47.	196.56	4.9112E-07
I-130	0.	536.09	Half-Life too short
BA-131	44.	123.00	6.7320E-08
I-131	30.	364.40	3.0936E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	50.	163.93	9.0462E-07
I-132	0.	667.69	Half-Life too short
TE-132	32.	220.10	1.5070E-07
BA-133	37.	302.04	4.3330E-08
BA-133M	31.	276.09	1.4975E-05
I-133	0.	529.07	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	30.	81.00	2.0360E-07
XE-133M	43.	233.22	6.2644E-06
CS-134	13.	604.70	6.7003E-09
I-134	0.	004.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	260.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT EFT-237507

Acquisition date : 19-JUL-2007 10:53:05

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	11.	810.59	1.6268E-08
I-136	0.	1313.82	Half-Life too short
CS-137	9.	661.65	6.7678E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1489.58	Half-Life too short
CE-139	52.	165.05	1.8819E-08
CS-139	0.	1263.23	Half-Life too short
DA-140	17.	537.32	5.9806E-08
LA-140	5.	1596.49	2.7636E-06
DA-141	0.	199.22	Half-Life too short
CE-141	49.	145.44	2.2713E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	47.	133.54	8.0149E-08
FR-144	0.	1489.15	Half-Life too short
ND-147	45.	91.18	1.1532E-07
PM-149M	19.	559.27	9.3478E-09
EU-152	33.	344.27	2.9883E-08
EU-154	14.	1804.76	3.5174E-08
EU-156	24.	646.29	2.2983E-07
MF-181	17.	482.83	9.9559E-09
TA-182	7.	1221.42	3.2693E-08
W-187	0.	685.91	Half-Life too short
RE-188	0.	155.83	Half-Life too short
HG-203	44.	279.19	1.2977E-08
BI-207	22.	569.67	8.1498E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	58.	248.98	3.8875E-06
RA-226	42.	186.21	2.2388E-07
AC-228	43.	338.32	7.6868E-08
TH-228	38.	84.37	1.2372E-06
PA-234	0.	131.20	Half-Life too short
TH-234	41.	63.29	1.7481E-06
U-235	46.	143.76	7.5463E-08
NP-239	48.	106.13	2.6366E-06
AM-241	45.	59.54	2.8858E-07

**EFT-2S**

**2008**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-2541608

Sample Location (Well Number): EFT-25'

1. Representative sample collected. Date/Time 4/16/08 1 1455

Sample collected by: Joy Marie Slaback / Joy Marie Slaback Date: 04/21/2008  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 4/21/08  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Riss Berger / [Signature] Date: 4-22-08  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KD Linsby / [Signature] Date: 4-28-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-2S41608
2 . Date Sampled	04/16/2008
3 . Time Sampled	14:55
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	04/21/2008
2 . Time Sample Counted	21:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.8 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3020.9 cpm
Net Spike Count Rate (cpm)	3013.1 cpm
H3 Spike Activity (dpm on count date)	7788.2 dpm
Counter Efficiency	0.3869 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	9.2 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	1.4 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

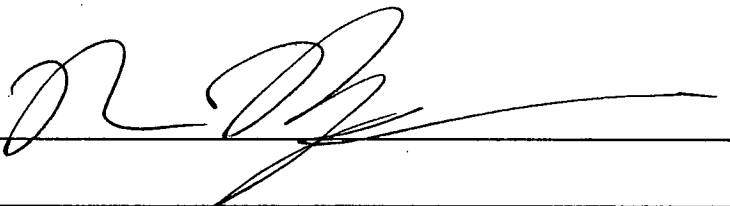
**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smp l min.})}}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.20\text{E-}06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician



Date

4-22-08



## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-2541608

Sample Location (Well Number): EFT-25

1. Representative sample collected. Date/Time 4/16/08 1:1455

Sample collected by: Joy Marie Slaback / Joy Marie Slaback Date: 04/20/2008  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 4/21/08  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: J. Southward / J. Southward Date: 4/22/08  
Fermi 2 RP Printed Name Signature

Sample number: EFT-25411608

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: J. Southward | J. Southward Date: 4/22/08  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: (K) LINDSAY | KO Lindsey Date: 4-24-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-2941600

Sample End Time: 16-APR-2008 14:55:00.00

REMARKS

PERFORMED BY:

*J. Soutter*  
SIGNATURE

REVIEWED BY:

*K2 Rudy* 4-24-08  
SIGNATURE/DATE

Sample ID : EFT-2841608

Acquisition date : 22-APR-2008 13:53:37

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-2841608  
 Sample collection start date: 16-APR-2008 14:55:00.00  
 Sample collection end date : 16-APR-2008 14:55:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : PELL Operator: JNS

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 22-APR-2008 13:53:37.13  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:01.00 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16  
 KeV/channel : 5.00189E-01 Zero offset: -1.47805E-01  
 Daily cal date : 22-APR-2008 06:30:50.32

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	351.68	52	43	2.41	703.39	694	17	2.06E-02	32.2	
2	0	511.56	158	44	2.47	1023.02	1013	23	8.76E-02	13.7	
3	0	558.66	65	10	2.39	1117.17	1108	10	3.50E-02	19.0	
4	0	1461.25	53	12	1.49	2921.558	2914?	16	2.95E-02	20.0	

Post-MID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	351.60	52	43	2.41	703.39	694	17	32.2		
0	511.56	158	44	2.47	1023.02	1013	23	13.7		
0	550.66	65	18	2.39	1117.17	1108	18	19.8		
0	1461.25	53	12	1.49	2921.55	2914	16	20.0		

TS -214  
Annih  
HVC  
K-40

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr. uCi/cc	1-Sigma %Error
K-40	1460.81	53	10.67*	2.501E+00	2.907E-07	2.907E-07	20.02

Flag: "\*" = Keyline

Summary of Nuclide Activity

Sample ID : ETT-2941600

Acquisition date : 22-APR-2008 13:53:37

Total number of lines in spectrum 4  
 Number of unidentified lines 0  
 Number of lines tentatively identified by NID 4 100.00%

Nuclide Type : natural

Nuclide	HLife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma Error	Flags
K-40	1.00E+05Y	1.00	2.987E-07	2.987E-07	0.598E-07	20.02	
Total Activity :			2.987E-07	2.987E-07			

Grand Total Activity : 2.987E-07 2.987E-07

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "Q" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund*	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	70.31	511.00*	193.46	9.380E+15	13.70	Decay
				% Abundances Found = 100.00			
AS-76	26.32M	5.44	559.10*	44.70	2.010E-06	19.79	Abun.
			563.23	1.17	-----	Not Found	-----
			571.30	0.14	-----	Not Found	-----
			657.03	6.10	-----	Not Found	-----
			665.31	0.39	-----	Not Found	-----
			740.12	0.12	-----	Not Found	-----
			771.76	0.12	-----	Not Found	-----
			867.63	0.12	-----	Not Found	-----
			1129.87	0.14	-----	Not Found	-----
			1212.72	1.63	-----	Not Found	-----
			1216.02	3.04	-----	Not Found	-----
			1220.52	1.39	-----	Not Found	-----
			1439.13	0.33	-----	Not Found	-----
			1453.60	0.13	-----	Not Found	-----
			1787.67	0.33	-----	Not Found	-----
				% Abundances Found = 73.70			
PE-214	26.80M	320.66	87.30	4.67	-----	Not Found	-----
			241.90	7.49	-----	Not Found	-----
			295.21	19.20	-----	Not Found	-----
			351.92*	37.20	1.000E+35	32.10	
			785.91	1.10	-----	Not Found	-----
				% Abundances Found = 53.40 (Abn. Limit = 37.20%)			

Flag: "\*" = Keyline



Unidentified Energy Lines  
Sample ID : EFT-2041600

Page : 5  
Acquisition date : 22-APR-2008 13:53:37

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	351.68	52	.43	2.41	703.39	694	17	2.86E-02	32.2	5.70E+00	T
0	511.56	158	.44	2.47	1023.02	1013	23	8.76E-02	13.7	4.89E+00	T
0	558.66	65	.10	2.39	1117.17	1108	18	3.58E-02	19.8	4.69E+00	T

Flags: "T" = Tentatively associated

\*\*\*\*\*  
 \* Detroit Edison Fermi 2 MDA Report, Generated 22 APR-2000 14:23:44.04 \*  
 \* Sample ID : EFT-2341600 \*  
 \*\*\*\*\*

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (dpm/cc)
BE-7	26.	477.59	8.2124E-08
F-18	0.	511.00	Half-Life too short
NA-22	11.	1274.54	1.0288E-08
NA-24	7.	1368.53	6.4999E-06
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	11.	889.25	8.8354E-09
CR-51	33.	320.00	8.9529E-08
MN-54	16.	834.83	9.2887E-09
CO-56	9.	1238.25	1.4529E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	42.	158.38	1.4783E-08
CO-57	44.	122.06	1.0295E-08
CO-58	9.	110.76	7.5194E-09

CO-60	11.	1332.49	1.0201E-00
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1401.04	Half-Life too short
ZN-65	11.	1115.52	1.8764E-00
ZN-69M	0.	430.63	Half-Life too short
SE-75	40.	136.00	1.3302E-00
AS-76	53.	559.10	1.1441E-00
BR-82	13.	776.49	1.5769E-07
BR-83	0.	529.64	Half-Life too short
BR-84	0.	801.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	40.	513.99	2.5167E-06
KR-85M	0.	151.10	Half-Life too short
SR-85	40.	513.99	1.1607E-00
RB-86	9.	1076.63	1.2012E-07
KR-87	0.	402.50	Half-Life too short
SR-87M	0.	300.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1302.39	Half-Life too short
Y-88	7.	1036.01	1.0676E-00
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.00	Half-Life too short
KR-90	0.	1110.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	9.	1204.90	3.2234E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1303.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Minimum Detectable Activity Report (continued)

Page : 2

Sample ID : EFT-2041800

Acquisition date : 22-APR-2000 13:53:37

Nuclide	Backgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	15.	702.63	7.4631E-09
NB-95	7.	765.79	6.6409E-09
NB-95M	26.	235.69	7.9119E-00
ZR-95	15.	756.72	1.6000E-00
NB-97	0.	657.90	Half-Life too short
ZR-97	11.	743.36	2.5464E-06
MO-99	9.	739.50	2.2014E-07
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	27.	497.00	1.0120E-00
TC-104	0.	357.99	Half-Life too short
RH-105	34.	310.90	6.5449E-07
RU-105	0.	724.50	Half-Life too short
RU-106	20.	621.04	0.1100E-00
CD-109	34.	80.03	3.4459E-07
AG-110M	13.	937.40	2.7799E-00
SN-113	29.	391.69	1.2105E-00
SN-117M	42.	150.56	1.1530E-00

SB-124	29.	602.71	9.9940E-09
SB-125	20.	427.89	2.6612E-08
TE-125M	39.	109.20	3.5794E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	30.	57.60	2.4600E-05
XE-127	40.	202.04	1.3107E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	22.	695.00	3.0400E-07
XE-129M	46.	196.56	2.6221E-07
I-130	0.	536.09	Half-Life too short
BA-131	50.	123.00	4.4391E-08
I-131	20.	364.40	1.5045E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	12.	773.67	5.3201E-07
XE-131M	49.0	163.93	5.7005E-07
I-132	0.	667.69	Half-Life too short
TE-132	35.	220.16	2.0006E-08
BA-133	32.	302.04	4.0456E-08
BA-133M	35.	276.09	5.2497E-07
I-133	10.	529.07	7.5157E-07
TE-133M	0.	912.50	Half-Life too short
XE-133	27.	01.00	0.4106E-08
XE-133M	35.	233.22	4.6017E-07
CS-134	20.	604.70	9.3102E-09
I-134	0.	004.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	29.	260.24	1.3230E-06
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Minimum Detectable Activity Report (continued)

Page : 3

Sample ID : EFT-2S41600

Acquisition date : 22-APR-2000 13:53:37

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	16.	010.50	1.2406E-08
I-136	0.	1313.02	Half-Life too short
CS-137	10.	661.65	6.9024E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.06	Half-Life too short
XE-138	0.	250.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	46.	165.05	9.0202E-09
CS-139	0.	1203.23	Half-Life too short
BA-140	14.	537.32	3.5155E-08
LA-140	9.	1596.49	1.3137E-07
BA-141	0.	190.22	Half-Life too short
CE-141	34.	145.44	1.6210E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	041.17	Half-Life too short
CE-143	42.	293.26	3.0946E-07
CE-144	43.	133.54	7.5177E-08
FR-144	0.	1409.15	Half-Life too short
WD-147	40.	91.10	6.6716E-08

PM-148M	7.	550.27	5.6274E-09
EU-152	35.	344.27	2.9725E-08
EU-154	11.	1004.76	4.0866E-08
EU-156	20.	646.29	1.4091E-07
HF-181	25.	482.03	1.0293E-08
TA-182	7.	1221.42	3.1682E-08
W-187	11.	685.81	1.4421E-06
RE-188	51.	155.03	1.0699E-05
HG-203	37.	279.19	1.0580E-08
BI-207	23.	569.67	8.2074E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	47.	240.98	6.5216E-07
RA-226	54.	186.21	2.5350E-07
AC-228	33.	338.32	6.7050E-08
TH-228	48.	84.37	1.3581E-06
PA-234	0.	131.20	Half-Life too short
TH-234	39.	63.29	1.3720E-06
U-235	36.	143.76	6.7144E-08
NP-239	44.	106.13	2.6150E-07
AM-241	31.	59.54	1.7527E-07

**EFT-2S**

**2009**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-2 S#031209

Sample Location (Well Number): EFT-25

1. Representative sample collected. Date/Time 3-12-09 / 13:30

Sample collected by: Chris Ellison / [Signature] Date: 3-12-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Proffitt / [Signature] Date: 4-17-09  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: D. Howard / [Signature] Date: 4-22-09  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: R. Byers / [Signature] Date: 4-22-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-2S031209
2 . Date Sampled	03/12/2009
3 . Time Sampled	13:30
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	04/21/2009
2 . Time Sample Counted	10:30
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.5 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2991.0 cpm
Net Spike Count Rate (cpm)	2983.5 cpm
H3 Spike Activity (dpm on count date)	7361.1 dpm
Counter Efficiency	0.4053 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	7.6 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.1 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.12\text{E-}06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician AM Johnson

Date 4.21.09



## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-25031209

Sample Location (Well Number): EFT-25

1. Representative sample collected. Date/Time 3-12-09 1 13:30

Sample collected by: Chris Ellison / [Signature] Date: 3-12-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: Pratt / [Signature] Date: 4-17-09  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function.

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Southward / [Signature] Date: 4/20/09  
Fermi 2 RP Printed Name Signature

Sample number: EFT-25031209

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Southward | Southward Date: 4/20/09  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: R. Lindsey | R. Lindsey Date: 4-27-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT2S031209

Sample End Time: 12-MAR-2009 13:30:00.00

REMARKS *K-40*

PERFORMED BY:

*Satturwald*  
SIGNATURE

REVIEWED BY:

*R. D. Lindley* 4-27-09  
SIGNATURE/DATE

Sample ID : EFT25031209

Acquisition date : 21-APR-2009 08:44:31

\*\*\*\*\*  
 Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT25031209  
 Sample collection start date: 12-MAR-2009 13:30:00.00  
 Sample collection end date : 12-MAR-2009 13:30:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : M2LL Operator: JNS

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 21-APR-2009 08:44:31.76  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:00.94 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2008 12:00:00.00  
 Kev/channel : 4.99882E-01 Zero offset: 7.45979E-02  
 Daily cal date : 21-APR-2009 06:54:02.66

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m2ll Efficiencies at : Peak energy

\*\*\*\*\*

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	511.53	93	42	3.44	1023.14	1015	10	5.16E-02	19.9	
2	0	558.62	21	6	0.78	1117.34	1112	11	1.14E-02	31.3	
3	0	1461.15	36	15	1.70	2922.75	2914	15	2.00E-02	28.8	
4	0	1764.33	13	10	0.70	3529.20	3520	14	7.11E-03	60.4	

6

Post-NID Peak Search Report

It	Energy	Area	Bkgrd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	511.53	93	42	3.44	1023.14	1015	18	19.8		<i>Ann</i>
0	558.62	21	6	0.78	1117.34	1112	11	31.3		<i>None</i>
0	1461.15	36	15	1.70	2922.75	2914	15	28.8		<i>K-40</i>
0	1764.33	13	10	0.70	3529.20	3520	14	60.4		<i>73. 214</i>

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	36	10.67*	2.501E+00	2.026E-07	2.026E-07	20.77

Flag: "\*" = Keyline

Summary of Nuclide Activity

Sample ID : EFT2S0031209

Acquisition date : 21-APR-2009 00:44:31

Total number of lines in spectrum 4  
 Number of unidentified lines 0  
 Number of lines tentatively identified by NID 4 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.026E-07	2.026E-07	0.583E-07	28.77	
Total Activity :			2.026E-07	2.026E-07			

Grand Total Activity : 2.026E-07 2.026E-07

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Nuclide	Half-life	Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	522.41	511.00*	193.46	1.000E+35	19.78	Decay
% Abundances Found = 100.00							
AS-76	26.32H	36.30	559.10*	44.70	1.246E+03	31.28	Decay, Abun.
			563.23	1.17	-----	Not Found	-----
			571.30	0.14	-----	Not Found	-----
			657.03	6.10	-----	Not Found	-----
			665.31	0.39	-----	Not Found	-----
			740.12	0.12	-----	Not Found	-----
			771.76	0.12	-----	Not Found	-----
			867.63	0.12	-----	Not Found	-----
			1129.07	0.14	-----	Not Found	-----
			1212.72	1.63	-----	Not Found	-----
			1216.02	3.84	-----	Not Found	-----
			1228.52	1.39	-----	Not Found	-----
			1439.13	0.33	-----	Not Found	-----
			1453.60	0.13	-----	Not Found	-----
			1787.67	0.33	-----	Not Found	-----
% Abundances Found = 73.70							
BI-214	19.90M	2880.88	609.31*	46.30	-----	Not Found	-----
			768.36	5.04	-----	Not Found	-----
			934.06	3.21	-----	Not Found	-----
			1120.29	15.10	-----	Not Found	-----
			1238.11	5.94	-----	Not Found	-----
			1377.67	4.11	-----	Not Found	-----
			1764.49	15.80	< 1.000E+35	60.37	
% Abundances Found = 16.54 (Abn. Limit = 48.48%)							

Flag: "\*" = Keyline



Sample ID : EFT2S031209

Acquisition date : 21-APR-2009 08:44:31

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	511.53	93	42	3.44	1023.14	1015	10	5.16E-02	19.8	4.88E+00	T
0	558.62	21	6	0.70	1117.34	1112	11	1.14E-02	31.3	4.69E+00	T
0	1764.33	13	10	0.70	3529.20	3520	14	7.11E-03	60.4	2.26E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	7.	477.59	7.2875E-08
F-18	0.	511.00	Half-Life too short
NA-22	3.	1274.54	6.4658E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	10.	889.25	1.0067E-08
CR-51	27.	320.00	1.8947E-07
MN-54	13.	834.83	9.2618E-09
CO-56	10.	1238.25	1.9959E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	42.	158.38	6.9262E-07
CO-57	33.	122.06	9.9220E-09
CO-58	9.	810.76	1.0277E-08
FE-59	6.	1099.22	2.3712E-08
CO-60	7.	1332.49	8.6624E-09
CJ-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	10.	1115.52	2.0008E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	23.	136.00	1.2702E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	37.	513.99	2.2528E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	37.	513.99	1.4830E-08
RB-86	0.	1076.63	4.0204E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	398.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	3.	1836.01	1.0045E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.00	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	0.	1204.90	4.6045E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT28031209

Acquisition date : 21-APR-2009 08:44:31

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	10.	702.63	8.0955E-09
NB-95	0.	765.79	1.4145E-08
NB-95M	0.	235.69	Half-Life too short
ZR-95	12.	756.72	2.0739E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	15.	497.08	1.4246E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	13.	621.04	7.2027E-08
CD-109	24.	88.03	3.1005E-07
AG-110M	11.	937.48	2.8105E-08
SN-113	27.	391.69	1.4344E-08
SN-117M	44.	158.56	6.6355E-08
SB-122	0.	563.93	Half-Life too short
SB-124	13.	602.71	1.0362E-08
SB-125	30.	427.89	2.7934E-08
TE-125M	30.	109.20	5.3271E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	35.	57.60	3.2912E-05
XE-127	36.	202.84	2.1903E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	13.	695.88	4.8430E-07
XE-129M	30.	196.56	3.3341E-06
I-130	0.	536.09	Half-Life too short
BA-131	37.	123.00	2.8216E-07
I-131	27.	364.48	2.7176E-07
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	36.	163.93	3.5990E-06
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	36.	302.84	4.3109E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	31.	81.00	7.8455E-06
XE-133M	0.	233.22	Half-Life too short
CS-134	26.	604.70	9.2254E-09
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	260.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT2S031209

Acquisition date : 21-APR-2009 08:44:31

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	14.	818.50	6.8266E-08
I-136	0.	1313.02	Half-Life too short
CS-137	11.	661.65	7.3340E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.88	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1428.50	Half-Life too short
CE-139	36.	165.85	1.0306E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	16.	537.32	2.2940E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	37.	145.44	3.4501E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	34.	133.54	7.3196E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	38.	91.10	5.5176E-07
PM-148M	9.	550.27	1.1030E-08
EU-152	22.	344.27	2.4454E-08
EU-154	9.	1004.76	4.6234E-08
EU-155	35.	105.31	4.5672E-08
EU-156	13.	646.29	5.6792E-07
HF-181	18.	482.03	1.5476E-08
TA-182	5.	1221.42	3.3443E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	20.	279.19	1.5489E-08
BI-207	19.	569.67	7.6400E-09
TL-208	0.	503.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	37.	186.21	2.1304E-07
AC-228	21.	338.32	5.5883E-08
TH-228	24.	84.37	1.0306E-06
PA-234	0.	131.20	Half-Life too short
TH-234	23.	63.29	2.8492E-06
U-235	40.	143.76	7.1012E-08
NP-239	0.	106.13	Half-Life too short
AM-241	23.	59.54	1.5476E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT 25 91109

Sample Location (Well Number): 25

1. Representative sample collected. Date/Time 9/11/09 1 1105

Sample collected by: Thomas Allen / Tom Date: 8-11-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 9/21/09  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Tom M. Gorman Date: 9-22-09  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection/Supervision or delegate.

Performed by: Robert A. G. [Signature] Date: 10-13-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT2S91109
2 . Date Sampled	09/11/2009
3 . Time Sampled	11:05
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	09/21/2009
2 . Time Sample Counted	14:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.7 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2763.5 cpm
Net Spike Count Rate (cpm)	2755.8 cpm
H3 Spike Activity (dpm on count date)	7189.1 dpm
Counter Efficiency	0.3833 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	7.0 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.20\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician \_\_\_\_\_

Date 9-22-9

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT 25 9 11 09

Sample Location (Well Number): 25

1. Representative sample collected. Date/Time 9/11/09 1 1105

Sample collected by: Thomas Alan / Tom Date: 9-11-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 9/24/09  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Southward / Southward Date: 10/13/09  
Fermi 2 RP Printed Name Signature

Sample number: EFT 2591109

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Southward | Southward | Date: 10/13/09  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert G. R. [Signature] | Date: 10-14-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



RADIATION PROTECTION DEPARTMENT  
GAMMA SPECTROSCOPY ANALYSIS REPORT  
HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT2S91109

Sample End Time: 11-SEP-2009 11:05:00.00

REMARKS *K-40 - Bi-214, Tl-208, AM.*

PERFORMED BY:

*Southward*  
SIGNATURE

REVIEWED BY:

*Holtz*  
SIGNATURE/DATE

Sample ID : EFT2S91109

Acquisition date : 13-OCT-2009 13:50:21

\*\*\*\*\*  
 Fermi 2 Radiation Protection Gamma Spectroscopy Report  
 \*\*\*\*\*

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT2S91109  
 Sample collection start date: 11-SEP-2009 11:05:00.00  
 Sample collection end date : 11-SEP-2009 11:05:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.000000E+03 cc  
 Sample geometry : M2LL Operator: JNS

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 13-OCT-2009 13:50:21.52  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:00.00 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 3-JUN-2009 17:37:00.00  
 Kev/channel : 4.99961E-01 Zero offset: 7.82824E-02  
 Daily cal date : 13-OCT-2009 06:21:56.95

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy  
 \*\*\*\*\*

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	1	510.74	26	39	2.09	1021.38	1014	18	1.44E-02	60.2	1.10E+00
2	1	511.55	48	32	1.90	1023.00	1014	18	2.69E-02	29.3	
3	0	609.82	0	23	1.45	1219.54	1213	15	1.28E-02	50.9	
4	0	1461.66	46	4	1.07	2923.16	2915	17	2.56E-02	17.9	

Sample Title : EFT2591109

Page : 1

Decay Time = 32 02:45:21.52

Acquisition Time = 13-OCT-2009 13:50:21.5

2

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
1	510.74	26	39	2.09	1021.38	1014	18	60.2	1.10E+00	<i>Pi-208</i> <i>Anti</i> <i>Bi-214</i> K-40 <i>for 10-14-09</i>
1	511.55	48	32	1.90	1023.00	1014	18	29.3		
0	609.82	23	33	1.45	1219.54	1213	15	58.9		
0	1461.66	46	4	1.07	2923.16	2915	17	17.9		

Nuclide Line Activity Report  
Sample ID : EFT2S91109

Page : 2  
Acquisition date : 13-OCT-2009 13:50:21

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	46	10.67*	2.501E+00	2.594E-07	2.594E-07	17.90

Flag: "\*" = Keyline

Summary of Nuclide Activity

Sample ID : EFT2S91109

Acquisition date : 13-OCT-2009 13:50:21

Total number of lines in spectrum 4  
 Number of unidentified lines 1  
 Number of lines tentatively identified by MID 3 75.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.594E-07	2.594E-07	0.464E-07	17.90	
Total Activity :			2.594E-07	2.594E-07			

Grand Total Activity : 2.594E-07 2.594E-07

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	421.55	511.00*	193.46	1.000E+35	60.15	Decay
/ % Abundances Found = 100.00							
RU-103	39.35D	0.82	497.08*	89.00	---	Not Found	Abun.
610.33 5.60 2.399E-07 58.86							
% Abundances Found = 5.92							
XE-135	9.11H	84.63	249.79*	89.90	---	Not Found	Decay, Abun.
608.19 2.89 7.918E+18 58.86							
% Abundances Found = 3.11							
PM-148M	41.30D	0.78	288.11	12.56	---	Not Found	Abun.
414.07 18.66 --- Not Found ---							
432.78 5.35 --- Not Found ---							
501.26 6.75 --- Not Found ---							
550.27* 94.90 --- Not Found ---							
599.74 12.54 --- Not Found ---							
611.26 5.48 2.387E-07 58.86							
629.97 89.00 --- Not Found ---							
725.78 32.80 --- Not Found ---							
915.33 17.17 --- Not Found ---							
1013.81 20.30 --- Not Found ---							
% Abundances Found = 1.74							
BI-214	19.90M	2324.64	609.31*	46.30	1.000E+35	58.86	Decay
768.36 5.04 --- Not Found ---							
934.06 3.21 --- Not Found ---							
1120.29 15.10 --- Not Found ---							
1238.11 5.94 --- Not Found ---							
1377.67 4.11 --- Not Found ---							
1764.49 15.80 --- Not Found ---							
% Abundances Found = 48.48 (Abn. Limit = 48.48%)							

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EFT2S91109

Page : 5  
Acquisition date : 13-OCT-2009 13:50:21

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
1	510.74	26	39	2.09	1021.38	1014	10	1.44E-02	60.2	4.88E+00	T
1	511.55	48	32	1.90	1023.00	1014	10	2.69E-02	29.3	4.88E+00	
0	609.02	23	33	1.45	1219.54	1213	15	1.20E-02	50.9	4.52E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	12.	477.59	8.3188E-08
F-18	0.	511.00	Half-Life too short
NA-22	5.	1274.54	7.4678E-09
NA-24	0.	1368.53	Half-Life too short
MO-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	5.	889.25	8.0513E-09
CR-51	27.	320.08	1.5563E-07
MN-54	4.	834.83	5.6648E-09
CO-56	17.	1238.25	2.3751E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	30.	158.38	2.4545E-07
CO-57	28.	122.06	8.9837E-09
CO-58	16.	810.76	1.2219E-08
FE-59	11.	1099.22	2.7255E-08
CO-60	9.	1332.49	9.4332E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	7.	1115.52	1.6438E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	23.	136.00	1.2184E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	? 0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	26.	513.99	1.9129E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	26.	513.99	1.1615E-08
RB-86	3.	1076.63	2.1481E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	5.	1836.01	1.1361E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	0 11.	1204.98	4.7111E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short



Sample ID : EFT2S91109

Acquisition date : 13-OCT-2009 13:50:21

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	?	266.90	Half-Life too short
NB-94	15.	702.63	7.5887E-09
NB-95	11.	765.79	1.3521E-08
NB-95M	27.	235.69	1.2182E-05
ZR-95	11.	756.72	1.7880E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	20.	497.08	1.4174E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	17.	621.84	7.9118E-08
CD-109	29.	88.03	3.3434E-07
AG-110M	9.	937.48	2.5177E-08
SN-113	26.	391.69	1.3410E-08
SN-117M	29.	158.56	3.6865E-08
SB-122	0.	563.93	Half-Life too short
SB-124	20.	602.71	1.1446E-08
SB-125	17.	427.89	2.1367E-08
TE-125M	33.	109.28	4.5254E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	23.	57.60	2.6016E-05
XE-127	26.	202.84	0 1.6399E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	16.	695.88	4.4756E-07
XE-129M	46.	196.56	2.0033E-06
I-130	0.	536.09	Half-Life too short
BA-131	37.	123.80	1.7957E-07
I-131	18.	364.48	1.1875E-07
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	31.	163.93	2.1326E-06
I-132	0.	667.69	Half-Life too short
TE-132	28.	228.16	6.0273E-06
BA-133	18.	302.84	3.1786E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	32.	81.00	2.9051E-06
XE-133M	0.	233.22	Half-Life too short
CS-134	18.	604.70	7.7958E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT2S91109

Acquisition date : 13-OCT-2009 13:50:21

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	13.	818.50	4.4788E-08
I-136	0.	1313.02	Half-Life too short
CS-137	18.	661.65	9.0637E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1428.50	Half-Life too short
CE-139	29.	165.85	9.1426E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	21.	537.32	1.7077E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	27.	145.44	2.5401E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	24.	133.54	6.2118E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	22.	91.10	2.6375E-07
PM-148M	15.	550.27	1.1830E-08
EU-152	26.	344.27	2.6051E-08
EU-154	7.	1004.76	4.1274E-08
EU-155	21.	105.31	3.6322E-08
EU-156	12.	646.29	3.9391E-07
HF-181	19.	402.03	1.4097E-08
TA-182	12.	1221.42	4.5545E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	31.	279.19	1.4527E-08
BI-207	15.	569.67	6.7901E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	35.	240.90	8.5626E-05
RA-226	31.	186.21	1.9449E-07
AC-228	27.	338.32	6.1620E-08
TH-228	26.	84.37	1.0530E-06
PA-234	0.	131.20	Half-Life too short
TH-234	21.	63.29	2.1053E-06
U-235	24.	143.76	5.5908E-08
NP-239	0.	106.13	Half-Life too short
AM-241	26.	59.54	1.6317E-07

**EFT-2S**

**2010**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EF1-0110-25

Sample Location (Well Number): 25

1. Representative sample collected. Date/Time 6/1/10 1 1000

Sample collected by: Southward, Southward Date: 6/23/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward, Southward Date: 6/23/10  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: John M. Yorks - 1 Date: 6-25-10  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert Coffey JR Date: 6-30-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EF1-6110-2S
2 . Date Sampled	06/01/2010
3 . Time Sampled	10:00
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	06/25/2010
2 . Time Sample Counted	08:55
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.3 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2683.2 cpm
Net Spike Count Rate (cpm)	2675.9 cpm
H3 Spike Activity (dpm on count date)	6887.9 dpm
Counter Efficiency	0.3885 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	6.5 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.16\text{E}-06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 6-25-10

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EF1-6110-25

Sample Location (Well Number): 25

1. Representative sample collected. Date/Time 6/1/10 1 1000  
Sample collected by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Charles Proffitt / Charles Proffitt Date: 9-14-10  
Fermi 2 RP Printed Name Signature

Sample number: EF1-6110-25

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Charles Proffitt / Charles Puffer Date: 9-14-10  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray Date: 10-5-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1-6110-2S

Sample End Time: 1-JUN-2010 10:00:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*Charles Puffer*  
SIGNATURE

REVIEWED BY:

*[Signature]*  
SIGNATURE DATE



Sample ID : EF1-6110-2S

Acquisition date : 14-SEP-2010 09:54:45

\*\*\*\*\*  
 Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1-6110-2S  
 Sample collection start date: 1-JUN-2010 10:00:00.00  
 Sample collection end date : 1-JUN-2010 10:00:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : MLL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 14-SEP-2010 09:54:45.90  
 Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00  
 Elapsed real time : 0 00:45:00.00 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 23-JUN-2010 12:28:00.00  
 Kev/channel : 5.00041E-01 Zero offset: 0.46290E-02  
 Daily cal date : 14-SEP-2010 06:21:27.75

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	139.54	66	113	1.57	278.88	274	11	2.44E-02	33.5	
2	0	511.15	209	92	2.82	1022.07	1014	17	7.74E-02	12.6	
3	0	559.47	105	36	1.67	1116.71	1108	14	3.90E-02	15.4	
4	0	609.33	55	37	2.36	1218.42	1213	12	2.05E-02	25.6	
5	0	1461.23	63	20	1.94	2922.25	2914	19	2.32E-02	21.0	

Sample Title : EF1-6110-28  
Decay Time = 104 23:54:45.90

Page : 1  
Acquisition Time = 14-SEP-2010 09:54:45.9

0

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	XErr	Fit	Nuclides
0	139.54	66	113	1.57	279.88	274	11	33.5	- HwC	
0	511.15	209	92	2.82	1022.07	1014	17	12.6	- ANN.	
0	558.47	105	36	1.67	1116.71	1109	14	15.4	- HwC	
0	609.33	55	37	2.36	1219.42	1213	12	25.6	- Bi-214	
0	1461.23	63	20	1.94	2922.25	2914	19	21.0		K-40

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	63	10.67*	2.501E+00	2.350E-07	2.350E-07	21.01

Flag: "\*" = Keyline

Total number of lines in spectrum 5  
Number of unidentified lines 0  
Number of lines tentatively identified by MID 5 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.350E-07	2.350E-07	0.494E-07	21.01	
Total Activity :			2.350E-07	2.350E-07			

Grand Total Activity : 2.350E-07 2.350E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	1377.96	511.00*	193.46	1.000E+35	12.64	Decay
% Abundances Found = 100.00							
AS-76	26.32H	95.76	559.10*	44.70	3.362E+21	15.43	Decay, Abun.
563.23 1.17 ---- Not Found ----							
571.30 0.14 ---- Not Found ----							
657.03 6.10 ---- Not Found ----							
665.31 0.39 ---- Not Found ----							
740.12 0.12 ---- Not Found ----							
771.76 0.12 ---- Not Found ----							
867.63 0.12 ---- Not Found ----							
1129.87 0.14 ---- Not Found ----							
1212.72 1.63 ---- Not Found ----							
1216.02 3.84 ---- Not Found ----							
1228.52 1.39 ---- Not Found ----							
1439.13 0.33 ---- Not Found ----							
1453.60 0.13 ---- Not Found ----							
1787.67 0.33 ---- Not Found ----							
% Abundances Found = 73.70							
MO-99	66.02H	38.17	140.51	3.80	8.445E+04	33.51	Decay, Abun.
181.06 6.20 ---- Not Found ----							
366.43 1.37 ---- Not Found ----							
739.58* 12.80 ---- Not Found ----							
778.00 4.50 ---- Not Found ----							
% Abundances Found = 13.25							
TC-99M	6.02H	418.65	140.50*	89.07	1.000E+35	33.51	Decay
% Abundances Found = 100.00							
RU-103	39.35D	2.67	497.08*	89.00	----	----	Abun.
610.33 5.60 1.392E-06 25.56							
% Abundances Found = 5.92							
XE-135	9.11H	276.65	249.79*	89.90	----	----	Decay, Abun.
608.19 2.89 1.000E+35 25.56							
% Abundances Found = 3.11							
CS-138	32.20M	4696.19	138.10	1.49	1.000E+35	33.51	Decay, Abun.
227.76 1.51 ---- Not Found ----							
408.98 4.66 ---- Not Found ----							
462.79 30.70 ---- Not Found ----							
546.94 10.80 ---- Not Found ----							
871.80 5.11 ---- Not Found ----							
1009.78 29.80 ---- Not Found ----							
1147.22 1.24 ---- Not Found ----							
1343.59 1.14 ---- Not Found ----							
1435.86* 76.30 ---- Not Found ----							
% Abundances Found = 0.92							
BI-214	19.90M	7598.86	609.31*	46.30	1.000E+35	25.56	Decay
768.36 5.04 ---- Not Found ----							

Sample ID : EF1-6110-25

Acquisition date : 14-SEP-2010 09:54:45

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
BI-214	19.90M	7598.86	934.06	3.21	---- Not Found	----	Decay
			1120.29	15.10	---- Not Found	----	
			1238.11	5.94	---- Not Found	----	
			1377.67	4.11	---- Not Found	----	
			1764.49	15.80	---- Not Found	----	
% Abundances Found =				48.48	(Abn. Limit = 48.48%)		

Flag: "\*" = Keyline

## Unidentified Energy Lines

Page : 6

Sample ID : EF1-6110-2S

Acquisition date : 14-SEP-2010 09:54:45

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	139.54	66	113	1.57	278.00	274	11	2.44E-02	33.5	6.39E+00	T
0	511.15	209	92	2.82	1022.07	1014	17	7.74E-02	12.6	4.00E+00	T
0	558.47	105	36	1.67	1116.71	1108	14	3.90E-02	15.4	4.69E+00	T
0	609.33	55	37	2.36	1210.42	1213	12	2.05E-02	25.6	4.52E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	20.	477.59	2.0420E-07
F-18	0.	511.00	Half-Life too short
NA-22	13.	1274.54	7.0862E-09
NA-24	0.	1360.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	19.	809.25	1.6720E-08
CR-51	52.	320.00	8.6562E-07
MN-54	19.	834.93	8.4072E-09
CO-56	23.	1230.25	3.4610E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	0.	158.30	Half-Life too short
CO-57	66.	122.06	1.0670E-08
CO-58	22.	810.76	1.9069E-08
FE-59	17.	1099.22	6.8259E-08
CO-60	12.	1332.49	7.3389E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	17.	1115.52	2.0189E-08
ZN-69M	0.	430.63	Half-Life too short
SE-75	62.	136.00	1.9382E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	82.	513.99	2.1065E-06
KR-85M	0.	151.10	Half-Life too short
SR-85	82.	513.99	2.0567E-08
RB-86	16.	1076.63	4.0577E-06
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	308.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1302.39	Half-Life too short
Y-88	9.	1836.01	1.5056E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.80	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	23.	1204.90	1.0354E-05
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1303.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short



Sample ID : EF1-6110-25

Acquisition date : 14-SEP-2010 09:54:45

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	24.	702.63	6.1897E-09
NB-95	19.	765.79	4.8070E-08
NB-95M	0.	235.69	Half-Life too short
ZR-95	30.	756.72	4.1325E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	31.	497.08	4.1435E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	33.	621.84	8.1104E-08
CD-109	67.	88.03	3.6374E-07
AG-110M	14.	937.48	2.4586E-08
SN-113	39.	391.69	1.6768E-08
SN-117M	78.	158.56	1.6039E-06
SB-122	0.	563.93	Half-Life too short
SB-124	38.	602.71	2.3790E-08
SB-125	41.	427.89	2.2507E-08
TE-125M	55.	109.28	9.1307E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	46.	57.60	3.7605E-05
XE-127	61.	202.84	6.4457E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	24.	695.88	1.6130E-06
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	71.	123.80	1.1757E-05
I-131	0.	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	67.	163.93	1.4538E-04
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	56.	302.84	3.5479E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	40.	604.70	7.9998E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EF1-6110-2S

Acquisition date : 14-SEP-2010 09:54:45

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	18.	818.50	1.5854E-06
I-136	0.	1313.02	Half-Life too short
CS-137	29.	661.65	7.4534E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	75.	165.85	1.3484E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	34.	537.32	7.3863E-06
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	58.	145.44	1.1371E-07
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	62.	133.54	7.5464E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	57.	91.10	2.6969E-05
PM-148M	28.	550.27	3.5556E-08
EU-152	51.	344.27	2.4065E-08
EU-154	15.	1004.76	3.8279E-08
EU-155	51.	105.31	3.7240E-08
EU-156	23.	646.29	9.6042E-06
HF-181	34.	482.03	3.9985E-08
TA-182	25.	1221.42	6.5130E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	55.	279.19	3.7199E-08
BI-207	18.	569.67	5.0327E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	85.	186.21	2.0853E-07
AC-228	48.	330.32	5.4665E-08
TH-228	59.	84.37	1.1071E-06
PA-234	0.	131.20	Half-Life too short
TH-234	58.	63.29	1.8844E-05
U-235	62.	143.76	5.7995E-08
NP-239	0.	106.13	Half-Life too short
AM-241	51.	59.54	1.4722E-07

**EFT-2S**

**2011**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT 61611 25

Sample Location (Well Number): 25

1. Representative sample collected. Date/Time 6-16-11 1 16:40

Sample collected by: Thomas Mowl / [Signature] Date: 6-22-11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: C. Proffitt / [Signature] Date: 6-22-11  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: S. Smith / [Signature] Date: 6-23-11  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert G. [Signature] / [Signature] Date: 6-24-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks [Signature] 6-24-11

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-61611-2S
2 . Date Sampled	06/16/2011
3 . Time Sampled	16:40
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**


1 . Date Sample Counted	06/23/2011
2 . Time Sample Counted	03:13
3 . Background Inf.:	
Minutes Counted	30 min.
Background Count Rate (cpm)	5.6 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2291.3 cpm
Net Spike Count Rate (cpm)	2285.7 cpm
H3 Spike Activity (dpm on count date)	6512.3 dpm
Counter Efficiency	0.3510 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	6.0 cpm
Sample Count Time (min.)	30.0 min.
Net Sample Count Rate (cpm)	0.4 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	1.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}}{\text{Efficiency} \times 2.22\text{E6 dpm/uCi} \times \text{Sample Volume}} = 6.47\text{E-07 uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E6 uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 6-23-11

Reviewed 

Date 6-27-11

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-61611 25

Sample Location (Well Number): 25

1. Representative sample collected. Date/Time 6-16-11 1 16.40

Sample collected by: Thomas Mow / [Signature] Date: 6-22-11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

**Note:** Use new sample containers only

Sample sealed by: C Proffitt / [Signature] Date: 6-22-11  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: C Proffitt / [Signature] Date: 6-22-11  
Fermi 2 RP Printed Name Signature

Sample number: EFT-61611-25

- 4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".

(Note disposition of unidentified peaks in "Remarks")

Performed by: C Proth | [Signature] Date: 6-22-11  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

- 5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray SR1 | [Signature] Date: 6-23-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
W H J 6-23-11  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-61611-28

Sample End Time: 16-JUN-2011 16:40:00.00

REMARKS

*Natural*

PERFORMED BY:

*Charles Ruppel*  
SIGNATURE

REVIEWED BY:

*[Signature]*  
SIGNATURE/DATE



\*\*\*\*\*

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-61611-2S  
 Sample collection start date: 16-JUN-2011 16:40:00.00  
 Sample collection end date : 16-JUN-2011 16:40:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.000000E+03 cc  
 Sample geometry : PELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 22-JUN-2011 16:09:31.37  
 Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00  
 Elapsed real time : 0 00:45:00.64 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 14-JUN-2011 14:50:56.41  
 Kev/channel : 4.99884E-01 Zero offset: 2.83532E-01  
 Daily cal date : 22-JUN-2011 14:32:40.30

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

PK	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	66.61	36	85	0.98	132.68	128	9	1.32E-02	50.2	
2	0	352.50	97	52	1.44	704.59	699	14	3.60E-02	18.8	
3	1	509.67	58	27	1.86	1019.00	1015	14	2.15E-02	19.9	2.42E+00
4	1	511.59	90	41	2.03	1022.05	1015	14	3.32E-02	19.7	
5	0	610.21	107	38	2.33	1220.12	1213	19	3.96E-02	16.9	
6	0	1461.33	69	9	0.98	2922.74	2913	20	2.55E-02	16.4	

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	66.61	36	85	0.98	132.68	128	9	50.2		
0	352.50	97	52	1.44	704.59	699	14	18.8		
1	509.67	58	27	1.86	1019.00	1015	14	19.9	2.42E+00	
1	511.59	90	41	2.03	1022.85	1015	14	19.7		
0	610.21	107	38	2.33	1220.12	1213	19	16.9		
0	1461.33	69	9	0.98	2922.74	2913	20	16.4		

Low FWHM / High %Error  
 Pb-214  
 > Ann. Peak  
 Bi-214  
 K-40  
 6-23-11

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	69	10.67*	2.353E+00	2.746E-07	2.746E-07	16.43

Flag: "\*" = Keyline

Sample ID : EFT-61611-28

Acquisition date : 22-JUN-2011 16:09:31

Total number of lines in spectrum 6  
 Number of unidentified lines 1  
 Number of lines tentatively identified by NID 5 83.33%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.746E-07	2.746E-07	0.451E-07	16.43	
Total Activity :			2.746E-07	2.746E-07			

Grand Total Activity : 2.746E-07 2.746E-07

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Sample ID : EFT-61611-25

Acquisition date : 22-JUN-2011 16:09:31

Nuclide	Half-life	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
		Ratio	Ratio			(uCi/cc)	%Error	
F-18	109.74M	78.66		511.00*	193.46	4.812E+15	19.68	Decay
		% Abundances		Found = 100.00				
SE-75	119.78D	0.05		66.05	1.02	2.624E-06	50.20	Abun.
				96.73	3.41	----	Not Found	----
				121.12	16.70	----	Not Found	----
				136.00*	59.20	----	Not Found	----
				198.60	1.45	----	Not Found	----
				264.65	59.80	----	Not Found	----
				279.53	25.20	----	Not Found	----
				303.91	1.32	----	Not Found	----
				400.65	11.40	----	Not Found	----
		% Abundances		Found = 0.57				
RU-103	39.35D	0.15		497.08*	89.00	----	Not Found	----
				610.33	5.60	5.006E-07	16.86	Abun.
		% Abundances		Found = 5.92				
CS-136	13.16D	0.46		66.91	12.50	2.836E-07	50.20	Abun.
				86.29	6.30	----	Not Found	----
				153.22	7.46	----	Not Found	----
				163.89	4.61	----	Not Found	----
				176.55	13.56	----	Not Found	----
				273.65	12.66	----	Not Found	----
				340.57	48.50	----	Not Found	----
				818.50*	99.70	----	Not Found	----
				1048.07	79.60	----	Not Found	----
				1235.34	19.70	----	Not Found	----
		% Abundances		Found = 4.10				
PM-148M	41.30D	0.15		288.11	12.56	----	Not Found	----
				414.07	18.66	----	Not Found	----
				432.78	5.35	----	Not Found	----
				501.26	6.75	----	Not Found	----
				550.27*	94.90	----	Not Found	----
				599.74	12.54	----	Not Found	----
				611.26	5.48	5.090E-07	16.86	
				629.97	89.00	----	Not Found	----
				725.70	32.80	----	Not Found	----
				915.33	17.17	----	Not Found	----
				1013.81	20.30	----	Not Found	----
		% Abundances		Found = 1.74				
TA-182	114.74D	0.05		67.75	42.30	6.338E-08	50.20	Abun.
				100.10	14.10	----	Not Found	----
				1189.05	16.30	----	Not Found	----
				1221.42*	27.10	----	Not Found	----
				1230.97	11.50	----	Not Found	----
		% Abundances		Found = 38.01				
BI-214	19.90M	433.77		609.31*	46.30	1.000E+35	16.86	Decay
				768.36	5.04	----	Not Found	----

Sample ID : EFT-61611-2S

Acquisition date : 22-JUN-2011 16:09:31

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by	
	Half-life	Ratio			(uCi/cc)	%Error		
BI-214	19.90M	433.77	934.06	3.21	----	Not Found	----	Decay
			1120.29	15.10	----	Not Found	----	
			1238.11	5.94	----	Not Found	----	
			1377.67	4.11	----	Not Found	----	
			1764.49	15.80	----	Not Found	----	
% Abundances Found =				48.48	(Abn. Limit = 48.48%)			
PB-214	26.80M	322.09	87.30	4.67	----	Not Found	----	Decay
			241.98	7.49	----	Not Found	----	
			295.21	19.20	----	Not Found	----	
			351.92*	37.20	1.000E+35	18.79		
			785.91	1.10	----	Not Found	----	
% Abundances Found =				53.40	(Abn. Limit = 37.20%)			

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	66.61	36	85	0.98	132.68	128	9	1.32E-02	50.2	1.38E+00	T
0	352.50	97	52	1.44	704.59	699	14	3.60E-02	18.8	5.38E+00	T
1	509.67	58	27	1.86	1019.00	1015	14	2.15E-02	19.9	4.59E+00	
1	511.59	90	41	2.03	1022.85	1015	14	3.32E-02	19.7	4.58E+00	T
0	610.21	107	38	2.33	1220.12	1213	19	3.96E-02	16.9	4.25E+00	T

Flags: "T" = Tentatively associated

\* Sample ID : EFT-61611-28 \*

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	28.	477.59	6.0393E-08
F-18	0.	511.00	Half-Life too short
NA-22	14.	1274.54	7.8628E-09
NA-24	9.	1368.53	5.2848E-06
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	18.	889.25	7.6370E-09
CR-51	37.	320.00	6.5292E-08
MN-54	33.	834.83	8.9710E-09
CO-56	19.	1238.25	1.3845E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	48.	158.38	1.0981E-08
CO-57	38.	122.06	6.8623E-09
CO-58	22.	810.76	7.6456E-09
FE-59	14.	1099.22	1.4154E-08
CO-60	10.	1332.49	7.2044E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	14.	1115.52	1.4763E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	42.	136.00	9.6761E-09
AS-76	49.	559.10	7.9005E-07
BR-82	10.	776.49	1.0032E-07
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	60.	513.99	1.9719E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	60.	513.99	9.0971E-09
RB-86	15.	1076.63	1.0394E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	3.	1836.01	5.4638E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	16.	1204.90	2.8657E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short



Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	22.	702.63	6.3460E-09
NB-95	17.	765.79	6.9204E-09
NB-95M	59.	235.69	8.0495E-08
ZR-95	22.	756.72	1.3240E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	19.	743.36	2.3170E-06
MO-99	21.	739.58	2.3090E-07
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	27.	497.08	7.2939E-09
TC-104	0.	357.99	Half-Life too short
RH-105	39.	318.90	4.9340E-07
RU-105	0.	724.50	Half-Life too short
RU-106	24.	621.84	6.2214E-08
CD-109	45.	88.03	2.7056E-07
AG-110M	24.	937.48	2.5105E-08
SN-113	34.	391.69	9.2716E-09
SN-117M	48.	158.56	8.5931E-09
SB-122	19.	563.93	3.4648E-08
SB-124	35.	602.71	7.7847E-09
SB-125	29.	427.89	1.9225E-08
TE-125M	47.	109.28	2.7649E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	28.	57.60	1.8560E-05
XE-127	59.	202.84	1.0049E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	26.	695.88	2.3301E-07
XE-129M	58.	196.56	2.0163E-07
I-130	0.	536.09	Half-Life too short
BA-131	45.	123.80	3.0353E-08
I-131	32.	364.48	1.1352E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	18.	773.67	4.5594E-07
XE-131M	63.	163.93	4.4657E-07
I-132	0.	667.69	Half-Life too short
TE-132	52.	228.16	2.4140E-08
BA-133	43.	302.84	3.2472E-08
BA-133M	50.	276.09	4.3389E-07
I-133	25.	529.87	8.0335E-07
TE-133M	0.	912.58	Half-Life too short
XE-133	34.	81.00	6.4957E-08
XE-133M	42.	233.22	3.5194E-07
CS-134	27.	604.70	6.5233E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	46.	268.24	1.1569E-06
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	21.	818.50	9.7319E-09
I-136	0.	1313.02	Half-Life too short
CS-137	22.	661.65	7.0235E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	52.	165.85	7.2518E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	19.	537.32	2.0426E-08
LA-140	0.	1596.49	0.7997E-08
BA-141	0.	190.22	Half-Life too short
CE-141	66.	145.44	1.5306E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	60.	293.26	3.2448E-07
CE-144	45.	133.54	5.4210E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	46.	91.10	4.9489E-08
PM-148M	38.	550.27	0.2063E-09
EU-152	39.	344.27	2.2183E-08
EU-154	15.	1004.76	3.9348E-08
EU-155	40.	105.31	3.6001E-08
EU-156	31.	646.29	1.2724E-07
HF-181	36.	482.03	0.6474E-09
TA-182	16.	1221.42	3.1016E-08
W-187	19.	685.81	1.3125E-06
RE-188	64.	155.03	1.4901E-05
AU-199	48.	158.38	5.6034E-08
HG-203	49.	279.19	0.4161E-09
BI-207	25.	569.67	6.0011E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	67.	240.98	5.3094E-07
RA-226	61.	186.21	1.8599E-07
AC-228	41.	338.32	5.2016E-08
TH-228	51.	84.37	9.6771E-07
PA-234	0.	131.20	Half-Life too short
TH-234	40.	63.29	1.0710E-06
U-235	57.	143.76	5.8910E-08
NP-239	39.	106.13	1.7691E-07
AM-241	30.	59.54	1.2690E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-102411-25

Sample Location (Well Number): EFT-215

1. Representative sample collected. Date/Time 10/24/11 / 13:35

Sample collected by: Thomas Mow / [Signature] Date: 10/24/11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Thomas Mow / [Signature] Date: 10/25/11  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Tom M. Yorkin / [Signature] Date: 11-1-11  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: [Signature] / [Signature] Date: 11-2-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks W/A

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-21S
2 . Date Sampled	10/24/2011
3 . Time Sampled	13:35
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	10/30/2011
2 . Time Sample Counted	17:20
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.5 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2548.6 cpm
Net Spike Count Rate (cpm)	2541.1 cpm
H3 Spike Activity (dpm on count date)	6383.7 dpm
Counter Efficiency	0.3981 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	7.4 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.14\text{E}-06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 11-1-11

Reviewed 

Date **NOV 01 2011**

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-102411-25

Sample Location (Well Number): EFT-215

1. Representative sample collected. Date/Time 10/24/11 1 13:35

Sample collected by: Thomas Mow / [Signature] Date: 10/24/11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Thomas Mow / [Signature] Date: 10/25/11  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: C. Proffitt / [Signature] Date: 11-2-11  
Fermi 2 RP Printed Name Signature

Sample number: EFT 102411-25

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".

(Note disposition of unidentified peaks in "Remarks")

Performed by: C Proffitt | [Signature] Date: 11-2-11  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert Ayala | [Signature] Date: 11-2-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT102411-2S

Sample End Time: 24-OCT-2011 13:35:00.00

REMARKS No Plant Related Isotopes

PERFORMED BY:

Charles Rupp  
SIGNATURE

REVIEWED BY:

Bob Smith  
SIGNATURE/DATE

Sample ID : EFT102411-23

Acquisition date : 2-NOV-2011 10:57:10

\*\*\*\*\*

## Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT102411-23  
 Sample collection start date: 24-OCT-2011 13:35:00.00  
 Sample collection end date : 24-OCT-2011 13:35:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc ✓  
 Sample geometry : BELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 ✓ Acquire date : 2-NOV-2011 10:57:10.20  
 Preset live time : 0 00:45:00.00 ✓ Elapsed live time : 0 00:45:00.00  
 Elapsed real time : 0 00:45:00.62 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 14-JUN-2011 14:50:56.41  
 KeV/channel : 5.00053E-01 Zero offset: -5.47137E-01  
 Daily cal date : 2-NOV-2011 00:42:06.40 ✓

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 ✓ Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

Pk	It	Energy	Area	Bkgnd	FWHM	Chanel	Left	Pw	Cts/Sec	%Err	Fit
1	0	511.48	159	44	3.06	1023.96	1015	19	5.89E-02	13.0	
2	0	558.61	66	4	3.83	1118.22	1110	16	2.44E-02	14.0	
3	0	608.94	61	34	1.09	1218.87	1209	17	2.25E-02	25.5	
4	0	1461.30	70	0	3.19	2923.48	2915	16	2.59E-02	15.0	



Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Po	%Err	Fit	Nuclides
0	511.40	159	44	3.06	1023.96	1015	19	13.0		<i>Ann. Peak. Cd-115 Bi-214 K-40 <u>P-11-2-11</u></i>
0	559.61	66	4	3.03	1119.22	1110	16	14.0		
0	609.94	61	34	1.09	1219.87	1209	17	25.5		
0	1461.30	70	8	3.19	2923.48	2915	16	15.0		

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected	Decay Corr	1-Sigma
					uCi/cc	uCi/cc	%Error
K-40	1460.81	78	10.67*	2.353E+00	2.791E-07	2.791E-07	14.99

Flag: "\*" = Keyline

Sample ID : EFT102411-25

Acquisition date : 2-NOV-2011 10:57:10

Total number of lines in spectrum	4	
Number of unidentified lines	0	
Number of lines tentatively identified by MID	4	100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.791E-07	2.791E-07	0.418E-07	14.99	
Total Activity :			2.791E-07	2.791E-07			

Grand Total Activity : 2.791E-07 2.791E-07

Flags: "K" = Keyline not found

"M" = Manually accepted

"E" = Manually edited

"A" = Nuclide specific abn. limit

Sample ID : EFT102411-23

Acquisition date : 2-NOV-2011 10:57:10

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
F-18	109.74M	116.86	511.00*	193.46	2.705E+27	13.02	Decay
	% Abundances		Found = 100.00				
AS-76	26.32H	8.12	559.10*	44.70	9.343E-06	14.05	Abun.
			563.23	1.17	---	Not Found	---
			571.30	0.14	---	Not Found	---
			657.03	6.10	---	Not Found	---
			665.31	0.39	---	Not Found	---
			740.12	0.12	---	Not Found	---
			771.76	0.12	---	Not Found	---
			867.63	0.12	---	Not Found	---
			1129.87	0.14	---	Not Found	---
			1212.72	1.63	---	Not Found	---
			1216.02	3.84	---	Not Found	---
			1228.52	1.39	---	Not Found	---
			1439.13	0.33	---	Not Found	---
			1453.60	0.13	---	Not Found	---
			1787.67	0.33	---	Not Found	---
	% Abundances		Found = 73.70				
RU-103	39.35D	0.23	497.00*	89.00	---	Not Found	---
			610.33	5.60	2.991E-07	25.46	Abun.
	% Abundances		Found = 5.92				
XE-135	9.11H	23.46	249.79*	89.90	---	Not Found	---
			600.19	2.89	5.727E+00	25.46	Decay, Abun.
	% Abundances		Found = 3.11				
BI-214	19.90M	644.46	609.31*	46.30	1.000E+35	25.46	Decay
			768.36	5.04	---	Not Found	---
			934.06	3.21	---	Not Found	---
			1120.29	15.10	---	Not Found	---
			1238.11	5.94	---	Not Found	---
			1377.67	4.11	---	Not Found	---
			1764.49	15.80	---	Not Found	---
	% Abundance		Found = 48.48 (Abn. Limit = 48.48%)				

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	FW	Cts/Sec	%Err	%Eff	Flags
0	511.48	159	44	3.06	1023.96	1015	19	5.09E-02	13.0	4.58E+00	T
0	558.61	66	4	3.83	1118.22	1110	16	2.44E-02	14.0	4.40E+00	T
0	608.94	61	34	1.09	1218.87	1209	17	2.25E-02	25.5	4.25E+00	T

Flags: "T" = Tentatively associated

\*\*\*\*\*  
 \* Detroit Edison Fermi 2 MDA Report, Generated 2-10-2011 11:42:17.10 \*  
 \*\*\*\*\*  
 \* Sample ID : EFT102411-2S \*  
 \*\*\*\*\*

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	30.	477.59	6.4378E-08
F-18	0.	511.00	Half-Life too short
NA-22	11.	1274.54	7.2947E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	10.	889.25	6.1458E-09
CR-51	32.	320.00	6.5821E-08
MM-54	33.	834.83	9.1024E-09
CO-56	10.	1238.25	1.4020E-08
MM-56	0.	1810.69	Half-Life too short
NI-56	45.	158.38	1.4886E-08
CO-57	40.	122.06	7.0423E-09
CO-58	20.	810.76	7.5413E-09
FE-59	12.	1099.22	1.3651E-08
CO-60	14.	1332.49	8.1506E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	13.	1115.52	1.4474E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	42.	136.00	9.8558E-09
AS-76	50.	559.10	5.0383E-06
BR-82	12.	776.49	4.2695E-07
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	57.	513.99	1.9206E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	57.	513.99	9.1361E-09
RB-86	13.	1076.63	1.1027E-07
KR-87	0.	402.50	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	8.	1836.01	8.0725E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	12.	1204.90	2.6510E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT102411-23

Acquisition date : 2-NOV-2011 10:57:10

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	19.	702.63	5.8711E-09
NB-95	12.	765.79	6.2216E-09
NB-95M	40.	235.69	1.1703E-07
ZR-95	15.	756.72	1.1557E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	14.	739.58	3.9984E-07
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	20.	497.05	6.6292E-09
TC-104	0.	357.99	Half-Life too short
RH-105	31.	318.90	1.7450E-06
RU-105	0.	724.50	Half-Life too short
RU-106	20.	621.84	6.7484E-08
CD-109	41.	88.03	2.6294E-07
AG-110M	22.	937.48	2.4551E-08
SN-113	25.	391.69	8.2283E-09
SN-117M	42.	158.56	9.4511E-09
SB-122	15.	563.93	6.6040E-08
SB-124	22.	602.71	6.5615E-09
SB-125	36.	427.89	2.1050E-08
TE-125M	52.	109.28	2.9818E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	28.	57.60	1.0035E-05
XE-127	45.	202.84	9.3574E-09
TE-129	0.	459.60	Half-Life too short
TE-129M	29.	695.88	2.5904E-07
XE-129M	50.	196.56	2.3594E-07
I-130	0.	536.09	Half-Life too short
BA-131	67.	123.80	4.3006E-08
I-131	27.	364.48	1.3435E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	20.	773.67	2.4259E-06
XE-131M	53.	163.93	4.8014E-07
I-132	0.	667.69	Half-Life too short
TE-132	47.	228.16	4.2785E-08
BA-133	47.	302.84	3.3651E-08
BA-133M	44.	276.09	1.4205E-06
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	22.	81.00	7.0920E-08
XE-133M	46.	233.22	9.1470E-07
CS-134	32.	604.70	7.0020E-09
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	41.	260.24	5.9615E-06
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT102411-2S

Acquisition date : 2-NOV-2011 10:57:10

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	15.	818.50	9.9037E-09
I-136	0.	1313.02	Half-Life too short
CS-137	21.	661.65	6.8682E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	46.	165.85	6.9476E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	30.	537.32	4.0701E-08
LA-140	8.	1596.49	2.8801E-07
BA-141	0.	190.22	Half-Life too short
CE-141	41.	145.44	1.3128E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	50.	293.26	1.3811E-06
CE-144	47.	133.54	5.5910E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	48.	91.10	6.0197E-08
PM-148M	11.	550.27	5.0100E-09
EU-152	38.	344.27	2.1952E-08
EU-154	9.	1004.76	3.1644E-08
EU-155	42.	105.31	3.4705E-08
EU-156	27.	646.29	1.3669E-07
HF-181	31.	482.03	8.5121E-09
TA-182	27.	1221.42	3.9803E-08
W-187	15.	685.81	8.9769E-06
RE-188	0.	155.03	Half-Life too short
AU-199	45.	158.38	1.0384E-07
HG-203	40.	279.19	7.9766E-09
BI-207	28.	569.67	6.4427E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	55.	240.98	8.5730E-07
RA-226	55.	186.21	1.7620E-07
AC-228	39.	339.32	5.0090E-08
TH-228	34.	84.37	8.1151E-07
PA-234	0.	131.20	Half-Life too short
TH-234	45.	63.29	1.1316E-06
U-235	42.	143.76	5.0964E-08
NP-239	51.	106.13	4.6900E-07
AM-241	30.	59.54	1.2729E-07



**EFT-2D**

**2006**

### FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-2D060606

Sample Location (Well Number): EFT-2D

1. Representative sample collected. Date/Time 06/06/06 / 1452

Sample collected by: Jay Slabach / Jay Slabach Date: 06/06/06  
Printed Name / Signature Collection Signed 02/01/07

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample ≥ 50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Freiling / Cheryl A. Freiling Date: 08/02/06  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Russ Bogen / [Signature] Date: 2-5-7  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: William V. Lipton / William V. Lipton Date: 2/15/07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks No tritium detected. William V. Lipton 4869 2/15/07

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-2D060606
2 . Date Sampled	06/06/2006
3 . Time Sampled	14:52
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	02/02/2007
2 . Time Sample Counted	10:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.4 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3388.1 cpm
Net Spike Count Rate (cpm)	3380.7 cpm
H3 Spike Activity (dpm on count date)	8340.7 dpm
Counter Efficiency	0.4053 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	8.9 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	1.5 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

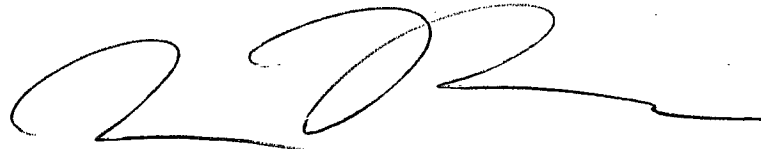
**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.12\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 dpm/uCi x Sample Volume}} < \text{MDA}$$

Technician  Date 2-5-7

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-2D 060606

Sample Location (Well Number): EFT-2D

1. Representative sample collected. Date/Time 06/06/06 / 1452

Sample collected by: Joy Slaback / Joy Marie Slaback <sup>Collector</sup> Date: 06/06/06  
Printed Name / Signature <sub>Signed 02/01/07</sub>

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: Christopher Friling / Christopher A Friling Date: 08/02/06  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: KD Rudy / KD Rudy Date: 8.21.07  
Fermi 2 RP Printed Name Signature

Sample number: EFT-2D060606

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard [Signature] Date: 7-2-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: [Signature] [Signature] Date: 7-17-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1 EFT-2D060606

Sample End Time: 6-JUN-2006 14:52:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*CC [Signature]*

SIGNATURE

REVIEWED BY:

*KD Lindsey 7-17-07*

SIGNATURE/DATE

Sample ID : EF1 EFT-2D0060606

Acquisition date : 2-JUL-2007 13:33:45

## Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-2D0060606  
 Sample collection start date: 6-JUN-2006 14:52:00.00  
 Sample collection end date : 6-JUN-2006 14:52:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 CC  
 Sample geometry : PELL Operator: CMH

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 2-JUL-2007 13:33:45.44  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:00.90 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.18  
 KeV/channel : 4.99646E-01 Zero offset: 5.21199E-02  
 Daily cal date : 2-JUL-2007 10:33:40.58

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_mell Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	511.29	160	46	2.65	1023.10	1016	21	0.90E-02	13.3	annihilation
2	0	550.72	50	25	1.34	1110.09	1112	11	2.79E-02	23.0	H <sub>2</sub> O
3	0	609.30	40	26	1.63	1219.31	1212	13	2.67E-02	26.2	B <sub>1</sub> -214
4	0	1460.06	66	3	1.02	2923.43	2917	13	3.65E-02	13.6	K-40

Sample Title : EF1 EFT-20060606  
Decay Time = 390 22:41:45.44

Page : 1  
Acquisition Time = 2-JUL-2007 13:33:45.44

Post-MID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	511.29	160	46	2.65	1023.16	1016	21	13.3		
0	550.72	50	25	1.34	1110.09	1112	11	23.0		
0	609.30	48	26	1.63	1219.31	1212	13	26.2		
0	1460.86	66	3	1.82	2923.43	2917	13	13.6		K-40



Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/CC	Decay Corr uCi/CC	1-Sigma %Error
K-40	1460.81	66	10.67*	2.501E+00	3.690E-07	3.690E-07	13.57

Flag: "\*" = Keyline

Total number of lines in spectrum 4  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 4 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/CC	Decay Corr uCi/CC	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	3.690E-07	3.690E-07	0.502E-07	13.57	
Total Activity :			3.690E-07	3.690E-07			
Grand Total Activity :			3.690E-07	3.690E-07			

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/CC)	1-Sigma %Error	Rejected by
F-18	109.74M	5130.10	511.00*	193.46	1.000E+35	13.30	Decay
% Abundances Found =			100.00				
AS-76	26.32H	356.49	559.10*	44.70	1.000E+35	23.79	Decay, Abun.
% Abundances Found =			73.70				
RU-103	39.35D	9.94	497.00*	09.00	2.796E-04	26.16	Abun.
% Abundances Found =			5.92				
XE-135	9.11H	1029.96	249.79*	09.90	1.000E+35	26.16	Decay, Abun.
% Abundances Found =			3.11				
PM-148M	41.30D	9.47	298.11	12.56	2.064E-04	26.16	Abun.
% Abundances Found =			1.74				
BI-214	19.90M	28290.29	609.31*	46.30	1.000E+35	26.16	Decay
% Abundances Found =			48.48 (Abn. Limit = 48.48%)				

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	511.29	160	46	2.65	1023.16	1016	21	8.90E-02	13.3	4.88E+00	T
0	558.72	50	25	1.34	1119.99	1112	11	2.79E-02	23.8	4.69E+00	T
0	607.30	46	26	1.63	1219.31	1212	13	2.67E-02	26.2	4.52E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
BE-7	22.	477.59	1.1086E-05
F-18	0.	511.00	Half-Life too short
NA-22	16.	1274.54	1.5904E-08
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	28.	889.25	3.1682E-07
CR-51	0.	320.08	Half-Life too short
MN-54	7.	834.83	1.5541E-08
CO-56	8.	1238.25	4.0012E-07
MN-56	0.	1010.69	Half-Life too short
NI-56	0.	158.38	Half-Life too short
CO-57	33.	122.06	2.4143E-08
CO-58	11.	810.76	3.4707E-07
FE-59	6.	1099.22	5.5296E-06
CO-60	10.	1332.49	1.1447E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	13.	1115.52	5.9293E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	44.	136.00	1.2977E-07
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	45.	513.99	2.6185E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	45.	513.99	6.9140E-07
RB-86	0.	1076.63	Half-Life too short
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	1.	1936.01	6.9208E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	14.	1204.90	3.7191E-04
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Nuclide	Eckgnd Sum	Energy (keV)	MDA (uCi/CC)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	17.	702.63	0.0067E-09
NB-95	0.	765.79	Half-Life too short
NB-95M	0.	235.69	Half-Life too short
ZR-95	9.	756.72	0.0423E-07
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.50	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	23.	497.00	0.4071E-06
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	10.	621.04	1.2506E-07
CD-109	35.	00.03	6.2366E-07
AG-110M	7.	937.40	6.1574E-08
SN-113	16.	391.69	9.5469E-08
SN-117M	0.	150.56	Half-Life too short
SB-122	0.	563.93	Half-Life too short
SB-124	17.	602.71	6.7015E-07
SB-125	24.	427.09	3.2471E-08
TE-125M	32.	109.20	3.2664E-04
TE-127	0.	417.90	Half-Life too short
TE-127M	33.	57.60	2.9790E-04
XE-127	0.	202.04	Half-Life too short
TE-129	0.	459.60	Half-Life too short
TE-129M	0.	695.00	Half-Life too short
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	0.	123.00	Half-Life too short
I-131	0.	364.40	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	0.	163.93	Half-Life too short
I-132	0.	667.69	Half-Life too short
TE-132	0.	220.16	Half-Life too short
BA-133	32.	302.04	4.3551E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.07	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	0.	01.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	17.	604.70	1.0657E-08
I-134	0.	004.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	260.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EF1 EFT-2D060606

Acquisition date : 2-JUL-2007 13:33:45

Nuclide	Eckgnd Sum	Energy (keV)	MDA (uCi/CC)
CS-136	0.	919.50	Half-Life too short
I-136	0.	1313.02	Half-Life too short
CS-137	10.	661.65	7.3761E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	259.31	Half-Life too short
BA-139	0.	1439.50	Half-Life too short
CE-139	47.	165.85	6.9046E-08
CS-139	0.	1293.23	Half-Life too short
BA-140	0.	537.32	Half-Life too short
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	199.22	Half-Life too short
CE-141	0.	145.44	Half-Life too short
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	55.	133.54	2.1565E-07
PR-144	0.	1409.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PM-148M	16.	559.27	5.0610E-06
EU-152	32.	344.27	3.0294E-08
EU-154	11.	1004.76	5.4424E-08
EU-156	0.	646.29	Half-Life too short
HF-181	20.	482.03	5.0342E-06
TA-182	10.	1221.42	3.7633E-07
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	37.	279.19	3.2549E-06
BI-207	21.	569.67	8.1774E-09
TL-209	0.	593.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.90	Half-Life too short
RA-226	59.	106.21	2.6372E-07
AC-228	32.	338.32	7.4210E-08
TH-228	39.	84.37	1.0072E-06
PA-234	0.	131.20	Half-Life too short
TH-234	0.	63.29	Half-Life too short
U-235	49.	143.76	7.8108E-08
NP-239	0.	106.13	Half-Life too short
AM-241	34.	59.54	1.8319E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-2D 121806

Sample Location (Well Number): EFT-2D

1. Representative sample collected. Date/Time 12/17/06 1 11:32

Sample collected by: J. Slaback / Joy Marie Slaback Date: 02/01/07  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jennif Southward Date: 2/2/07  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: D. Howard / AM Howard Date: APR 20 2007  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KD Lindsey / KD Lindsey Date: 11-14-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_



Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-2D121806
2 . Date Sampled	12/18/2006
3 . Time Sampled	11:32
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	04/19/2007
2 . Time Sample Counted	18:27
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.7 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3407.6 cpm
Net Spike Count Rate (cpm)	3399.9 cpm
H3 Spike Activity (dpm on count date)	8243.8 dpm
Counter Efficiency	0.4124 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	8.9 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	1.2 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.12\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician

*Am / [Signature]*

Date

APR 20 2007

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-2D 121806

Sample Location (Well Number): EFT-2D

1. Representative sample collected. Date/Time 12/18/06 1 11 32

Sample collected by: J. Slaback / Jay Marie Slaback Date: 02/01/07  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 7/11/07  
Printed Name / Signature 7/11/07

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: RD Lindsay / RD Lindsay Date: 8-8-07  
Fermi 2 RP Printed Name Signature

Sample number: EFD-20121806

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: STEPHEN SPICK / [Signature] Date: 7-17-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System.  
If so, verify the critical levels and LLDs and count sample in accordance  
with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: RO LINDSEY / [Signature] Date: 8-8-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1 EFT-20121806

Sample End Time: 18-DEC-2006 11:32:00.00

REMARKS

PERFORMED BY:

*Stephen Finner*

SIGNATURE

REVIEWED BY:

*B. R. [Signature]*

8-4-07

SIGNATURE/DATE

Sample ID : EF1 EFT-2D121906

Acquisition date : 17-JUL-2007 09:20:10

\*\*\*\*\*

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-2D121906
Sample collection start date: 18-DEC-2006 11:32:00.00
Sample collection end date : 18-DEC-2006 11:32:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : PELL Operator: SDS

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 17-JUL-2007 09:20:10.91
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:00.90 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16
Kev/channel : 4.99739E-01 Zero offset: -1.07317E-01
Daily cal date : 17-JUL-2007 09:15:42.31

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

Table with 11 columns: Pk, It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, SErr, Fit. Contains 4 rows of peak data with handwritten annotations like 'RW-227', 'annihilation', 'H2O', and 'K-40'.

1

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	66.48	34	59	1.56	133.41	130	9	44.5		
0	511.16	168	39	2.52	1023.22	1015	21	11.9		
0	559.09	71	39	1.54	1119.13	1111	17	23.2		
0	1460.94	65	0	1.75	2923.77	2917	14	12.4		K-40

Nuclide Types: natural

Nuclide	Energy	Area	%Obs	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.01	65	10.67*	2.501E+00	3.657E-07	3.657E-07	12.40

Flag: "\*" = Keyline

Total number of lines in spectrum 4  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 4 100.00%

Nuclide Type : natural

Nuclide	Half	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	3.657E-07	3.657E-07	0.454E-07	12.40	
Total Activity :			3.657E-07	3.657E-07			

Grand Total Activity : 3.657E-07 3.657E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit



Nuclide	Half Life		Energy	%Abund	Activity 1	Sigma	Rejected by
	Half-life	Ratio					
F-18	109.74H	2767.73	511.00*	100.00	1.000E+35	11.93	Decay
% Abundances Found = 100.00							
SE-75	119.78D	1.76	66.05	1.02	1.174E-05	44.50	Abun.
			96.73	3.41	----	----	Not Found
			121.12	16.70	----	----	Not Found
			136.00*	59.20	----	----	Not Found
			198.60	1.45	----	----	Not Found
			264.65	59.00	----	----	Not Found
			279.53	25.20	----	----	Not Found
			303.91	1.32	----	----	Not Found
			400.65	11.40	----	----	Not Found
% Abundances Found = 0.57							
AS-76	26.32H	192.33	559.10*	44.70	1.000E+35	23.25	Decay, Abun.
			563.23	1.17	----	----	Not Found
			571.30	0.14	----	----	Not Found
			657.03	6.10	----	----	Not Found
			665.31	0.39	----	----	Not Found
			740.12	0.12	----	----	Not Found
			771.76	0.12	----	----	Not Found
			867.63	0.12	----	----	Not Found
			1129.87	0.14	----	----	Not Found
			1212.72	1.63	----	----	Not Found
			1216.02	3.04	----	----	Not Found
			1220.52	1.39	----	----	Not Found
			1439.13	0.33	----	----	Not Found
			1453.60	0.13	----	----	Not Found
			1787.67	0.33	----	----	Not Found
% Abundances Found = 73.70							
CS-136	13.16D	16.03	66.91	12.50	1.888E-02	44.50	Decay, Abun.
			66.29	6.30	----	----	Not Found
			153.22	7.46	----	----	Not Found
			163.09	4.61	----	----	Not Found
			176.55	13.56	----	----	Not Found
			273.65	12.66	----	----	Not Found
			340.57	48.50	----	----	Not Found
			818.50*	99.70	----	----	Not Found
			1048.07	79.60	----	----	Not Found
			1235.34	19.70	----	----	Not Found
% Abundances Found = 4.10							
TA-102	114.74D	1.84	67.75	42.30	2.996E-07	44.50	Abun.
			100.10	14.10	----	----	Not Found
			1189.05	16.30	----	----	Not Found
			1221.42*	27.10	----	----	Not Found
			1230.97	11.50	----	----	Not Found
% Abundances Found = 38.01							

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	66.48	34	59	1.56	133.41	130	9	1.87E-02	44.5	1.43E+00	T
0	511.16	160	39	2.52	1023.22	1015	21	9.32E-02	11.9	4.88E+00	T
0	559.09	71	39	1.54	1119.13	1111	17	3.95E-02	23.2	4.60E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Signal Sum	Energy (keV)	NDA (uCi/cc)
BE-7	24.	477.59	1.1255E-06
F-18	0.	511.00	Half-Life too short
NA-22	9.	1274.54	1.0902E-08
NA-24	0.	1360.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	6.	889.25	3.6000E-08
CR-51	36.	320.00	1.5436E-05
MN-54	15.	834.83	1.4289E-08
CO-56	8.	1238.25	8.2863E-08
MN-56	0.	1010.60	Half-Life too short
NI-56	0.	150.39	Half-Life too short
CO-57	44.	122.06	1.7375E-08
CO-58	0.	810.76	5.1011E-08
FE-59	11.	1099.22	4.3223E-07
CO-60	13.	1332.49	1.2098E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	7.	1115.52	2.8367E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	44.	136.00	4.5955E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	892.41	Half-Life too short
KR-85	40.	513.99	2.6037E-06
KR-85M	0.	151.10	Half-Life too short
SR-85	40.	513.99	1.0302E-07
RB-86	0.	1076.63	Half-Life too short
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	398.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	3.	1836.01	2.9603E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.00	Half-Life too short
KR-90	0.	1110.69	Half-Life too short
RB-90	0.	831.60	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	11.	1204.90	3.9446E-05
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : E1 EFT-CD121066

Acquisition date : 17-JUL-2007 09:28:10

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	598.28	Half-Life too short
Y-93	0.	266.98	Half-Life too short
NB-94	29.	702.63	1.0167E-08
NB-95	12.	765.79	4.0248E-07
NB-95M	0.	235.69	Half-Life too short
ZR-95	11.	756.72	1.2747E-07
NB-97	0.	657.98	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	148.58	Half-Life too short
TC-101	0.	386.81	Half-Life too short
RU-103	26.	497.88	3.7184E-07
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.98	Half-Life too short
RU-105	0.	724.58	Half-Life too short
RU-106	14.	621.84	1.0132E-07
CD-109	42.	88.83	5.1777E-07
AO-110M	16.	937.48	5.3448E-08
SN-113	31.	391.69	4.2588E-08
SN-117M	0.	158.56	Half-Life too short
SB-122	0.	563.93	Half-Life too short
SB-124	23.	682.71	9.5898E-08
SB-125	25.	427.89	2.8784E-08
TE-125M	38.	189.28	4.8935E-05
TE-127	0.	417.98	Half-Life too short
TC-127M	29.	57.68	8.9868E-05
XE-127	33.	282.84	5.4538E-07
TE-129	0.	459.68	Half-Life too short
TE-129M	18.	695.88	1.8841E-05
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.89	Half-Life too short
BA-131	0.	123.88	Half-Life too short
I-131	0.	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	0.	163.93	Half-Life too short
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	36.	382.84	4.4527E-08
BA-133M	0.	276.89	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.88	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	21.	684.78	9.9413E-09
I-134	0.	884.89	Half-Life too short
TE-134	0.	218.47	Half-Life too short
BA-135M	0.	268.84	Half-Life too short
I-135	0.	1268.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : CF1 EFT-2D121803

Acquisition date : 17-JUL-2007 09:28:18

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	0.	818.58	Half-Life too short
I-136	0.	1313.82	Half-Life too short
CS-137	15.	661.65	0.5369E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1428.58	Half-Life too short
CE-139	49.	165.85	2.8337E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	0.	537.32	Half-Life too short
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	198.22	Half-Life too short
CE-141	42.	145.44	1.4114E-06
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	47.	133.54	1.2870E-07
PR-144	0.	1489.15	Half-Life too short
HD-147	0.	91.18	Half-Life too short
PM-148M	17.	558.27	2.5498E-07
EU-152	27.	344.27	2.7468E-08
EU-154	6.	1084.76	4.1182E-08
EU-156	0.	646.29	Half-Life too short
HF-181	24.	482.83	2.9856E-07
TA-182	18.	1221.42	1.2259E-07
M-187	0.	685.81	Half-Life too short
RE-188	0.	155.83	Half-Life too short
HG-203	42.	279.19	2.3685E-07
BI-207	28.	569.67	7.9471E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	248.98	Half-Life too short
RA-226	59.	186.21	2.6381E-07
AC-228	32.	338.32	7.8188E-08
TH-228	48.	84.37	1.5288E-06
PA-234	0.	131.28	Half-Life too short
TH-234	36.	63.29	4.7678E-04
U-235	49.	143.76	7.8833E-08
NP-239	0.	186.13	Half-Life too short
AM-241	47.	59.54	2.1234E-07

**EFT-2D**

**2007**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-2D7507

Sample Location (Well Number): EFT-2D

1. Representative sample collected. Date/Time 7/5/07 1 1402

Sample collected by: Joy Marie Staback / Joy Marie Staback Date: 12/10/2007  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 12/10/07  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: R. Burgess / [Signature] Date: 12/14/07  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: K. Kelly / K. Kelly Date: 7-26-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

\_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1. Sample Location 2D  
 2. Date Sampled 07/05/2007  
 3. Time Sampled 14:02  
 4. Sample Volume, (ml) 4 ml

**Instrument Count Data**

1. Date Sample Counted 12/14/2007  
 2. Time Sample Counted 08:00  
 3. Background Inf.:  
 Minutes Counted 10 min.  
 Background Count Rate (cpm) 8.2 cpm  
 4. Efficiency Inf.: (Daily Spike Source ID # 111)  
 Gross Spike Count Rate (cpm) 3189.3 cpm  
 Net Spike Count Rate (cpm) 3181.1 cpm  
 H3 Spike Activity (dpm on count date) 7944.9 dpm  
 Counter Efficiency 0.4004 cpm/dpm  
 5. Sample Info:  
 Sample Gross Count Rate (cpm) 9.3 cpm  
 Sample Count Time (min.) 10.0 min.  
 Net Sample Count Rate (cpm) 1.1 cpm  
 6. Critical Level:  
 Critical Level Count Rate (cpm) 2.1 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.19\text{E}-06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician

*Chris Burnett*

Date

*12/14/07*



## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-2D7507

Sample Location (Well Number): EFT-2D

1. Representative sample collected. Date/Time 07/05/2007 11402

Sample collected by: J. Slaback / Joy Marie Slaback Date: 07/16/2007  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 08/08/07  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: K. Lindson / K. Lindson Date: 8-8-07  
Fermi 2 RP Printed Name Signature

Sample number: EFT-2D7507

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard / [Signature] Date: 7-19-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Kid Lindsey / [Signature] Date: 8-8-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Numbers: EF1 EFT-2D7507

Sample End Time: 5-JUL-2007 14:02:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*[Handwritten Signature]*

SIGNATURE

REVIEWED BY:

*KD Lindsey 8-8-07*

SIGNATURE/DATE

Sample ID : EF1 EFT-2D7507

Acquisition date : 19-JUL-2007 09:52:30

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-2D7507  
 Sample collection start date: 5-JUL-2007 14:02:00.00  
 Sample collection end date : 5-JUL-2007 14:02:00.00  
 Type of sample : 1.L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : M211 Operator: CMH

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 19-JUL-2007 09:52:30.46  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:00.92 Percent dead time : 0.65 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.13  
 KeV/channel : 4.99741E-01 Zero offset: -1.77476E-01  
 Daily cal date : 19-JUL-2007 09:20:24.04

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

PK	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	354.56	62	54	3.32	700.03	700	23	3.47E-02	35.1	Pb-214
2	0	511.17	124	59	3.05	1023.21	1016	14	6.80E-02	16.0	annihilation
3	0	550.35	73	10	1.62	1117.62	1110	14	4.00E-02	16.0	Hu c
4	0	1461.47	40	13	1.45	2924.67	2920	11	2.21E-02	24.0	K-40

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## Post-MID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	354.56	62	54	3.32	709.03	700	23	35.1		
0	511.17	124	59	3.05	1023.21	1016	14	16.0		
0	558.35	73	10	1.62	1117.62	1110	14	16.0		
0	1461.47	40	13	1.45	2924.67	2920	11	24.0		K-40

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	40	10.67*	2.501E+00	2.230E-07	2.230E-07	23.97

Flag: "\*" = Keyline

Total number of lines in spectrum 4  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 4 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma XError	Flags
K-40	1.00E+05Y	1.00	2.230E-07	2.230E-07	0.530E-07	23.97	
Total Activity :			2.230E-07	2.230E-07			

Grand Total Activity : 2.230E-07 2.230E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half life	Half-Life Ratio	Energy	Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	101.57	511.00*	100.45	1.000E+3E	15.97	Decay
		% Abundances	Found = 100.00				
AS-76	26.32H	12.62	559.10*	44.70	3.307E-04	16.00	Decay, Abun.
			563.33	1.17	---	Not Found	---
			571.30	0.14	---	Not Found	---
			657.03	0.10	---	Not Found	---
			665.31	0.39	---	Not Found	---
			740.12	0.12	---	Not Found	---
			771.76	0.12	---	Not Found	---
			867.63	0.12	---	Not Found	---
			1129.07	0.14	---	Not Found	---
			1212.72	1.63	---	Not Found	---
			1216.00	3.84	---	Not Found	---
			1220.52	1.39	---	Not Found	---
			1439.13	0.33	---	Not Found	---
			1453.60	0.13	---	Not Found	---
			1707.67	0.33	---	Not Found	---
		% Abundances	Found = 73.70				
ZF-97	16.90H	19.65	254.15	1.25	---	Not Found	---
			335.39	2.27	5.976E-01	35.10	Decay, Abun.
			507.63	5.30	---	Not Found	---
			602.52	1.39	---	Not Found	---
			743.36*	98.00	---	Not Found	---
			1021.30	1.21	---	Not Found	---
			1147.95	2.60	---	Not Found	---
			1362.60	1.35	---	Not Found	---
			1758.46	1.35	---	Not Found	---
		% Abundances	Found = 1.99				
DS-133	10.50Y	0.00	79.62	0.55	---	Not Found	---
			81.00	33.00	---	Not Found	---
			276.40	6.90	---	Not Found	---
			302.84*	17.00	---	Not Found	---
			356.00	60.00	2.754E-00	35.10	Abun.
			383.35	0.70	---	Not Found	---
		% Abundances	Found = 46.53				

Flag: "w" = Keyline



Unidentified Energy Lines  
Sample ID : EFl EFT-ED7507

Page : 5  
Acquisition date : 19-JUL-2007 09:52:30

It	Energy	Area	Ekvnd	FWHM	Channel	Left	Pe	Cts/Sec	%Err	%Eff	Flags
0	354.56	62	54	3.32	709.03	700	23	2.47E-02	35.1	5.68E+00	T
0	511.17	124	59	3.05	1023.21	1016	14	6.08E-02	16.0	4.80E+00	T
0	550.35	73	10	1.62	1117.62	1110	14	4.00E-02	16.0	4.69E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	25.	477.59	8.9363E-08
F-18	0.	511.00	Half-Life too short
NA-22	15.	1274.54	1.1650E-08
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.04	Half-Life too short
SC-46	14.	889.25	1.0354E-08
CR-51	23.	320.00	9.1706E-08
MN-54	11.	834.93	7.9856E-09
CO-56	13.	1230.25	1.7920E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	42.	150.30	3.5875E-08
CO-57	43.	122.06	1.0382E-08
CO-58	17.	810.76	1.0435E-08
FE-59	12.	1099.22	2.1137E-08
CO-60	11.	1332.49	1.0316E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.04	Half-Life too short
ZN-65	12.	1115.52	1.9661E-08
ZN-69M	0.	430.63	Half-Life too short
SE-75	48.	136.00	1.5297E-08
AS-76	0.	559.10	Half-Life too short
BR-82	12.	776.49	6.2573E-08
BR-83	0.	529.64	Half-Life too short
DR-84	0.	801.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	51.	513.99	2.5802E-06
KR-85M	0.	151.10	Half-Life too short
SR-85	51.	513.99	1.2907E-08
RB-86	10.	1076.63	1.6550E-07
KR-87	0.	402.50	Half-Life too short
SR-87M	0.	308.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1302.39	Half-Life too short
Y-88	7.	1936.01	1.1161E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.00	Half-Life too short
KR-90	0.	1110.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RD-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	10.	1204.00	3.7000E-08
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1303.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EF1 EFT-207597

Acquisition date : 19-JUL-2007 09:52:30

Nuclide	Backgd Sum	Energy (keV)	MDA (uCi/cc)
CR-90	0.	590.20	Half-Life too short
Y-93	0.	256.90	Half-Life too short
NB-94	19.	702.63	0.4654E-09
NB-95	14.	765.79	1.0486E-09
NB-95M	56.	235.65	5.0913E-07
ZR-95	9.	756.72	1.3553E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	16.	739.58	2.0724E-06
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	22.	497.08	1.0725E-08
TC-104	0.	357.99	Half-Life too short
RH-105	32.	318.90	2.5702E-05
RU-105	0.	724.50	Half-Life too short
RU-106	16.	621.04	7.5364E-08
CD-109	43.	80.03	3.9032E-07
AG-110M	20.	937.48	3.2690E-08
SN-113	30.	391.69	1.2862E-08
SN-117M	43.	158.56	1.7460E-08
SB-122	22.	563.93	3.6738E-07
SB-124	25.	602.71	1.0241E-08
SB-125	25.	427.89	2.5338E-08
TE-125M	40.	109.20	3.9959E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	28.	57.60	2.5142E-05
XE-127	56.	202.04	1.6412E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	9.	695.85	2.4501E-07
XE-129M	48.	196.56	4.9272E-07
I-130	0.	536.09	Half-Life too short
BA-131	47.	123.80	6.8521E-08
I-131	27.	364.48	2.8955E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	41.	163.93	0.3376E-07
I-132	0.	667.69	Half-Life too short
TE-132	44.	220.16	1.7131E-07
BA-133	41.	302.04	4.5552E-08
BA-133M	46.	276.09	1.7209E-05
I-133	0.	529.07	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	41.	81.00	2.8823E-07
XE-133M	43.	233.22	6.0671E-06
CS-134	24.	604.70	8.7006E-09
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.50	Half-Life too short

Sample ID : EF1 EFT-207507

Acquisition date : 19-JUL-2007 09:52:30

Nuclide	Background Sum	Energy (keV)	MDA (uCi/cc)
CS-136	17.	818.58	1.9098E-08
I-136	0.	1313.02	Half-Life too short
CS-137	18.	661.65	9.0308E-09
XE-137	0.	455.40	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	47.	165.85	1.0330E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	15.	537.32	5.5189E-08
LA-140	9.	1596.49	3.3186E-06
BA-141	0.	190.22	Half-Life too short
CE-141	51.	145.44	2.2963E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	39.	133.54	7.0402E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	35.	91.10	1.0266E-07
PM-148M	20.	550.27	9.9979E-09
EU-152	41.	344.27	3.2198E-08
EU-154	11.	1004.76	4.9658E-08
EU-156	13.	646.29	1.7841E-07
HF-181	17.	482.03	1.0057E-08
TA-182	9.	1221.42	3.5428E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	40.	279.19	1.2345E-08
BI-207	16.	569.67	7.0293E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	48.	240.98	2.9854E-06
RA-226	53.	186.21	2.5112E-07
AC-228	31.	338.32	6.5543E-08
TH-228	45.	84.37	1.3320E-06
PA-234	0.	131.20	Half-Life too short
TH-234	36.	63.29	1.6551E-06
U-235	48.	143.76	7.7333E-08
NP-239	38.	106.13	2.4905E-06
AM-241	38.	59.54	1.7357E-07

**EFT-2D**

**2008**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-2D41608

Sample Location (Well Number): EFT-2D

1. Representative sample collected. Date/Time 4/16/08 1 1615

Sample collected by: Jay Marie Slaback / Jay Marie Slaback Date: 4/21/08  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 4/21/08  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Russ Burton / Russ Burton Date: 4-22-08  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KO Lindsey / KO Lindsey Date: 4-28-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-2D41708
2 . Date Sampled	04/16/2008
3 . Time Sampled	16:15
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	04/22/2008
2 . Time Sample Counted	21:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.8 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3013.1 cpm
Net Spike Count Rate (cpm)	3005.3 cpm
H3 Spike Activity (dpm on count date)	7787.0 dpm
Counter Efficiency	0.3859 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	9.7 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	1.9 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.20\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 uCi/ml x Sample Volume}} < \text{MDA}$$

Technician \_\_\_\_\_



Date 4-22-08

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-2D41608

Sample Location (Well Number): EFT-2D

1. Representative sample collected. Date/Time 4/16/08 1 1615

Sample collected by: Joy Marie Slaback / Joy Marie Slaback Date: 4/21/2008  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 4/21/08  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: J. Southward / J. Southward Date: 4/22/08  
Fermi 2 RP Printed Name / Signature



Sample number: EFT-2D41608

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: J. Southward | J. Southward | Date: 4/22/08  
Fermi 2 RP      Printed Name      Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: KD Lindsay | KD Lindsay | Date: 4-24-08  
Fermi 2      Printed Name      Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DETROIT EDISON FERMI-2 FOWLER PLANT

16-APR-2008 10:15:00.00

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-2X-1000

Sample End Time: 16-APR-2008 10:15:00.00

REMARKS

PERFORMED BY:

*J Southward*  
SIGNATURE

REVIEWED BY:

*R D Puley 4-24-08*  
SIGNATURE DATE

Sample ID : LIT-2041600

Acquisition date : 22-APR-2008 11:09:01

Fernal L Radiation Protection Gamma Spectroscopy Report

Sample Parameters

Sample ID Number: EFT 0141000  
 Sample collection start date: 16-APR-2008 10:15:00.00  
 Sample collection end date : 16-APR-2008 15:15:00.00  
 Type of sample : 1 L Pyri. Liquid  
 Sample quantit, : 1.00000E+03 cc  
 Sample geometry : PELL Operator: JHC

Acquisition Parameters

Detector number : DET 1 Acquire date : 22-APR-2008 11:09:01.31  
 Preset live time : 0 00:00:00.00 Elapsed live time : 0 00:00:09.00  
 Elapsed real time : 0 00:00:01.09 Percent dead time : 0.05 %

Calibration Parameters

Detector number : DET 1 Yearly cal date : 20-JUN-2007 12:10:46.16  
 KeV/channel : 5.00109E-01 Zero offsets: -1.47005E-01  
 Daily cal date : 22-APR-2008 06:30:50.32

Peak Search Parameters

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.000000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

Nuclide Identification Parameters

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dcaaster.lib  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

PK	It	Energy/	Area	Wgtgd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	143.54	83	115	7.80	287.06	370	20	4.60E-02	34.0	
2	0	352.46	56	32	2.05	704.93	700	12	2.98E-02	21.3	
3	0	511.00	157	31	2.54	1022.45	1013	10	8.70E-02	11.0	
4	0	550.60	71	27	1.90	1117.23	1100	15	3.04E-02	19.0	
5	0	1461.00	33	13	1.51	2921.05	2910	14	1.81E-02	29.0	

Sample Title : EFT-2E:1600  
Decay Time = 5 10:54:01.32

Page : 1  
Acquisition Time = 22-APR-2000 11:03:01.3

Peak Fit Report

Id	Energy	Area	Magnd	FWHM	Channel	Left	Pw	SErr	Fit	Nuclides
0	143.54	83	115	7.80	207.88	276	20	24.0		<del>N/A</del> 4-24-08
0	252.46	56	22	2.65	704.93	760	12	21.3		B. 204
0	511.20	157	31	2.54	1022.48	1013	18	11.6		Annex
0	550.09	71	27	1.80	1117.23	1108	15	19.0		Annex
0	1161.08	33	13	1.51	2921.05	2913	14	20.0		K 40

Nuclide Type: natural

Nuclide	Energy	Area	%IBL	NETF	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma NET/CC
K-40	1460.81	33	10.67*	2.591E+00	1.835E-07	1.835E-07	39.59

Nuclide Type: fission

Nuclide	Energy	Area	%IBL	NETF	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma NET/CC
Ce-141	145.14	63	60.10*	6.475E+00	3.902E-08	4.087E-08	33.59

Flags "X" = Keyline

Summary of Nuclide Activity

Sample ID : EFT-2D41606

Acquisition Date : 22-APR-2000 11:02:01

Total number of lines in spectrum 5  
 Number of unidentified lines 0  
 Number of lines tentatively identified by NID 5 100.00%

Nuclide Type : natural

Nuclide	Half	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error Flags
K-40	1.90E+09Y	1.00	1.835E-07	1.835E-07	0.510E-07	27.85
Total Activity :			1.835E-07	1.835E-07		

Nuclide Type : fission

Nuclide	Half	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error Flags
CE-141	32.58D	1.13	3.982E-08	4.507E-08	1.502E-08	33.95
Total Activity :			3.982E-08	4.507E-08		

Grand Total Activity : 2.233E-07 2.285E-07

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abs. limit

Rejected Report  
 Sample ID : EFT 2041808

Page : 4  
 Acquisition date : 22-APR-2008 11:07:01

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	76.00	511.00	100.00	1.027E+15	11.50	Decay
			% Abundances Found =		100.00		
CC-48	63.03D	0.07	142.53	62.70	3.225E+00	33.99	Abun.
			809.23	99.98	---	Not Found	---
			1120.51	99.99	---	Not Found	---
% Abundances Found =		23.07					
FE-59	44.60D	3.13	142.65	1.03	2.048E+06	33.99	Abun.
			192.34	3.11	---	Not Found	---
			1092.22	56.50	---	Not Found	---
			1291.56	43.26	---	Not Found	---
% Abundances Found =		0.99					
AS-76	20.32H	5.20	559.10	44.70	1.903E+06	19.70	Abun.
			563.23	1.17	---	Not Found	---
			571.29	0.14	---	Not Found	---
			657.03	0.10	---	Not Found	---
			665.31	0.30	---	Not Found	---
			740.12	0.12	---	Not Found	---
			771.70	0.12	---	Not Found	---
			867.63	0.12	---	Not Found	---
			1109.87	0.14	---	Not Found	---
			1212.72	1.63	---	Not Found	---
			1216.02	2.04	---	Not Found	---
			1226.52	1.39	---	Not Found	---
			1439.13	0.33	---	Not Found	---
			1453.60	0.13	---	Not Found	---
1707.67	0.32	---	Not Found	---			
% Abundances Found =		73.70					
XE-127	38.41D	0.16	145.22	84.24	5.077E+07	33.99	Abun.
			172.10	24.70	---	Not Found	---
			202.34	68.10	---	Not Found	---
			374.96	17.40	---	Not Found	---
% Abundances Found =		3.70					
FE-214	20.00M	311.53	87.30	4.67	---	Not Found	---
			241.90	7.49	---	Not Found	---
			295.21	19.20	---	Not Found	---
			351.92	37.30	1.306E+08	21.02	
			703.91	1.16	---	Not Found	---
% Abundances Found =		52.40		(Abn. Limit = 37.20%)			
U-235	9999.00Y	0.00	100.14	1.50	---	Not Found	---
			143.70	10.50	1.636E+07	33.99	Abun.
			163.35	4.70	---	Not Found	---
			185.72	24.00	---	Not Found	---
			202.12	1.00	---	Not Found	---

Rejected Report (continued)  
Sample ID : EFT-ED41608

Page : 5  
Acquisition date : 02-01-2005 11:00:00

Flag: "W" = Keyline



Unidentified Energy Lines  
Sample ID : EFT-2041000

Page : 2  
Acquisition date : 22-APR-2000 11:09:01

It	Energy	Area	Bgnd	FWHM	Channel	Left	Pr	Cts/Sec	%Err	%Eff	Flags
0	352.46	56	22	2.03	704/93	700	12	3.00E-02	21.3	5.70E-05	T
0	511.28	157	31	2.54	1022/45	1012	10	5.70E-02	11.6	4.20E-05	T
c	553.69	71	27	1.80	1117/23	1109	10	3.04E-01	19.0	4.60E-05	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Isotope	Wt%gnd Con.	Energy (keV)	MDA (uCi/gnd)
BE-7	21.	477.50	7.4862E-03
F-18	0.	511.06	Half-Life too short
NA-22	6.	1274.54	7.8900E-03
NA-24	10.	1369.53	7.0730E-03
NO-27	0.	1014.44	Half-Life too short
OL-30	0.	1642.42	Half-Life too short
OR-41	0.	1293.64	Half-Life too short
SE-46	9.	897.25	8.0026E-03
SR-51	27.	320.00	8.0415E-03
NH-54	10.	834.83	7.6600E-03
CO-56	17.	1239.25	1.8052E-03
NR-56	0.	1016.00	Half-Life too short
NI-56	50.	156.38	1.5643E-03
CO-57	39.	122.06	2.7337E-03
CO-58	14.	810.76	8.9993E-03
FE-59	17.	1099.22	2.1573E-03
CO-60	10.	1332.49	2.7018E-03
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1401.84	Half-Life too short
ZN-65	9.	1115.52	1.7113E-03
ZN-69M	0.	438.63	Half-Life too short
GE-75	46.	136.00	1.4000E-03
GO-76	76.	559.13	1.2113E-03
BR-82	5.	776.49	9.9001E-03
BR-83	3.	527.04	Half-Life too short
BR-84	0.	681.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	47.	513.99	2.4956E-03
KR-85M	0.	151.10	Half-Life too short
SR-85	47.	513.99	1.1490E-03
RB-86	16.	1076.63	1.3155E-03
KR-87	0.	402.50	Half-Life too short
SR-87M	0.	308.40	Half-Life too short
KR-88	0.	190.32	Half-Life too short
FS-88	0.	1302.39	Half-Life too short
Y-88	1.	1936.31	3.4454E-03
KR-89	0.	520.70	Half-Life too short
RE-89	0.	1031.80	Half-Life too short
KR-90	3.	1118.09	Half-Life too short
RE-90	0.	831.00	Half-Life too short
RE-90M	0.	834.00	Half-Life too short
Y-90M	0.	2002.31	Half-Life too short
SR-91	0.	1321.30	Half-Life too short

SR-92	0.	153.24	Half-Life too short
Y-92	0.	224.46	Half-Life too short

Minimum Detectable Activity Report (continued)

Sample ID: LFT 2D41000

Acquisition date: 22-APR 2000 11:09:01

Nuclide	Background Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	520.20	Half-Life too short
Y-93	0.	266.96	Half-Life too short
NB-94	17.	702.63	8.0135E-09
ND-96	14.	766.79	9.0491E-09
NB-95M	26.	235.69	7.6184E-08
ZR-95	14.	756.72	1.5321E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	12.	743.36	2.2035E-06
NO-99	0.	739.59	2.0044E-07
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-102	2.	497.00	9.3303E-09
TC-104	0.	357.99	Half-Life too short
RU-105	21.	312.90	4.8437E-07
RU-106	0.	724.50	Half-Life too short
RU-106	20.	621.84	8.1600E-08
DD-107	32.	63.03	3.5342E-07
AG-110M	14.	937.40	2.7999E-08
OH-113	21.	391.69	1.0547E-08
OH-117M	50.	150.50	1.2470E-08
DD-122	29.	563.93	4.7461E-08
OD-124	24.	602.71	9.2429E-09
SB-125	20.	427.89	2.3003E-08
TE-125M	34.	109.00	3.3650E-08
TE-127	0.	117.00	Half-Life too short
TE-127M	24.	57.60	2.2376E-05
ME-127	40.	202.04	1.2112E-08
YE-129	0.	459.60	Half-Life too short
TE-129M	12.	695.80	2.3015E-07
XE-129M	51.	196.56	2.7119E-07
I-130	0.	536.09	Half-Life too short
BA-131	27.	123.00	3.0341E-08
I-131	23.	304.48	1.3401E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	5.	773.37	3.2909E-07
XE-131M	33.	113.92	5.1173E-07
I-132	0.	667.69	Half-Life too short
TE-132	40.	220.16	2.9522E-08
BA-133	32.	302.04	4.0065E-08
BA-133M	45.	370.09	5.4654E-07
I-133	16.	529.87	7.0294E-07
YE-133M	0.	912.50	Half-Life too short
XE-133	40.	91.00	9.0000E-08
XE-133M	34.	235.22	4.3041E-07
CS-134	25.	604.70	8.0050E-09
I-134	0.	584.09	Half-Life too short
TE-134	0.	218.47	Half-Life too short
BA-135M	25.	200.24	1.3193E-08

Minimum Detectable Activity Report (continued)

Sample ID : EFT-2041600

Acquisition date : 22-APR-2020 11:09:01

Radionuclide	Background Sum	Energy (keV)	MDA (dCi/cc)
CS-136	16.	310.50	1.2399E-06
I-136	0.	1513.02	Half-Life too short
CC-137	18.	661.65	0.3196E-09
KE-137	0.	455.40	Half-Life too short
CS-138	0.	1465.86	Half-Life too short
XE-138	0.	250.31	Half-Life too short
EA-139	0.	1423.53	Half-Life too short
CE-139	47.	105.35	0.9173E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	15.	537.32	3.0210E-09
LA-140	3.	1500.49	8.2744E-08
BA-141	0.	190.22	Half-Life too short
LA-141	0.	1354.82	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	42.	293.26	3.5915E-07
CE-144	41.	130.54	7.3327E-08
PR-144	0.	1480.13	Half-Life too short
ND-147	37.	91.10	6.3461E-08
PM-148M	18.	550.27	0.3571E-09
EU-152	20.	354.27	2.6194E-08
EU-154	12.	1004.73	5.2076E-08
EU-156	13.	646.290	1.2038E-07
HF-161	26.	482.03	1.0450E-08
TA-162	7.	1221.42	3.8989E-08
U-137	14.	605.01	1.4114E-06
RE-168	30.	155.00	1.4031E-06
HO-200	33.	270.10	1.0121E-08
SI-207	14.	560.67	6.7203E-09
TL-208	0.	583.14	Half-Life too short
PD-212	0.	230.63	Half-Life too short
BI-214	0.	600.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	43.	240.00	6.0046E-07
RA-226	28.)	186.21	2.1498E-07
AC-228	24.	330.32	5.7775E-08
TH-228	47.	84.37	1.3460E-06
PA-234	0.	101.29	Half-Life too short
TH-234	20.	63.29	1.1829E-06
U-235	50.	143.76	7.0352E-06
NP-239	42.	105.13	2.4344E-07
AM-241	25.	59.54	1.5978E-07

**EFT-2D**

**2009**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-2D031209

Sample Location (Well Number): EFT-2D

1. Representative sample collected. Date/Time 3-12-09 / 15:20

Sample collected by: Chris Ellison / [Signature] Date: 3-12-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: [Signature] / [Signature] Date: 4-17-09  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: [Signature] / [Signature] Date: 4-22-09  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: [Signature] / [Signature] Date: 4-22-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-2D031209
2 . Date Sampled	03/12/2009
3 . Time Sampled	15:20
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	04/21/2009
2 . Time Sample Counted	15:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.5 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2991.0 cpm
Net Spike Count Rate (cpm)	2983.5 cpm
H3 Spike Activity (dpm on count date)	7361.1 dpm
Counter Efficiency	0.4053 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	8.9 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	1.4 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.12\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician *Dr. J. Ward* Date 4-21-09

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-2D031209

Sample Location (Well Number): EFT-2D

1. Representative sample collected. Date/Time 3-12-09 1 15:20

Sample collected by: Chris Ellison / [Signature] Date: 3-12-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples.

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Proffitt / [Signature] Date: 4-17-09  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function.

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: J. Southward / [Signature] Date: 4/21/09  
Fermi 2 RP Printed Name / Signature



Sample number: EFT - 2D031209

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".

(Note disposition of unidentified peaks in "Remarks")

Performed by: J Southward | J Southward Date: 4/20/09  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: KD LINDSAY | KD Lindsay Date: 5-6-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT2D031209

Sample End Time: 12-MAR-2009 15:20:00.00

REMARKS K-40

PERFORMED BY:

Charles Proffitt  
SIGNATURE

REVIEWED BY:

FD Pody 5-6-09  
SIGNATURE/DATE

Sample ID : EFT2D031209

Acquisition date : 5-MAY-2009 14:49:22

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT2D031209
Sample collection start date: 12-MAR-2009 15:20:00.00
Sample collection end date : 12-MAR-2009 15:20:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.000000E+03 cc
Sample geometry : MELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 5-MAY-2009 14:49:22.77
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:00.99 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2008 12:00:00.00
KeV/channel : 5.00074E-01 Zero offset: 7.35546E-02
Daily cal date : 5-MAY-2009 13:14:54.49

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

Table with 11 columns: Pk, It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. It contains 5 rows of peak data.

Post-MID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	66.75	40	93	1.58	133.33	124	18	49.5		<i>4% error</i>
0	351.95	38	26	1.68	703.65	699	11	30.5		<i>Pb-214</i>
0	511.05	142	16	2.57	1021.01	1015	13	10.2		<i>Ann</i>
0	558.42	60	9	1.85	1116.55	1112	10	16.2		<i>NWC</i>
0	1461.41	59	10	1.82	2922.31	2915	14	17.4		<i>K-40</i>

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	59	10.67*	2.501E+00	3.310E-07	3.310E-07	17.44

Flags: "\*" = Keyline

Total number of lines in spectrum 5  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 5 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	3.310E-07	3.310E-07	0.579E-07	17.44	
Total Activity :			3.310E-07	3.310E-07			
Grand Total Activity :			3.310E-07	3.310E-07			

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
		Ratio				(uCi/cc)	%Error	
F-18	109.74M	700.44		511.00*	193.46	1.000E+35	10.24	Decay
		% Abundances Found =			100.00			
SE-75	119.70D	0.45		66.05	1.02	6.631E-06	49.47	Abun.
				96.73	3.41	----	Not Found	----
				121.12	16.70	----	Not Found	----
				136.00*	59.20	----	Not Found	----
				190.60	1.45	----	Not Found	----
				264.65	59.00	----	Not Found	----
				279.53	25.20	----	Not Found	----
				303.91	1.32	----	Not Found	----
				400.65	11.40	----	Not Found	----
		% Abundances Found =			0.57			
AS-76	26.32H	49.23		559.10*	44.70	2.825E+07	16.25	Decay, Abun.
				563.23	1.17	----	Not Found	----
				571.30	0.14	----	Not Found	----
				657.03	6.10	----	Not Found	----
				665.31	0.39	----	Not Found	----
				740.11	0.12	----	Not Found	----
				771.76	0.12	----	Not Found	----
				867.63	0.12	----	Not Found	----
				1129.87	0.14	----	Not Found	----
				1212.72	1.63	----	Not Found	----
				1216.02	3.04	----	Not Found	----
				1220.52	1.39	----	Not Found	----
				1439.13	0.33	----	Not Found	----
				1453.60	0.13	----	Not Found	----
				1707.67	0.33	----	Not Found	----
		% Abundances Found =			73.70			
CS-136	13.16D	4.10		66.91	12.50	6.301E-06	49.47	Abun.
				86.29	6.30	----	Not Found	----
				153.22	7.46	----	Not Found	----
				163.89	4.61	----	Not Found	----
				176.55	13.56	----	Not Found	----
				273.65	12.66	----	Not Found	----
				340.57	40.50	----	Not Found	----
				619.50*	99.70	----	Not Found	----
				1040.07	79.60	----	Not Found	----
				1235.34	19.70	----	Not Found	----
		% Abundances Found =			4.10			
TA-182	114.74D	0.47		67.75	42.30	1.621E-07	49.47	Abun.
				100.10	14.10	----	Not Found	----
				1189.05	16.30	----	Not Found	----
				1221.42*	27.10	----	Not Found	----
				1230.97	11.50	----	Not Found	----
		% Abundances Found =			30.01			
PB-214	26.00M	2900.91		87.30	4.67	----	Not Found	Decay
				241.98	7.49	----	Not Found	----

Nuclide	Half-life	Ratio	Energy	%Abund	Activity 1-Sigma (uCi/cc)	%Error	Rejected by
PB-214	26.8004	2900.91	295.21	19.20	-----	Not Found	-----
			351.92*	37.20	1.000E+35	30.53	Decay
			705.91	1.10	-----	Not Found	-----
% Abundances Found =					53.40	(Abn. Limit =	37.20%)

Flag: "\*" = Keyline



It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	66.75	48	93	1.58	133.33	124	10	2.77E-02	49.5	1.46E+00	T
0	351.95	38	26	1.68	703.65	699	11	2.08E-02	30.5	5.78E+00	T
0	511.05	142	16	2.57	1021.01	1015	13	7.97E-02	10.2	4.88E+00	T
0	558.42	60	9	1.85	1116.55	1112	10	3.32E-02	16.2	4.69E+00	T

Flags: "T" = Tentatively associated

\* Sample ID : EFT2D031209 0 \*

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	20.	477.59	1.3514E-07
F-18	0.	511.00	Half-Life too short
NA-22	10.	1274.54	9.9496E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	10.	809.25	1.2377E-08
CR-51	32.	320.08	2.9979E-07
MN-54	14.	834.83	9.6625E-09
CO-56	18.	1238.25	2.9756E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	49.	158.38	3.7000E-06
CO-57	35.	122.06	1.0581E-08
CO-58	8.	810.76	1.1098E-08
FE-59	7.	1099.22	3.2249E-08
CO-60	14.	1332.49	1.1696E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	15.	1115.52	2.4304E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	54.	136.00	2.0323E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	42.	513.99	2.3858E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	42.	513.99	1.0230E-08
RB-86	9.	1076.63	7.1561E-07
KR-87	0.	482.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	2.	1836.01	9.0208E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	16.	1204.90	7.2565E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT2D031209

Acquisition date : 5-MAY-2009 14:49:22

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94 0	20.	702.63	8.6173E-09
NB-95	18.	765.79	2.5959E-08
NB-95M	0.	235.69	Half-Life too short
ZR-95	12.	756.72	2.4203E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	21.	497.03	2.1269E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	23.	621.84	9.4610E-08
CD-109	43.	80.03	4.1263E-07
AG-110M	13.	937.48	3.0020E-08
SN-113	24. >	391.69	1.4901E-08
SN-117M	47.	150.56	1.4165E-07
SB-122	0.	563.93	Half-Life too short
SB-124	27.	602.71	1.6932E-08
SB-125	19.	427.89	2.3189E-08
TE-125M	44.	109.28	6.7440E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	20.	57.60	3.2675E-05
XE-127	37.	202.84	2.9200E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	27.	695.88	8.8896E-07
XE-129M	49.	196.56	1.1413E-05
I-130	0.	536.09	Half-Life too short
BA-131	424. >	120480	7003356E007
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	47.	163.93	9.3531E-06
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	38.	302.84	4.4185E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.07	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	28.	604.70	9.7641E-09
I-134	0.	0 084.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Nuclide	Bkgnd Sum	Energy (keV)	PDA (uCi/cc)
CS-136	0.	810.50	1.1320E-07
I-136	0.	1313.02	Half-Life too short
CS-137	11.	661.65	7.3076E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.06	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	37.	165.85	1.1282E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	19.	537.32	5.3500E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	50.	145.44	5.3771E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641/17	a Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	53.	133.54	9.3441E-08
PR-144	0.	1409.15	Half-Life too short
ND-147	33.	91.10	1.2510E-06
PM-148M	17.	550.27	1.8220E-08
EU-152	25.	344.27	2.5055E-08
EU-154	15.	1004.76	5.7196E-08
EU-155	39.	105.31	4.0596E-08
EU-156	13.	646.29	1.0017E-06
HF-181	15.	402.03	1.8141E-08
TA-182	14.	1221.42	5.5700E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	30.	279.19	1.9711E-08
BI-207	26.	569.67	8.8208E-09
TL-209	0.	563.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.90	Half-Life too short
RA-226	40.	186.21	2.1914E-07
AC-228	32.	338.32	6.7179E-08
TH-228	0 47.	84.37	1.4211E-06
PA-234	0.	131.20	Half-Life too short
TH-234	36.	63.29	5.2210E-06
U-235	46.	143.76	7.5200E-08
NP-239	0.	106.13	Half-Life too short
AM-241	29.	59.54	1.6650E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT2D 91109

Sample Location (Well Number): 2D

1. Representative sample collected. Date/Time 9/11/09 1 1000

Sample collected by: Thomas Mew / Thomas Date: 9-11-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 9/21/09  
Printed Name / Signature

3. Sample counted in accordance with 76,000,70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Thomas M. Quinn / [Signature] Date: 9-22-09  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Ayers / [Signature] Date: 10-13-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location EFT2D91109  
 2 . Date Sampled 09/11/2009  
 3 . Time Sampled 10:00  
 4 . Sample Volume, (ml) 4 ml

**Instrument Count Data**

1 . Date Sample Counted 09/21/2009  
 2 . Time Sample Counted 14:00  
 3 . Background Inf.:  
     Minutes Counted 10 min.  
     Background Count Rate (cpm) 7.7 cpm  
 4 . Efficiency Inf.: (Daily Spike Source ID # 111)  
     Gross Spike Count Rate (cpm) 2763.5 cpm  
     Net Spike Count Rate (cpm) 2755.8 cpm  
     H3 Spike Activity (dpm on count date) 7189.1 dpm  
     Counter Efficiency 0.3833 cpm/dpm  
 5 . Sample Info:  
     Sample Gross Count Rate (cpm) 7.1 cpm  
     Sample Count Time (min.) 10.0 min.  
     Net Sample Count Rate (cpm) 0.0 cpm  
 6 . Critical Level:  
     Critical Level Count Rate (cpm) 2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.20\text{E}-06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 9-22-09

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT 2D 91109

Sample Location (Well Number): 2D

1. Representative sample collected. Date/Time 9/11/09 1 1000

Sample collected by: Thomas Muel / Tom Date: 9-11-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 9/24/09  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Southward / Southward Date: 10/12/09  
Fermi 2 RP Printed Name Signature

Sample number: EFT 2D 91109

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".

(Note disposition of unidentified peaks in "Remarks")

Performed by: Southward Southward Date: 10/12/09  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray SR [Signature] Date: 10-13-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT2D91109

Sample End Time: 11-SEP-2009 10:00:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:  
*Southwood*  
SIGNATURE

REVIEWED BY:  
*[Signature]* 10-13-09  
SIGNATURE DATE

Sample ID : EFT2D91109

Acquisition date : 12-OCT-2009 14:50:32

\*\*\*\*\*  
 Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT2D91109  
 Sample collection start date: 11-SEP-2009 10:00:00.00  
 Sample collection end date : 11-SEP-2009 10:00:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : P2LL Operator: JNS

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 12-OCT-2009 14:50:32.33  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:01.20 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 3-JUN-2009 17:37:00.00  
 Kev/channel : 5.00030E-01 Zero offset: 7.02676E-03  
 Daily cal date : 12-OCT-2009 14:12:36.26

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
 Abundance limit : 775.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	1	509.04	36	26	1.83	1019.62	1015	14	1.99E-02	33.8	2.52E+00
2	1	511.72	65	24	2.12	1023.37	1015	14	3.62E-02	21.8	
3	0	1461.59	30	> 5	1.17	2923.05	2918	12	1.60E-02	24.0	
4	0	1764.74	21	0	1.77	3529.33	3524	11	1.17E-02	21.8	

3

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
1	509.84	36	26	1.83	1019.62	1015	14	33.8	2.52E+00	Tl-208
1	511.72	65	24	2.12	1023.37	1015	14	21.8		ANN.
0	1461.59	30	5	1.17	2923.05	2918	12	24.0		K-40
0	1764.74	21	0	1.77	3529.33	3524	11	21.8		Bi-214

*f* 10-13-09

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	30	10.67*	2.501E+00	1.706E-07	1.706E-07	24.02

Flag: "\*" = Keyline

Summary of Nuclide Activity

Sample ID : EFT2D91109

Acquisition date : 12-OCT-2009 14:58:32

Total number of lines in spectrum 4  
 Number of unidentified lines 1  
 Number of lines tentatively identified by NID 3 75.00%

Nuclide Type : natural

8

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	>1.00E+05Y	1.00	1.706E-07	1.706E-07	0.410E-07	24.02	
Total Activity :			1.706E-07	1.706E-07			

Grand Total Activity : 1.706E-07 1.706E-07

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
F-18	109.74M	409.64	511.00*	193.46	1.000E+35	21.79	Decay
% Abundances			Found = 100.00				
BI-214	19.90M	2258.97	609.31*	46.30	----	Not Found	----
			768.36	5.04	----	Not Found	----
			934.06	3.21	----	Not Found	----
			1120.29	15.10	----	Not Found	----
			1238.11	5.94	----	Not Found	----
			1377.67	4.11	----	Not Found	----
			1764.49	15.80	1.000E+35	21.82	
% Abundances			Found = 16.54 (Abn. Limit = 48.48%)				

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EFT2D91109

Page : 5  
Acquisition date : 12-OCT-2009 14:58:32

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
1	509.84	36	26	1.83	1019.62	1015	14	1.99E-02	33.8	4.88E+00	
1	511.72	65	24	2.12	1023.37	1015	14	3.62E-02	21.8	4.88E+00	T
0	1764.74	21	0	1.77	3529.33	3524	11	1.17E-02	21.8	2.26E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	14.	477.59	8.6685E-08
F-18	0.	511.00	Half-Life too short
NA-22	9.	1274.54	9.6978E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	14.	889.25	1.1918E-08
CR-51	24.	320.00	1.4282E-07
MN-54	6.	834.83	6.4840E-09
CO-56	7.	1238.25	1.6229E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	36.	158.38	2.4178E-07
CO-57	36.	122.06	1.0026E-08
CO-58	8.	810.76	9.2717E-09
FE-59	10.	1099.22	2.5245E-08
CO-60	8.	1332.49	8.9898E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	5.	1115.52	1.5023E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	36.	136.00	1.4789E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	39.	513.99	2.2802E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	39.	513.99	1.3714E-08
RB-86	12.	1076.63	3.4814E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	4.	1836.01	1.0112E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	10.	1204.90	4.5225E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short



Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	16.	702.63	7.7801E-09
NB-95	13.	765.79	1.4272E-08
NB-95M	41.	235.69	1.2341E-05
ZR-95	10.	756.72	1.7633E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	16.	497.08	1.2620E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	11.	621.04	6.5333E-08
CD-109	30.	88.03	3.3945E-07
AG-110M	13.	937.48	2.9370E-08
SN-113	10.	391.69	1.1337E-08
SN-117M	34.	150.56	3.0105E-08
SB-122	0.	563.93	Half-Life too short
SB-124	15.	602.71	1.0150E-08
SB-125	22.	427.09	2.4295E-08
TE-125M	28.	109.20	4.1627E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	28.	57.60	2.8024E-05
XE-127	37.	202.04	1.8830E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	9.	695.08	3.5314E-07
XE-129M	34.	196.56	1.6200E-06
I-130	0.	536.09	Half-Life too short
BA-131	30.	123.00	1.7359E-07
I-131	27.	364.48	1.2995E-07
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	31.	163.93	2.0212E-06
I-132	0.	667.69	Half-Life too short
TE-132	30.	220.16	6.4108E-06
BA-133	29.	302.04	3.0993E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.07	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	34.	81.00	2.6194E-06
XE-133M	0.	233.22	Half-Life too short
CS-134	14.	604.70	6.9750E-09
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT2D91109

Acquisition date : 12-OCT-2009 14:58:32

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	12.	818.50	4.1209E-08
I-136	0.	1313.02	Half-Life too short
CS-137	13.	661.65	7.9751E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	33.	165.85	9.5585E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	11.	537.32	1.2624E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	31.	145.44	2.6520E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	31.	133.54	6.8597E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	27.	91.10	2.7321E-07
PM-148M	8.	550.27	8.9268E-09
EU-152	22.	344.27	2.4231E-08
EU-154	11.	1004.76	4.9680E-08
EU-155	29.	105.31	4.1880E-08
EU-156	11.	646.29	3.6409E-07
HF-181	14.	482.03	1.2248E-08
TA-182	10.	1221.42	4.2909E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	25.	279.19	1.2896E-08
BI-207	14.	569.67	6.6867E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	41.	240.98	7.7267E-05
RA-226	27.	186.21	1.8396E-07
AC-228	25.	338.32	5.9678E-08
TH-228	20.	84.37	9.5071E-07
PA-234	0.	131.20	Half-Life too short
TH-234	23.	63.29	2.2079E-06
U-235	50.	143.76	7.8740E-08
NP-239	0.	106.13	Half-Life too short
AM-241	23.	59.54	1.5320E-07

**EFT-2D**

**2010**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EF1-6110-2D

Sample Location (Well Number): 2D

1. Representative sample collected. Date/Time 6/1/10 1 1155

Sample collected by: Southward, Southward Date: 6/23/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward, Southward Date: 6/23/10  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Jain M. Yodanis / [Signature] Date: 6-25-10  
Fermi 2 Chemistry Printed Name / Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray, Sr. / [Signature] Date: 6-30-10  
Fermi 2 Printed Name / Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EF1-6110-2D
2 . Date Sampled	06/01/2010
3 . Time Sampled	11:55
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	06/24/2010
2 . Time Sample Counted	13:30
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	6.7 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2671.8 cpm
Net Spike Count Rate (cpm)	2665.1 cpm
H3 Spike Activity (dpm on count date)	6889.0 dpm
Counter Efficiency	0.3869 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	8.5 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	1.8 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	1.9 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.11\text{E-}06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 6-25-10

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EF1-6110-2D

Sample Location (Well Number): 2D

1. Representative sample collected. Date/Time 6/1/10 1 1155

Sample collected by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Charles Proffitt / Charles Proffitt Date: 9-15-10  
Fermi 2 RP Printed Name Signature

Sample number: EF1-6110-2D

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Charles Proffitt Charles Proffitt Date: 9-15-10  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray Robert C. Gray Date: 10-5-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DETOIT EDISON FERMI-2 POWER PLANT

15-SEP-2010 16:36:44.65

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1-6110-20

Sample End Time: 1-JUN-2010 11:55:00.00

REMARKS

PERFORMED BY:

*Chap. Drapier*  
SIGNATURE

REVIEWED BY:

*Robert J. [Signature]*  
SIGNATURE DATE



Sample ID : EF1-6110-2D

Acquisition date : 15-SEP-2010 15:51:40

\*\*\*\*\*

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1-6110-2D
Sample collection start date: 1-JUN-2010 11:55:00.00
Sample collection end date : 1-JUN-2010 11:55:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : MELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 15-SEP-2010 15:51:40.22
Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00
Elapsed real time : 0 00:45:00.86 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 23-JUN-2010 12:28:00.00
KeV/channel : 4.99959E-01 Zero offset: 1.16623E-01
Daily cal date : 15-SEP-2010 09:09:58.87

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

Table with 11 columns: Pk It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. It contains 8 rows of peak data.

Sample Title : EF1-6110-2D

Page : 1

Decay Time = 106 03:56:40.22

Acquisition Time = 15-SEP-2010 15:51:40.2

2

Post-MID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	66.36	63	99	1.10	132.50	129	9	30.7	— HwC	
0	295.19	57	73	1.33	590.19	585	11	32.3	— Pb-214	
0	511.48	267	90	2.96	1022.83	1015	20	10.0	— Ann.	
0	558.75	99	45	1.21	1117.36	1111	12	16.8	— HwC	
0	609.54	67	36	1.78	1219.96	1210	17	24.5	— Bi-214	
0	1120.49	35	8	1.38	2240.96	2233	16	24.7	— Bi-214	
0	1461.56	54	38	1.33	2923.15	2912	19	30.4	—	K-40
0	1764.74	33	0	1.56	3529.58	3523	14	17.4	— Bi-214	

Nuclide Line Activity Report  
Sample ID : EF1-6110-20

Page : 2  
Acquisition date : 15-SEP-2010 15:51:40

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	54	10.67*	2.501E+00	2.039E-07	2.039E-07	30.37

Flag: "\*" = Keyline

Summary of Nuclide Activity  
Sample ID : EF1-6110-2D

Page : 3  
Acquisition date : 15-SEP-2010 15:51:40

Total number of lines in spectrum 8  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 8 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.039E-07	2.039E-07	0.619E-07	30.37	
Total Activity :			2.039E-07	2.039E-07			
Grand Total Activity :			2.039E-07	2.039E-07			

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	1393.29	511.00*	193.46	1.000E+35	10.79	Decay
		% Abundances Found =	100.00				
SC-46	83.83D	1.27	142.53	62.70	---- Not Found ----		Abun.
			889.25*	99.98	---- Not Found ----		
			1120.51	99.99	2.907E-08	24.74	
		% Abundances Found =	38.07				
SE-75	119.78D	0.89	66.05	1.02	8.100E-06	30.73	Abun.
			96.73	3.41	---- Not Found ----		
			121.12	16.70	---- Not Found ----		
			136.00*	59.20	---- Not Found ----		
			198.60	1.45	---- Not Found ----		
			264.65	59.80	---- Not Found ----		
			279.53	25.20	---- Not Found ----		
			303.91	1.32	---- Not Found ----		
			400.65	11.40	---- Not Found ----		
		% Abundances Found =	0.57				
AS-76	26.32H	96.82	559.10*	44.70	6.636E+21	16.83	Decay, Abun.
			563.23	1.17	---- Not Found ----		
			571.30	0.14	---- Not Found ----		
			657.03	6.10	---- Not Found ----		
			665.31	0.39	---- Not Found ----		
			740.12	0.12	---- Not Found ----		
			771.76	0.12	---- Not Found ----		
			867.63	0.12	---- Not Found ----		
			1129.07	0.14	---- Not Found ----		
			1212.72	1.63	---- Not Found ----		
			1216.02	3.84	---- Not Found ----		
			1220.52	1.39	---- Not Found ----		
			1439.13	0.33	---- Not Found ----		
			1453.60	0.13	---- Not Found ----		
			1787.67	0.33	---- Not Found ----		
		% Abundances Found =	73.70				
RU-103	39.35D	2.70	497.00*	89.00	---- Not Found ----		Abun.
			610.33	5.60	1.710E-06	24.48	
		% Abundances Found =	5.92				
XE-135	9.11H	279.73	249.79*	89.90	---- Not Found ----		Decay, Abun.
			608.19	2.89	1.000E+35	24.47	
		% Abundances Found =	3.11				
CS-136	13.16D	8.07	66.91	12.50	9.606E-05	30.73	Abun.
			86.29	6.30	---- Not Found ----		
			153.22	7.46	---- Not Found ----		
			163.89	4.61	---- Not Found ----		
			176.55	13.56	---- Not Found ----		
			273.65	12.66	---- Not Found ----		
			340.57	48.50	---- Not Found ----		
			810.50*	99.76	---- Not Found ----		

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by		
CS-136	13.16D	8.07	1048.07	79.60	---	Not Found	Abun.		
			1235.34	19.70	---	Not Found			
			% Abundances Found =			4.10			
PM-148M	41.30D	2.57	288.11	12.56	---	Not Found	Abun.		
			414.07	18.66	---	Not Found			
			432.78	5.35	---	Not Found			
			501.26	6.75	---	Not Found			
			550.27*	94.90	---	Not Found			
			599.74	12.54	---	Not Found			
			611.26	5.48	1.599E-06	24.48			
			629.97	89.00	---	Not Found			
			725.70	32.80	---	Not Found			
			915.33	17.17	---	Not Found			
% Abundances Found =			20.30	---	Not Found				
% Abundances Found =			1.74						
TA-182	114.74D	0.93	67.75	42.30	2.009E-07	30.73	Abun.		
			100.10	14.10	---	Not Found			
			1189.05	16.30	---	Not Found			
			1221.42*	27.10	---	Not Found			
			1230.97	11.50	---	Not Found			
% Abundances Found =			38.01						
BI-214	19.90M	7683.38	609.31*	46.30	1.000E+35	24.47	Decay		
			768.36	5.04	---	Not Found			
			934.06	3.21	---	Not Found			
			1120.29	15.10	1.000E+35	24.74			
			1238.11	5.94	---	Not Found			
			1377.67	4.11	---	Not Found			
			1764.49	15.80	1.000E+35	17.41			
% Abundances Found =			80.84	(Abn. Limit =	48.48%)				
PE-214	26.00M	5705.19	87.30	4.67	---	Not Found	Decay, Abun.		
			241.98	7.49	---	Not Found			
			295.21	19.20	1.000E+35	32.32			
			351.92*	37.20	---	Not Found			
			785.91	1.10	---	Not Found			
% Abundances Found =			27.56	(Abn. Limit =	37.20%)				

Flag: "\*" = Keyline

## Unidentified Energy Lines

Page : 6

Sample ID : EF1-6110-2D

Acquisition date : 15-SEP-2010 15:51:40

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	XErr	XEff	Flags
0	66.36	63	99	1.10	132.50	129	9	2.35E-02	30.7	1.42E+00	T
0	295.19	57	73	1.33	590.19	585	11	2.10E-02	32.3	6.09E+00	T
0	511.48	267	90	2.96	1022.03	1015	20	9.90E-02	10.0	4.80E+00	T
0	558.75	99	45	1.21	1117.36	1111	12	3.67E-02	16.0	4.60E+00	T
0	609.54	67	36	1.70	1210.96	1210	17	2.47E-02	24.5	4.52E+00	T
0	1120.49	35	0	1.30	2240.96	2233	16	1.30E-02	24.7	2.90E+00	T
0	1764.74	33	0	1.56	3529.50	3523	14	1.22E-02	17.4	2.26E+00	T

Flags: "T" = Tentatively associated

\* Detroit Edison Fermi 2 MDA Report, Generated 15-SEP-2010 16:36:40.65 \*  
 \* Sample ID : EF1-6110-2D \*

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	30.	477.59	2.3630E-07
F-18	0.	511.00	Half-Life too short
NA-22	14.	1274.54	7.9979E-09
NA-24	0.	1360.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	22.	809.25	1.0100E-08
CR-51	41.	320.00	7.9031E-07
MN-54	23.	834.03	9.0070E-09
CO-56	19.	1230.25	3.1577E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	0.	150.30	Half-Life too short
CO-57	57.	122.06	9.9993E-09
CO-58	0.	810.76	1.2709E-08
FE-59	23.	1099.22	7.0151E-08
CO-60	17.	1332.49	0.6100E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1401.04	Half-Life too short
ZN-65	12.	1115.52	1.7453E-08
ZN-69M	0.	430.63	Half-Life too short
SE-75	72.	136.00	2.0910E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	001.50	Half-Life too short
BR-85	0.	002.41	Half-Life too short
KR-85	99.	513.99	2.3053E-06
KR-85M	0.	151.10	Half-Life too short
SR-85	99.	513.99	3.1551E-08
RB-86	10.	1076.63	3.4131E-06
KR-87	0.	402.50	Half-Life too short
SR-87M	0.	300.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1302.39	Half-Life too short
Y-88	10.	1036.01	1.5759E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.00	Half-Life too short
KR-90	0.	1110.69	Half-Life too short
RB-90	0.	031.69	Half-Life too short
RB-90M	0.	024.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	25.	1204.90	1.0052E-05
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1303.94	Half-Life too short



Sample ID : EF1-6110-20

Acquisition date : 15-SEP-2010 15:51:40

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NE-94	20.	702.63	5.6614E-09
NE-95	29.	765.79	5.9602E-08
NE-95M	0.	235.69	Half-Life too short
ZR-95	18.	756.72	3.3348E-08
NE-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	21.	497.08	3.5162E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	29.	621.04	7.7479E-08
CD-109	57.	88.03	3.3779E-07
AG-110M	10.	937.48	2.7602E-08
SN-113	38.	391.69	1.6715E-08
SN-117M	78.	158.56	1.6998E-06
SB-122	0.	563.93	Half-Life too short
SB-124	35.	602.71	2.3225E-08
SB-125	38.	427.89	2.1629E-08
TE-125M	62.	109.28	9.8161E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	56.	57.60	4.1662E-05
XE-127	53.	202.84	6.2045E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	34.	695.88	1.9364E-06
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	57.	123.80	1.1422E-05
I-131	0.	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	74.	163.93	1.6254E-04
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	54.	302.84	3.5112E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	34.	604.70	7.4493E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page : 3

Sample ID : EF1-6110-2D

Acquisition date : 15-SEP-2010 15:51:40

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	21.	818.50	1.8181E-06
I-136	0.	1313.02	Half-Life too short
CS-137	25.	661.65	7.0909E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	65.	165.85	1.2690E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	22.	537.32	6.4969E-06
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	66.	145.44	1.2354E-07
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	69.	133.54	7.9608E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	72.	91.10	3.2425E-05
PM-148M	20.	550.27	3.1399E-08
EU-152	40.	344.27	2.1369E-08
EU-154	22.	1004.76	4.5719E-08
EU-155	51.	105.31	3.7399E-08
EU-156	23.	646.29	1.0136E-05
HF-181	32.	482.03	3.9500E-08
TA-182	17.	1221.42	5.5204E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	55.	279.19	3.7703E-08
BI-207	36.	569.67	6.8340E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	68.	186.21	1.8808E-07
AC-228	49.	338.32	5.5211E-08
TH-228	55.	84.37	1.0727E-06
PA-234	0.	131.20	Half-Life too short
TH-234	56.	63.29	1.9191E-05
U-235	73.	143.76	6.2517E-08
NP-239	0.	106.13	Half-Life too short
AM-241	58.	59.54	1.5541E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-1025 10-2 D

Sample Location (Well Number): 2D

1. Representative sample collected. Date/Time 11-11-10 | 11:47

Sample collected by: Proffitt | [Signature] Date: 11-11-10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Proffitt | [Signature] Date: 11-11-10  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: S.R. Dyer | [Signature] Date: 11-12-10  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Bryant | [Signature] Date: 11-15-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_

Tritium Activity Calculation

Sample Information

1. Sample Location	EPT EPT-102510-2D
2. Date Sampled	11/11/2010
3. Time Sampled	11:47
4. Sample Volume, (ml)	4 ml

Instrument Count Data

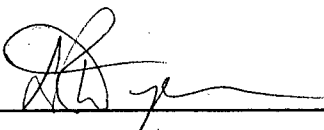
1. Date Sample Counted	11/11/2010
2. Time Sample Counted	22:08
3. Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.2 cpm
4. Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2546.6 cpm
Net Spike Count Rate (cpm)	2539.4 cpm
H3 Spike Activity (dpm on count date)	6741.6 dpm
Counter Efficiency	0.3767 cpm/dpm
5. Sample Info:	
Sample Gross Count Rate (cpm)	8.1 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.9 cpm
6. Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

Minimum Detectable Activity

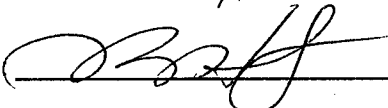
$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}}{\text{Efficiency} \times 2.22\text{E6 dpm/uCi} \times \text{Sample Volume}} = 1.18\text{E-06 uCi/ml}$$

Sample Activity

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E6 uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 11-12-10

Reviewed By 

Date 11/15/10

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-102510-210

Sample Location (Well Number): 210

1. Representative sample collected. Date/Time 10/25/10 1 11:25

Sample collected by: Thomas Nowl / Tom Date: 11/11/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: C. Proffitt / J. Proffitt Date: 11-22-10  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: C. Proffitt / J. Proffitt Date: 11-23-10  
Fermi 2 RP Printed Name Signature

Sample number: EFT-102510-20

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: C Proffitt [Signature] Date: 11-23-10  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: RO LINDSEY [Signature] Date: 1-3-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT  
GAMMA SPECTROSCOPY ANALYSIS REPORT  
HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-102510-2/D

Sample End Time: 25-OCT-2010 11:25:00.00

REMARKS

PERFORMED BY:

*Charles Proffitt*  
SIGNATURE

REVIEWED BY:

*KD Q...* 1-3-11  
SIGNATURE/DATE

Sample ID : EFT-102510-2/D

Acquisition date : 9-DEC-2010 10:12:10

## Fermi 2 Radiation Protection Gamma Spectroscopy Report

## \*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-102510-2/D  
 Sample collection start date: 25-OCT-2010 11:25:00.00  
 Sample collection end date : 25-OCT-2010 11:25:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : PELL Operator: CLP

## \*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 9-DEC-2010 10:12:10.00  
 Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00  
 Elapsed real time : 0 00:45:00.71 Percent dead time : 0.03 %

## \*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 23-JUN-2010 12:29:00.00  
 Kev/channel : 5.00192E-01 Zero offset: 9.50408E-02  
 Daily cal date : 9-DEC-2010 10:00:55.12

## \*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

## \*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	77.62	69	110	1.09	154.99	151	0	2.54E-02	29.6	
2	0	198.37	61	106	1.14	396.41	392	10	2.26E-02	34.0	
3	0	295.16	207	81	1.40	589.92	583	12	7.60E-02	11.1	
4	0	351.97	308	48	1.58	703.49	696	16	1.44E-01	6.5	
5	0	511.00	193	68	2.04	1021.59	1011	21	7.15E-02	12.9	
6	0	609.42	353	45	2.10	1218.21	1212	16	1.31E-01	6.9	
7	0	768.80	42	31	2.13	1536.86	1532	11	1.55E-02	29.8	
8	1	1110.99	40	22	2.40	2237.00	2231	24	1.40E-02	33.0	1.75E+00
9	1	1120.45	59	28	2.65	2339.93	2331	24	2.19E-02	26.0	
10	0	1238.26	57	6	1.80	2475.48	2469	12	2.11E-02	15.8	
11	0	1460.75	48	17	3.79	2920.31	2913	14	1.76E-02	23.6	
12	2	1762.76	43	0	2.62	3524.16	3519	16	1.60E-02	18.0	1.40E+00
13	2	1765.21	46	0	2.00	3529.06	3519	16	1.49E-02	23.5	



Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	38.	477.59	1.0677E-07
F-18	0.	511.00	Half-Life too short
NA-22	15.	1274.54	7.9453E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	23.	089.25	1.1097E-08
CR-51	59.	328.00	2.0364E-07
MN-54	16.	834.93	6.7224E-09
CO-56	60.	1238.25	3.1226E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	94.	158.38	1.1400E-06
CO-57	63.	122.06	8.9750E-09
CO-58	18.	910.76	9.7206E-09
FE-59	13.	1099.22	2.3329E-08
CO-60	9.	1332.49	6.3489E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	16.	1115.52	1.6308E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	63.	136.00	1.3760E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.58	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	60.	513.99	1.8665E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	60.	513.99	1.2971E-08
RB-86	18.	1076.63	4.6047E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	12.	1836.01	1.1334E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	19.	1204.90	4.6025E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT-102510-2/D

Acquisition date : 9-DEC-2010 10:12:18

Nuclide	Bckgrd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NE-94	31.	702.63	6.9890E-09
NE-95	23.	765.79	1.6064E-08
NE-95M	0.	235.69	Half-Life too short
ZR-95	20.	756.72	1.8040E-08
NE-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	300.81	Half-Life too short
RU-103	37.	497.08	1.5545E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	24.	621.84	6.3353E-08
CD-109	85.	80.03	3.7163E-07
AG-110M	23.	937.40	2.6135E-08
SN-113	23.	391.69	1.0095E-08
SN-117M	82.	150.56	7.7121E-08
SB-122	0.	563.93	Half-Life too short
SB-124	27.	602.71	1.0168E-08
SB-125	36.	427.09	2.0476E-08
TE-125M	72.	109.28	5.0356E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	30.	57.60	2.3620E-05
XE-127	80.	202.04	2.3397E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	23.	695.00	4.5925E-07
XE-129M	68.	196.56	4.3799E-06
I-130	0.	536.09	Half-Life too short
BA-131	63.	123.00	3.2619E-07
I-131	34.	364.48	3.1367E-07
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	65.	163.93	4.2678E-06
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	46.	302.04	3.2074E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.07	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	53.	81.00	1.3252E-05
XE-133M	0.	233.22	Half-Life too short
CS-134	24.	604.70	6.0405E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT-102510-2/D

Acquisition date : 9-DEC-2010 10:12:10

Nuclide	Bckgd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	17.	818.50	6.5567E-08
I-136	0.	1313.02	Half-Life too short
CS-137	26.	661.65	7.1904E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	250.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	70.	165.85	9.6502E-09
CS-139	0.	1203.23	Half-Life too short
BA-140	33.	537.32	2.0176E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	77.	145.44	3.6127E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	292.26	Half-Life too short
CE-144	73.	132.54	7.0624E-08
PR-144	0.	1409.15	Half-Life too short
ND-147	49.	91.10	5.7152E-07
PM-148M	27.	550.27	1.2005E-08
EU-152	51.	344.27	2.3740E-08
EU-154	10.	1004.76	4.1507E-08
EU-155	44.	105.31	3.4050E-08
EU-156	24.	646.29	6.3544E-07
HF-191	45.	402.03	1.7023E-08
TA-182	21.	1221.42	4.2129E-08
W-187	0.	605.01	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	57.	279.19	1.5490E-08
BI-207	27.	569.67	5.9500E-09
TL-208	0.	503.14	Half-Life too short
PE-212	0.	230.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PE-214	0.	351.92	Half-Life too short
RA-224	0.	240.90	Half-Life too short
RA-226	02.	106.21	2.0491E-07
AC-228	47.	330.32	5.3033E-08
TH-228	47.	04.37	9.3520E-07
PA-234	0.	131.20	Half-Life too short
TH-234	56.	63.29	3.2966E-06
U-235	03.	143.76	6.6159E-08
NP-239	0.	106.13	Half-Life too short
AM-241	41.	59.54	1.3273E-07

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	77.62	69	110	1.09	154.99	151	0	29.6		Pb-218
0	198.37	61	106	1.14	396.41	392	10	34.0		Pb-214
0	295.16	207	81	1.40	589.92	583	12	11.1		Pb-214
0	351.97	388	48	1.58	703.49	696	16	6.5		Pb-214
0	511.08	193	68	2.04	1021.59	1011	21	12.9		ANN.
0	609.42	353	45	2.10	1210.21	1212	16	6.0		Bi-214
0	768.00	42	31	2.13	1536.86	1532	11	29.0		Bi-214
1	1118.99	40	22	2.40	2237.00	2231	24	33.0	1.75E+00	Bi-214
1	1120.45	59	28	2.65	2239.03	2231	24	26.0		Bi-214
0	1238.26	57	6	1.98	2475.48	2469	12	15.8		Bi-214
0	1468.75	48	17	3.79	2920.31	2913	14	23.6		K-40
2	1762.76	43	0	2.62	3524.16	3519	16	18.8	1.48E+00	Bi-214
2	1765.21	40	0	2.80	3529.06	3519	16	23.5		Bi-214

*Handwritten:* 11-3-11

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay/ Corr uCi/cc	1-Sigma %Error
K-40	1460.81	48	10.67*	2.501E+00	1.786E-07	1.786E-07	23.59

Flag: "\*" = Keyline

Total number of lines in spectrum 13  
Number of unidentified lines 1  
Number of lines tentatively identified by NID 12 92.31%

Nuclide Type : natural

Nuclide	HLife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma Error Flags
K-40	1.00E+05Y	1.00	1.786E-07	1.786E-07	0.421E-07	23.59
Total Activity :			1.786E-07	1.786E-07		
Grand Total Activity :			1.786E-07	1.786E-07		

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Sample ID : EFT-102510-2/D

Acquisition date : 9-DEC-2010 10:12:10

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	590.03	511.00*	193.46	1.000E+35	12.90	Decay
		% Abundances	Found =	100.00			
SD-46	93.83D	0.54	142.53	62.70	---- Not Found ----		Abun.
			889.25*	99.98	---- Not Found ----		
			1120.51	99.99	2.966E-08	25.99	
		% Abundances	Found =	38.07			
CO-56	78.76D	0.57	846.75	99.96	---- Not Found ----		Abun.
			1037.02	14.03	---- Not Found ----		
			1230.25*	67.00	4.598E-02	15.03	
			1360.21	4.29	---- Not Found ----		
			1771.40	15.51	---- Not Found ----		
			2015.35	3.03	---- Not Found ----		
			2034.91	7.78	---- Not Found ----		
		% Abundances	Found =	31.66			
SE-75	119.78D	0.30	66.05	1.02	---- Not Found ----		Abun.
			96.73	3.41	---- Not Found ----		
			121.12	16.70	---- Not Found ----		
			136.00*	59.20	---- Not Found ----		
			198.60	1.45	8.264E-07	34.03	
			264.65	59.00	---- Not Found ----		
			279.53	25.20	---- Not Found ----		
			303.91	1.32	---- Not Found ----		
			400.65	11.40	---- Not Found ----		
		% Abundances	Found =	0.01			
KR-90	32.32S	120203.63	121.02	32.00	---- Not Found ----		Decay, Abun.
			539.49	29.00	---- Not Found ----		
			1110.69*	37.00	1.000E+35	32.97	
		% Abundances	Found =	37.76			
RU-103	39.35D	1.14	497.00*	89.00	---- Not Found ----		Abun.
			610.33	5.60	3.005E-06	6.70	
		% Abundances	Found =	5.92			
BA-131	11.80D	3.01	70.76	0.73	5.147E-05	29.56	Abun.
			92.29	0.64	---- Not Found ----		
			123.00*	29.00	---- Not Found ----		
			133.61	2.16	---- Not Found ----		
			216.07	19.70	---- Not Found ----		
			239.62	2.40	---- Not Found ----		
			249.43	2.02	---- Not Found ----		
			373.24	14.00	---- Not Found ----		
			404.04	1.31	---- Not Found ----		
			400.40	0.32	---- Not Found ----		
			406.51	2.07	---- Not Found ----		
			496.31	46.00	---- Not Found ----		
			572.67	0.16	---- Not Found ----		
			585.03	1.22	---- Not Found ----		
			620.10	1.36	---- Not Found ----		

Nuclide	Half-life	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by	
		Ratio				(uCi/cc)	%Error		
BA-131	11.80D	3.81		923.85	0.73	----	Not Found	----	Abun.
				1047.57	1.17	----	Not Found	----	
			% Abundances Found =		0.58				
TE-134	41.80M	1549.04		79.45	21.00	----	Not Found	----	Decay, Abun.
				180.89	18.00	----	Not Found	----	
				201.24	0.70	----	Not Found	----	
				210.47*	21.90	----	Not Found	----	
				277.95	21.30	----	Not Found	----	
				435.06	10.60	----	Not Found	----	
				461.00	10.00	----	Not Found	----	
				464.64	5.10	----	Not Found	----	
				565.99	10.90	----	Not Found	----	
	742.59	14.70	----	Not Found	----				
	767.20	30.00	1.000E+35	29.79					
% Abundances Found =		15.87							
XE-135	9.11H	118.46		249.79*	89.90	----	Not Found	----	Decay, Abun.
				608.19	2.89	1.236E+30	6.78		
			% Abundances Found =		3.11				
DA-142	10.70M	6051.37		77.60	9.60	1.000E+35	29.56	Decay, Abun.	
				231.52	10.10	----	Not Found		----
				255.12*	10.00	----	Not Found		----
				425.03	5.00	----	Not Found		----
				894.90	11.00	----	Not Found		----
				946.75	8.90	----	Not Found		----
				1000.06	7.00	----	Not Found		----
				1070.40	9.30	----	Not Found		----
	1202.20	5.30	----	Not Found	----				
	1204.06	14.00	----	Not Found	----				
% Abundances Found =		9.70							
PB-212	10.64H	101.40		74.81	10.70	----	Not Found	----	Decay, Abun.
				77.11	18.00	4.964E+23	29.56		
				87.30	8.00	----	Not Found	----	
				115.19	0.60	----	Not Found	----	
				230.63*	44.60	----	Not Found	----	
				300.09	3.41	----	Not Found	----	
% Abundances Found =		21.10	(Abn. Limit = 44.60%)						
BI-214	19.90M	3253.75		609.31*	46.30	1.000E+35	6.78	Decay	
				760.36	5.04	1.000E+35	29.79		
				934.06	3.21	----	Not Found		----
				1120.29	15.10	1.000E+35	25.99		
				1230.11	5.94	1.000E+35	15.83		
				1377.67	4.11	----	Not Found		----
				1764.49	15.00	1.000E+35	23.45		
% Abundances Found =		92.34	(Abn. Limit = 40.40%)						
PD-214	26.00M	2416.03		87.30	4.67	----	Not Found	----	Decay
				241.90	7.49	----	Not Found	----	



Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
PB-214	26.80M	2416.03	295.21	19.20	1.000E+35	11.12	Decay
			351.92*	37.20	1.000E+35	6.47	
			705.91	1.10	---	Not Found	
% Abundances Found =				80.96	(Abn. Limit = 37.20%)		

Flag: "w" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	77.62	69	110	1.09	154.99	151	8	2.54E-02	23.6	2.56E+00	T
0	198.37	61	106	1.14	396.41	392	10	2.20E-02	34.0	6.60E+00	T
0	295.16	207	81	1.40	509.92	503	12	7.68E-02	11.1	6.09E+00	T
0	351.97	388	48	1.58	703.49	696	16	1.44E-01	6.5	5.70E+00	T
0	511.00	193	60	2.04	1021.59	1011	21	7.15E-02	12.9	4.08E+00	T
0	609.42	353	45	2.10	1210.21	1212	16	1.31E-01	6.8	4.52E+00	T
0	768.80	42	31	2.13	1536.86	1532	11	1.55E-02	29.8	3.77E+00	T
1	1118.99	40	22	2.40	2237.00	2231	24	1.40E-02	33.0	2.90E+00	T
1	1120.45	59	28	2.65	2239.93	2231	24	2.19E-02	26.0	2.90E+00	T
0	1230.26	57	6	1.20	2475.48	2469	12	2.11E-02	15.8	2.74E+00	T
2	1762.76	43	0	2.62	3524.16	3519	16	1.60E-02	18.0	2.26E+00	T
2	1765.21	40	0	2.00	3529.06	3519	16	1.49E-02	23.5	2.26E+00	T

Flags: "T" = Tentatively associated

**EFT-2D**

**2011**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-61611 2D

Sample Location (Well Number): 2D

1. Representative sample collected. Date/Time 6-16-11 1 14:20

Sample collected by: Thomas Mow / [Signature] Date: 6-22-11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: C Proffitt / [Signature] Date: 6-22-11  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: SHEAN / [Signature] Date: 6-23-11  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C Gray / [Signature] Date: 6-24-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks [Signature] 6-24-11

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-61611-2D
2 . Date Sampled	06/16/2011
3 . Time Sampled	14:20
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	06/23/2011
2 . Time Sample Counted	03:13
3 . Background Inf.:	
Minutes Counted	30 min.
Background Count Rate (cpm)	5.6 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2291.3 cpm
Net Spike Count Rate (cpm)	2285.7 cpm
H3 Spike Activity (dpm on count date)	6512.3 dpm
Counter Efficiency	0.3510 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	6.0 cpm
Sample Count Time (min.)	30.0 min.
Net Sample Count Rate (cpm)	0.4 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	1.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 6.47\text{E-}07 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 uCi/ml x Sample Volume}} < \text{MDA}$$

Technician 

Date 6-23-11

Reviewed 

Date 6-23-11

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT 61611-2D

Sample Location (Well Number): 2D

1. Representative sample collected. Date/Time 6-16-11 1:14:20

Sample collected by: Thomas Mow / [Signature] Date: 6-22-11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: C Proffitt / [Signature] Date: 6-22-11  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: C Proffitt / [Signature] Date: 6-22-11  
Fermi 2 RP Printed Name Signature

Sample number: EFT-61611-2D

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: C Proffitt | [Signature] Date: 6-22-11  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gage | [Signature] Date: 6-23-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_ N WA 6-23-11  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT  
GAMMA SPECTROSCOPY ANALYSIS REPORT  
HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-61611-2D

Sample End Time: 16-JUN-2011 14:20:00.00

REMARKS

*Natural*

PERFORMED BY:

*Charles Proffey*  
SIGNATURE

REVIEWED BY:

*[Signature]*  
SIGNATURE/DATE



Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-61611-2D  
Sample collection start date: 16-JUN-2011 14:20:00.00  
Sample collection end date : 16-JUN-2011 14:20:00.00  
Type of sample : 1 L Mari. Liquid  
Sample quantity : 1.000000E+03 cc  
Sample geometry : MELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 22-JUN-2011 16:57:19.73  
Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00  
Elapsed real time : 0 00:45:00.61 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 14-JUN-2011 14:50:56.41  
Kev/channel : 4.99884E-01 Zero offset: 2.83532E-01  
Daily cal date : 22-JUN-2011 14:32:40.38

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
Abundance limit : 75.00000 Library : dacmaster.nlb  
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	352.65	50	70	1.18	704.89	700	11	1.84E-02	35.0	
2	0	511.23	185	58	2.44	1022.13	1013	22	6.87E-02	12.9	
3	0	610.05	81	34	3.54	1219.81	1209	20	2.99E-02	21.1	
4	0	1461.53	69	10	1.20	2923.13	2912	20	2.54E-02	16.5	

3

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	xErr	Fit	Nuclides
0	352.65	50	70	1.10	704.89	700	11	35.0		
0	511.23	185	50	2.44	1022.13	1013	22	12.9		
0	610.05	01	34	3.54	1219.01	1209	20	21.1		
0	1461.53	69	10	1.20	2923.13	2912	20	16.5		

*Pb-214  
Ann. Peak  
Bi-214  
K-40  
8-6-23-12*

Sample ID : EFT-61611-2D

Acquisition date : 22-JUN-2011 16:57:19

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	69	10.67*	2.352E+00	2.740E-07	2.740E-07	16.53

Flag: "\*" = Keyline

Sample ID : EFT-61611-2D

Acquisition date : 22-JUN-2011 16:57:19

Total number of lines in spectrum	4	
Number of unidentified lines	0	
Number of lines tentatively identified by NID	4	100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.740E-07	2.740E-07	0.453E-07	16.53	
Total Activity :			2.740E-07	2.740E-07			
Grand Total Activity :			2.740E-07	2.740E-07			

Flags: "K" = Keyline not found

"M" = Manually accepted

"E" = Manually edited

"A" = Nuclide specific abn. limit

Sample ID : EFT-61611-2D

Acquisition date : 22-JUN-2011 16:57:19

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
F-18	109.74M	80.37	511.00*	193.46	3.259E+16	12.94	Decay
% Abundances Found =			100.00				
RU-103	39.35D	0.16	497.08*	89.00	---	Not Found	---
% Abundances Found =			5.92				
PM-148M	41.30D	0.15	288.11	12.56	---	Not Found	---
			414.07	18.66	---	Not Found	---
			432.78	5.35	---	Not Found	---
			501.26	6.75	---	Not Found	---
			550.27*	94.90	---	Not Found	---
			599.74	12.54	---	Not Found	---
			611.26	5.48	3.842E-07	21.13	---
			629.97	89.00	---	Not Found	---
			725.70	32.80	---	Not Found	---
			915.33	17.17	---	Not Found	---
% Abundances Found =			1.74				
BI-214	19.90M	443.21	609.31*	46.30	1.000E+35	21.13	Decay
			768.36	5.04	---	Not Found	---
			934.06	3.21	---	Not Found	---
			1120.29	15.10	---	Not Found	---
			1238.11	5.94	---	Not Found	---
			1377.67	4.11	---	Not Found	---
			1764.49	15.80	---	Not Found	---
			% Abundances Found =			48.48 (Abn. Limit = 48.48%)	
PB-214	26.00M	329.10	87.30	4.67	---	Not Found	---
			241.98	7.49	---	Not Found	---
			295.21	19.20	---	Not Found	---
			351.92*	37.20	1.000E+35	35.02	---
			705.91	1.10	---	Not Found	---
% Abundances Found =			53.40 (Abn. Limit = 37.20%)				

Flag: "\*" = Keyline

Sample ID : EFT-61611-2D

Acquisition date : 22-JUN-2011 16:57:19

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	352.65	50	70	1.18	704.89	700	11	1.84E-02	35.0	5.38E+00	T
0	511.23	185	58	2.44	1022.13	1013	22	6.87E-02	12.9	4.59E+00	T
0	610.05	81	34	3.54	1219.81	1209	20	2.99E-02	21.1	4.25E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	16.	477.59	4.6619E-08
F-18	0.	511.00	Half-Life too short
NA-22	13.	1274.54	7.7262E-09
NA-24	11.	1368.53	6.7069E-06
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	11.	889.25	6.1151E-09
CR-51	41.	320.00	6.8231E-08
MN-54	20.	834.83	7.2172E-09
CO-56	22.	1238.25	1.4976E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	48.	158.38	1.1142E-08
CO-57	48.	122.06	7.6349E-09
CO-58	19.	810.76	7.2204E-09
FE-59	9.	1099.22	1.1542E-08
CO-60	12.	1332.49	7.6853E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	19.	1115.52	1.6825E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	41.	136.00	9.5576E-09
AS-76	38.	559.10	7.6781E-07
BR-82	11.	776.49	1.1116E-07
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	62.	513.99	2.0067E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	62.	513.99	9.2704E-09
RB-86	13.	1076.63	9.9586E-08
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	8.	1836.01	7.9832E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	22.	1204.90	3.3488E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT-61611-2D

Acquisition date : 22-JUN-2011 16:57:19

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	25.	702.63	6.7211E-09
NB-95	19.	765.79	7.2370E-09
NB-95M	52.	235.69	7.7580E-08
ZR-95	22.	756.72	1.3252E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	23.	743.36	2.9084E-06
MO-99	14.	739.58	1.9896E-07
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	24.	497.08	6.9389E-09
TC-104	0.	357.99	Half-Life too short
RH-105	35.	318.90	5.0034E-07
RU-105	0.	724.50	Half-Life too short
RU-106	19.	621.84	5.5869E-08
CD-109	68.	88.03	3.3029E-07
AG-110M	14.	937.48	1.9581E-08
SN-113	36.	391.69	9.5046E-09
SN-117M	49.	158.56	8.7682E-09
SB-122	23.	563.93	3.8601E-08
SB-124	21.	602.71	6.1796E-09
SB-125	35.	427.89	2.0936E-08
TE-125M	30.	109.28	2.2388E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	32.	57.60	1.9689E-05
XE-127	51.	202.84	9.4367E-09
TE-129	0.	459.60	Half-Life too short
TE-129M	16.	695.88	1.8914E-07
XE-129M	52.	196.56	1.9487E-07
I-130	0.	536.09	Half-Life too short
BA-131	36.	123.80	2.7369E-08
I-131	26.	364.48	1.0439E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	18.	773.67	4.9686E-07
XE-131M	47.	163.93	3.9209E-07
I-132	0.	667.69	Half-Life too short
TE-132	56.	228.16	2.5730E-08
BA-133	49.	302.84	3.4509E-08
BA-133M	45.	276.09	4.3696E-07
I-133	30.	529.87	9.6722E-07
TE-133M	0.	912.58	Half-Life too short
XE-133	37.	81.00	6.8548E-08
XE-133M	43.	233.22	3.6692E-07
CS-134	25.	604.70	6.2800E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	47.	268.24	1.2685E-06
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short



Sample ID : EFT-61611-2D

Acquisition date : 22-JUN-2011 16:57:19

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	15.	818.50	8.4923E-09
I-136	0.	1313.02	Half-Life too short
CS-137	23.	661.65	7.1653E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	50.	165.85	7.0830E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	33.	537.32	3.6720E-08
LA-140	4.	1596.49	7.0443E-08
BA-141	0.	190.22	Half-Life too short
CE-141	46.	145.44	1.3077E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	43.	293.26	2.9683E-07
CE-144	42.	133.54	5.2548E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	33.	91.10	4.2634E-08
PM-148M	24.	550.27	6.6809E-09
EU-152	37.	344.27	2.1647E-08
EU-154	9.	1004.76	3.2317E-08
EU-155	39.	105.31	3.3599E-08
EU-156	16.	646.29	9.5447E-08
HF-181	23.	482.03	7.1484E-09
TA-182	10.	1221.42	2.5573E-08
W-187	12.	685.81	1.1878E-06
RE-188	58.	155.03	1.6221E-05
AU-199	48.	150.38	5.7633E-08
HG-203	42.	279.19	7.8398E-09
BI-207	19.	569.67	5.4040E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	62.	240.98	5.3291E-07
RA-226	56.	186.21	1.7785E-07
AC-228	39.	338.32	5.0777E-08
TH-228	46.	84.37	9.2501E-07
PA-234	0.	131.20	Half-Life too short
TH-234	41.	63.29	9.9117E-07
U-235	53.	143.76	5.6782E-08
NP-239	42.	106.13	1.8892E-07
AM-241	26.	59.54	1.1975E-07

# FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-101811-2D

Sample Location (Well Number): EFT-21D

1. Representative sample collected. Date/Time 10/18/11 / 15:50

Sample collected by: Thomas Now / [Signature] Date: 10/18/11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample ≥ 50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Thomas Now / [Signature] Date: 10/25/11  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: [Signature] Date: 11-1-11  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray Jr. / [Signature] Date: 11-2-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks W/A

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-101811-2D
2 . Date Sampled	10/18/2011
3 . Time Sampled	15:50
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	11/01/2011
2 . Time Sample Counted	15:11
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.2 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2521.9 cpm
Net Spike Count Rate (cpm)	2514.7 cpm
H3 Spike Activity (dpm on count date)	6381.8 dpm
Counter Efficiency	0.3940 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	9.1 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	1.9 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.13\text{E-}06 \text{ uCi/ml}$$


Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 11-1-11

Reviewed By: 

Date 11-1-11

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-101811-2D

Sample Location (Well Number): EFT-2/D

1. Representative sample collected. Date/Time 10/18/11 | 15:50

Sample collected by: Thomas Mow | [Signature] Date: 10/18/11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Thomas Mow | [Signature] Date: 10/25/11  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function.

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: [Signature] | [Signature] Date: 11-1-11  
Fermi 2 RP Printed Name Signature

Sample number: EFT-101811 2D

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Prothier | [Signature] Date: 11-1-11  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Biggs, Jr. | [Signature] Date: 11-1-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
NA  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-101811-20

Sample End Time: 18-OCT-2011 15:50:00.00

REMARKS No plant related isopes

PERFORMED BY:

Charles Propper  
SIGNATURE

REVIEWED BY:

[Signature]  
SIGNATURE/DATE

Sample ID : EFT-101811-2D

Acquisition date : 1-NOV-2011 09:58:29

\*\*\*\*\*

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-101811-2D
Sample collection start date: 18-OCT-2011 15:50:00.00
Sample collection end date : 18-OCT-2011 15:50:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : MELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 1-NOV-2011 09:58:29.31
Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00
Elapsed real time : 0 00:45:00.66 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 14-JUN-2011 14:50:56.41
Kev/channel : 5.00032E-01 Zero offset: -5.54949E-01
Daily cal date : 1-NOV-2011 07:48:09.27

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

Table with 11 columns: Pk It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. It contains 8 rows of peak data.

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	511.95	210	48	3.83	1024.95	1014	28	11.6		
0	560.79	69	37	6.84	1122.62	1109	29	27.6		
0	609.57	42	41	1.00	1220.18	1215	13	34.5		
0	768.12	19	13	1.11	1537.27	1529	13	45.5		
0	913.21	17	16	0.97	1827.43	1823	14	52.4		
0	1120.33	16	17	2.11	2241.66	2236	13	59.2		
0	1461.66	83	13	2.85	2924.30	2915	22	16.5		
0	1764.21	38	3	3.15	3529.38	3519	19	18.7		

*Ann. Peak*  
*High FWHM*  
*Bi-214*  
*Bi-214*  
*High % error*  
*Bi-214*  
*K-40*  
*Bi-214*

*R-11-1+11*



Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	83	10.67*	2.352E+00	3.311E-07	3.311E-07	16.46

Flag: "\*" = Keyline

Sample ID : EFT-101011-2D

Acquisition date : 1-NOV-2011 09:50:29

Total number of lines in spectrum	8	
Number of unidentified lines	0	
Number of lines tentatively identified by MID	8	100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	3.311E-07	3.311E-07	0.545E-07	16.46	
Total Activity :			3.311E-07	3.311E-07			
Grand Total Activity :			3.311E-07	3.311E-07			

Flags: "K" = Keyline not found

"M" = Manually accepted

"E" = Manually edited

"A" = Nuclide specific abn. limit

Sample ID : EFT-101011-2D

Acquisition date : 1-NOV-2011 09:58:29

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
F-18	109.74M	100.71	511.00*	100.00	1.000E+35	11.65	Decay
% Abundances Found = 100.00							
SC-46	83.83D	0.16	142.53	62.70	---	Not Found	---
889.25* 99.90 --- Not Found ---							
1120.51 99.99 6.394E-09 59.24							
% Abundances Found = 38.07							
AS-76	26.32H	12.56	559.10*	44.70	2.133E-04	27.65	Decay, Abun.
563.23 1.17 --- Not Found ---							
571.30 0.14 --- Not Found ---							
657.03 6.10 --- Not Found ---							
665.31 0.39 --- Not Found ---							
740.12 0.12 --- Not Found ---							
771.76 0.12 --- Not Found ---							
867.63 0.12 --- Not Found ---							
1129.87 0.14 --- Not Found ---							
1212.72 1.63 --- Not Found ---							
1216.02 3.04 --- Not Found ---							
1220.52 1.39 --- Not Found ---							
1439.13 0.33 --- Not Found ---							
1453.60 0.13 --- Not Found ---							
1787.67 0.33 --- Not Found ---							
% Abundances Found = 73.70							
KR-90	32.32S	36814.96	121.82	32.00	---	Not Found	---
539.49 29.00 --- Not Found ---							
1110.69* 37.00 1.000E+35 59.24							
% Abundances Found = 37.76							
Y-92	3.54H	93.37	448.50	2.30	---	Not Found	---
561.10 2.40 8.404E+21 27.65							
844.30 1.25 --- Not Found ---							
934.46* 13.90 --- Not Found ---							
1405.40 4.80 --- Not Found ---							
% Abundances Found = 9.74							
RU-103	39.35D	0.35	497.00*	89.00	---	Not Found	---
610.33 5.60 2.252E-07 34.49							
% Abundances Found = 5.92							
TE-133M	55.40M	357.96	168.87	11.50	---	Not Found	---
261.55 15.70 --- Not Found ---							
334.14 5.40 --- Not Found ---							
647.40 29.30 --- Not Found ---							
863.91 19.50 --- Not Found ---							
912.58* 87.00 1.000E+35 52.43							
914.72 16.50 1.000E+35 52.43							
978.19 9.50 --- Not Found ---							
% Abundances Found = 53.24							
I-134	52.60M	377.02	135.40	3.76	---	Not Found	---
Decay, Abun.							

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by	
	Half-life	Ratio			(uCi/cc)	%Error		
I-134	52.60M	377.02	235.47	1.98	----	Not Found	----	Decay, Abun.
			405.45	7.30	----	Not Found	----	
			540.83	7.80	----	Not Found	----	
			595.36	11.40	----	Not Found	----	
			621.79	10.60	----	Not Found	----	
			677.34	8.50	----	Not Found	----	
			766.68	4.10	1.000E+35	45.50		
			847.03	95.41	----	Not Found	----	
			857.29	6.96	----	Not Found	----	
			884.09*	65.30	----	Not Found	----	
			947.86	4.04	----	Not Found	----	
			1072.55	15.30	----	Not Found	----	
			1136.16	9.70	----	Not Found	----	
			1613.00	4.36	----	Not Found	----	
			1806.84	5.70	----	Not Found	----	
			% Abundances Found =			1.56		
TE-134	41.80M	474.43	79.45	21.00	----	Not Found	----	Decay, Abun.
			180.89	18.00	----	Not Found	----	
			201.24	8.70	----	Not Found	----	
			210.47*	21.90	----	Not Found	----	
			277.95	21.30	----	Not Found	----	
			435.06	10.60	----	Not Found	----	
			461.00	10.00	----	Not Found	----	
			464.64	5.10	----	Not Found	----	
			565.99	18.90	----	Not Found	----	
			742.59	14.70	----	Not Found	----	
			767.20	30.00	1.000E+35	45.50		
% Abundances Found =			15.87					
XE-135	9.11H	36.28	249.79*	89.90	----	Not Found	----	Decay, Abun.
			608.19	2.89	2.857E+04	34.49		
% Abundances Found =			3.11					
PM-148M	41.30D	0.33	288.11	12.56	----	Not Found	----	Abun.
			414.07	18.66	----	Not Found	----	
			432.78	5.35	----	Not Found	----	
			501.26	6.75	----	Not Found	----	
			550.27*	94.90	----	Not Found	----	
			599.74	12.54	----	Not Found	----	
			611.26	5.48	2.275E-07	34.49		
			629.97	89.00	----	Not Found	----	
			725.70	32.80	----	Not Found	----	
			915.33	17.17	----	Not Found	----	
% Abundances Found =			1.74					
BI-214	19.90M	996.53	609.31*	46.30	1.000E+35	34.49	Decay	
			768.36	5.04	1.000E+35	45.50		
			934.06	3.21	----	Not Found		----
			1120.29	15.10	1.000E+35	59.24		
			1238.11	5.94	----	Not Found		----

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by	
	Half-life	Ratio			(uCi/cc)	%Error		
BI-214	19.90M	996.53	1377.67	4.11	---	Not Found	---	Decay
			1764.49	15.80	1.000E+35	10.73		
% Abundances Found =				86.12	(Abn. Limit = 48.48%)			

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	511.95	210	48	3.83	1024.95	1014	28	7.79E-02	11.6	4.58E+00	T
0	560.79	69	37	6.84	1122.62	1109	29	2.57E-02	27.6	4.40E+00	T
0	609.57	42	41	1.80	1220.10	1215	13	1.56E-02	34.5	4.25E+00	T
0	768.12	19	13	1.11	1537.27	1529	13	7.01E-03	45.5	3.56E+00	T
0	913.21	17	16	0.97	1827.43	1823	14	6.40E-03	52.4	3.05E+00	T
0	1120.33	16	17	2.11	2241.66	2236	13	5.79E-03	59.2	2.74E+00	T
0	1764.21	38	3	3.15	3529.38	3519	19	1.41E-02	18.7	2.14E+00	T

Flags: "T" = Tentatively associated

\*\*\*\*\*  
 \* Sample ID : EFT-101011-2D \*

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	32.	477.59	7.0420E-08
F-18	0.	511.00	Half-Life too short
NA-22	12.	1274.54	7.4401E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	14.	889.25	7.3304E-09
CR-51	33.	320.00	7.5553E-08
MN-54	25.	834.03	8.1307E-09
CO-56	26.	1238.25	1.7222E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	48.	158.38	2.6680E-08
CO-57	48.	122.06	7.7941E-09
CO-58	25.	810.76	8.8503E-09
FE-59	19.	1099.22	1.7803E-08
CO-60	13.	1332.49	7.9453E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	13.	1115.52	1.4319E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	58.	136.00	1.1018E-08
AS-76	0.	559.10	Half-Life too short
BR-82	20.	776.49	5.2613E-06
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	63.	513.99	2.0241E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	63.	513.99	1.0134E-08
RB-86	12.	1076.63	1.2975E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	5.	1836.01	7.0034E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	11.	1204.90	2.6997E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT-101811-2D

Acquisition date : 1-NOV-2011 09:58:29

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	24.	702.63	6.5929E-09
NB-95	19.	765.79	8.4237E-09
NB-95M	38.	235.69	2.9124E-07
ZR-95	15.	756.72	1.1917E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	17.	739.58	1.4844E-06
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	24.	497.08	7.9309E-09
TC-104	0.	357.99	Half-Life too short
RH-105	37.	318.90	1.8604E-05
RU-105	0.	724.50	Half-Life too short
RU-106	25.	621.84	6.4378E-08
CD-109	40.	88.03	2.6051E-07
AG-110M	25.	937.48	2.6175E-08
SN-113	41.	391.69	1.0591E-08
SN-117M	48.	158.56	1.2781E-08
SB-122	33.	563.93	3.2813E-07
SB-124	36.	602.71	8.5711E-09
SB-125	25.	427.89	1.8144E-08
TE-125M	56.	109.28	3.2658E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	34.	57.60	2.1383E-05
XE-127	56.	202.84	1.1339E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	22.	695.88	2.5269E-07
XE-129M	57.	196.56	3.6816E-07
I-130	0.	536.09	Half-Life too short
BA-131	58.	123.80	5.3753E-08
I-131	32.	364.48	2.2113E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	55.	163.93	6.6112E-07
I-132	0.	667.69	Half-Life too short
TE-132	44.	228.16	1.1759E-07
BA-133	42.	302.84	3.1971E-08
BA-133M	35.	276.09	1.0286E-05
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	32.	81.00	1.7678E-07
XE-133M	56.	233.22	4.6835E-06
CS-134	28.	604.70	6.6326E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1268.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short



Sample ID : EFT-101811-2D

Acquisition date : 1-NOV-2011 09:58:29

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	20.	818.50	1.4572E-08
I-136	0.	1313.02	Half-Life too short
CS-137	22.	661.65	7.0421E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	250.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	60.	165.85	8.0737E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	31.	537.32	5.4135E-08
LA-140	11.	1596.49	2.5158E-06
BA-141	0.	190.22	Half-Life too short
CE-141	50.	145.44	1.7124E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	43.	133.54	5.4362E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	34.	91.10	7.0183E-08
PM-148M	27.	550.27	8.0222E-09
EU-152	35.	344.27	2.0920E-08
EU-154	16.	1004.76	4.0650E-08
EU-155	37.	105.31	3.2991E-08
EU-156	27.	646.29	1.7119E-07
HF-181	33.	482.03	9.4529E-09
TA-182	18.	1221.42	3.4512E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
AU-199	48.	158.38	3.1321E-07
HG-203	51.	279.19	9.6105E-09
BI-207	20.	569.67	5.4970E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	51.	240.98	2.1051E-06
RA-226	62.	186.21	1.8750E-07
AC-228	39.	338.32	5.1323E-08
TH-228	44.	84.37	9.0950E-07
PA-234	0.	131.20	Half-Life too short
TH-234	41.	63.29	1.2472E-06
U-235	62.	143.76	6.1383E-08
NP-239	41.	106.13	1.7696E-06
AM-241	38.	59.54	1.4164E-07

**GEL LAB RESULTS**

**EFT-2D 2010**

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Company : Detroit Edison - Fermi 1  
Address : PO Box 44440  
Detroit, Michigan 48244

Report Date: February 17, 2010

Contact: Mr. Tom Mow  
Project: **Fermi 1 - PO# 4700246055**

Client Sample ID: EF1-2/D  
Sample ID: 245517007  
Matrix: Ground Water  
Collect Date: 04-JAN-10 11:30  
Receive Date: 25-JAN-10  
Collector: Client

Project: ROIT00116  
Client ID: ROIT001

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
<b>Rad Gas Flow Proportional Counting</b>											
<i>GFPC, Gross A/B, liquid "As Received"</i>											
Alpha	U	3.08	+/-3.04	4.45	5.00	pCi/L		DXB5 02/05/10	1436	945898	1
Beta		5.53	+/-2.52	3.27	5.00	pCi/L					

### The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EPA 900.0	

**GEL LABORATORIES LLC**

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

**Certificate of Analysis**

Company: Detroit Edison - Fermi 1  
 Address: PO Box 44440  
 Detroit, Michigan 48244  
 Contact: Mr. Tom Mow  
 Project: Fermi 1 - PO# 4700246055

Report Date: December 30, 2010

Client Sample ID: EFT-102510-2/D  
 Sample ID: 268144007  
 Matrix: Water  
 Collect Date: 25-OCT-10 11:25  
 Receive Date: 06-DEC-10  
 Collector: Client

Project: ROIT00116  
 Client ID: ROIT001

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
<b>Rad Gas Flow Proportional Counting</b>											
<i>GFPC, Gross A/B, liquid "As Received"</i>											
Alpha		5.01	+/-3.40	4.82	5.00	pCi/L		VXC2 12/29/10	1335	1059089	1
Beta		6.85	+/-2.24	2.82	5.00	pCi/L					

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	EPA 900.0/SW846 9310	

**EFT-4S**

**2006**

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-45061206

Sample Location (Well Number): EFT-45

1. Representative sample collected. Date/Time 06/12/06 / 1422

Sample collected by: Day Slebeck / [Signature] Date: 06/12/06  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Fealing / [Signature] Date: 08/02/06  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: [Signature] / [Signature] Date: 8-5-06  
Fermi 2 RP Printed Name Signature

Sample number: EFT-45061206

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Aberc , Andrew Hue Date: 8-6-06  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: RP LINDSEY , RP Hue Date: 2-21-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT  
GAMMA SPECTROSCOPY ANALYSIS REPORT  
HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-45061206 EF1

Sample End Time: 12-JUN-2006 14:22:00.00

REMARKS

PERFORMED BY:

*Andrew Hill*

SIGNATURE

REVIEWED BY:

*RD Roddy 2-21-08*

SIGNATURE/DATE



Sample ID : EFT-4S061206 EF1

Acquisition date : 5-AUG-2006 13:32:45

Fermi 2 Radiation Protection Gamma Spectroscopy Report

Sample Parameters

Sample ID Numbers: EFT-4S061206 EF1
Sample collection start date: 12-JUN-2006 14:22:00.00
Sample collection end date : 12-JUN-2006 14:22:00.00
Type of sample : 1 L Marin. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : N211 Operator: AKG

Acquisition Parameters

Detector number : DET 4 Acquire date : 5-AUG-2006 13:32:45.00
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:00:01.11 Percent dead time : 0.05 %

Calibration Parameters

Detector number : DET 4 Yearly cal date : 26-APR-2006 11:58:00.00
KeV/Channel : 5.00143E-01 Zero offset: -2.30456E-03
Daily cal date : 5-AUG-2006 03:20:12.42

Peak Search Parameters

Start channel: 100 End channel: 4000
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

Nuclide Identification Parameters

Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFT04\_m211 Efficiencies at : Peak energy

Table with 11 columns: Pk, It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. It contains 5 rows of peak data.

Post-HD Peak Search Report

Id	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	XErr	Fit	Nuclides
0	511.32	171	27	2.91	1022.65	1014	19	10.7		<i>Annihilation HW</i>
0	559.00	25	33	1.88	1118.71		15	23.2		
0	609.57	20	49	3.75	1219.24	1212	13	55.3		
1	1460.91	68	0	2.79	2913.51	2915	17	14.5	1.10E+00	<i>B. 214 K-40</i>
1	1461.91	15	0	2.42	2925.51	2915	17	63.7		

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorr Det	Det., Corr	1-Sigma
					uCi/cc	uCi/cc	%Error
K-40	1460.81	65	10.67%	2.300E+00	4.145E-07	4.145E-07	14.49

Flag: "w" - Keyline

Total number of lines in spectrum 5  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 5 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma XError	Flags
K-40	1.00E+05Y	1.00	4.145E-07	4.145E-07	0.600E-07	14.49	
Total Activity :			4.145E-07	4.145E-07			

Grand Total Activity : 4.145E-07 4.145E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Sample ID # EFT-43061206 Eri

Acquisition date : 5-AUG-2006 13:32:45

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	%Error	Rejected by
F-18	109.74M	708.87	511.00	100.00	1.000E+05	10.70	Decay
		% Abundances	Found =	100.00			
AS-76	26.32H	49.22	559.10*	44.70	3.297E+07	23.20	Decay, Abun.
			563.23	1.17	---	---	Not Found
			571.30	0.14	---	---	Not Found
			657.03	6.10	---	---	Not Found
			665.31	0.39	---	---	Not Found
			740.12	0.12	---	---	Not Found
			771.76	0.12	---	---	Not Found
			867.63	0.12	---	---	Not Found
			1129.07	0.14	---	---	Not Found
			1212.72	1.63	---	---	Not Found
			1216.02	3.84	---	---	Not Found
			1228.52	1.39	---	---	Not Found
			1439.13	0.33	---	---	Not Found
			1453.60	0.13	---	---	Not Found
			1707.67	0.33	---	---	Not Found
		% Abundances	Found =	73.70			
BR-84	31.80M	2444.21	604.80	1.00	---	---	Decay, Abun.
			736.50	1.31	---	---	Not Found
			802.20	6.10	---	---	Not Found
			881.50*	42.00	---	---	Not Found
			1015.90	6.20	---	---	Not Found
			1213.30	2.60	---	---	Not Found
			1463.00	2.00	1.000E+35	63.71	
			1741.20	1.60	---	---	Not Found
			1877.50	1.14	---	---	Not Found
			1897.30	14.90	---	---	Not Found
			2029.60	2.10	---	---	Not Found
		% Abundances	Found =	2.45			
RU-103	39.35D	1.37	497.00*	89.00	---	---	Abun.
			610.33	5.60	4.627E-07	55.29	
		% Abundances	Found =	5.92			
XE-135	9.11H	142.20	249.79*	89.90	---	---	Decay, Abun.
			600.19	2.89	1.000E+35	55.29	
		% Abundances	Found =	3.11			
PP-140M	41.30D	1.31	200.11	12.56	---	---	Abun.
			414.07	10.66	---	---	Not Found
			432.70	5.35	---	---	Not Found
			501.26	6.75	---	---	Not Found
			550.27*	94.90	---	---	Not Found
			599.74	12.54	---	---	Not Found
			611.26	5.40	4.521E-07	55.29	
			629.97	09.00	---	---	Not Found
			725.70	32.80	---	---	Not Found
			915.33	17.17	---	---	Not Found
			1013.01	20.30	---	---	Not Found
		% Abundances	Found =	1.74			

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
BI-214	19.90M	3905.82	609.31*	46.30	1.000E+35	55.29	Decay
			768.36	5.04	---	---	Not Found
			934.06	3.21	---	---	Not Found
			1120.29	15.10	---	---	Not Found
			1238.11	5.94	---	---	Not Found
			1377.67	4.11	---	---	Not Found
			1764.49	15.00	---	---	Not Found
% Abundances Found =			48.48	(Abn. Limit = 48.48%)			

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	511.32	171	27	2.91	1022.65	1014	19	9.48E-02	10.7	4.48E+00	T
0	559.00	65	33	2.09	1118.05	1111	15	3.59E-02	23.2	4.31E+00	T
0	609.57	20	49	3.75	1219.24	1212	13	1.54E-02	55.3	4.16E+00	T
1	1461.91	15	0	2.42	2925.51	2915	17	6.45E-03	63.7	2.31E+00	T

Flags: "T" = Tentatively associated

\* Sample ID : EFT-45061206 EF1

Minimum Detectable Activity Report

Nuclide	Bckgnd Sp.	Energy (keV)	MDA (uCi/cc)
BE-7	27.	477.53	1.7000E-07
F-18	0.	511.00	Half-Life too short
Na-22	5.	1274.54	8.7100E-09
Na-24	0.	1368.53	Half-Life too short
Mg-27	0.	1014.44	Half-Life too short
Cl-38	0.	1542.42	Half-Life too short
Cl-41	0.	1293.64	Half-Life too short
SC-46	10.	209.25	1.3707E-08
CR-51	35.	320.08	3.3542E-07
MN-54	12.	834.83	1.0099E-08
CO-56	19.	1238.25	3.2375E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	50.	158.38	4.0762E-06
CO-57	34.	122.06	1.1385E-08
CO-58	12.	810.76	1.4751E-08
FE-59	24.	1099.22	5.7787E-08
CO-60	11.	1332.49	1.1649E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	14.	1115.52	2.5710E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	47.	136.00	2.0000E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-84	0.	541.04	Half-Life too short
BR-84	0.	631.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	56.	513.99	2.9506E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	56.	513.99	2.2543E-06
RE-86	9.	1076.63	7.7169E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	308.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	8.	1036.01	1.6691E-08
KR-89	0.	220.90	Half-Life too short
RE-89	0.	1031.80	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
CD-90	0.	831.69	Half-Life too short
ZR-90M	0.	624.23	Half-Life too short
Y-90M	0.	200.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	8.	1204.90	5.6911E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	8.	934.46	Half-Life too short



Sample ID : EPT-45061205 EFl

Acquisition date : 5 JUL 2020 13:32:45

Nuclide	Backgd Sum	Energy (keV)	Concn (uCi/cc)
CR-51	0.	590.10	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	20.	702.63	9.3279E-09
NB-95	10.	765.79	2.1544E-08
NB-95M	0.	235.69	Half-Life too short
ZR-95	21.	756.72	3.3554E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	20.	497.00	2.2766E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	20.	621.84	9.6411E-08
CD-109	41.	80.03	4.5125E-07
AG-110M	8.	937.48	2.8409E-08
SN-113	32.	391.69	1.0419E-08
SN-117M	47.	158.56	1.5406E-07
SB-121	0.	563.93	Half-Life too short
SB-124	23.	602.71	1.6943E-08
SB-125	41.	427.89	3.5301E-08
TE-125M	40.	109.28	7.7594E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	39.	57.60	3.6153E-05
XE-127	40.	202.84	3.6000E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	24.	695.88	9.1612E-07
XE-129M	60.	196.56	1.3610E-05
I-130	0.	536.09	Half-Life too short
BA-131	41.	123.80	7.4094E-07
I-131	39.	364.48	1.1908E-06
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	55.	163.93	1.0800E-05
I-132	0.	667.69	Half-Life too short
TE-132	0.	220.16	Half-Life too short
BA-133	27.	302.84	4.2501E-08
BA-133M	0.	276.09	Half-Life too short
TE-133	0.	529.57	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	91.00	Half-Life too short
XE-133M	0.	232.22	Half-Life too short
CS-134	20.	604.70	1.0639E-08
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
I-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Nuclide	Background Sum	Energy (keV)	Activity (uCi/cc)
CS-137	10.	610.50	1.7676E-07
I-136	0.	1313.02	Half-Life too short
CS-137	16.	661.65	9.4361E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	250.31	Half-Life too short
DA-139	0.	1420.50	Half-Life too short
CE-139	59.	165.05	1.5263E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	20.	537.32	6.9991E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	44.	145.44	5.4920E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	49.	133.54	9.8362E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	20.	91.10	1.1300E-06
PM-148M	30.	550.27	2.5311E-08
CU-152	34.	344.27	3.2420E-08
EU-154	8.	1004.76	4.6979E-08
EU-156	23.	646.29	1.5392E-06
HF-181	30.	402.07	1.1000E-07
TA-182	10.	1221.42	5.1506E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HC-203	42.	279.19	2.5622E-08
BI-207	27.	569.67	9.7634E-09
TL-208	0.	583.14	Half-Life too short
DB-212	0.	230.63	Half-Life too short
TI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
TA-224	0.	240.90	Half-Life too short
RA-226	44.	186.21	2.5096E-07
AC-228	34.	338.32	7.5961E-08
TH-230	42.	84.37	1.4940E-06
PA-234	0.	131.20	Half-Life too short
TH-234	52.	63.29	6.6030E-06
U-235	30.	143.76	7.6030E-08
PF-239	0.	106.13	Half-Life too short
AM-241	43.	59.54	2.0654E-07

### FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-4S 061206

Sample Location (Well Number): EFT-4S

1. Representative sample collected. Date/Time 06/12/06 1 14 22

Sample collected by: Joy Slebeck / Joy Marie Slebeck Date: 06/12/06  
Printed Name / Signature Collection Date: 06/12/06  
Signed: 02/01/07

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample ≥ 50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Friling / Christopher Friling Date: 08/02/06  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Russ Burt Date: 2-5-7  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: William V Lipton / William V Lipton Date: 2/15/07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks No tritium detected. William V Lipton 4865 2/15/07

Tritium Activity Calculation

WR E F I 04-050  
Pg 2 of 2

Sample Information

1 . Sample Location EFT-4S061206  
 2 . Date Sampled 06/12/2006  
 3 . Time Sampled 14:22  
 4 . Sample Volume, (ml) 4 ml

Instrument Count Data


1 . Date Sample Counted 02/02/2007  
 2 . Time Sample Counted 10:00  
 3 . Background Inf.:  
 Minutes Counted 10 min.  
 Background Count Rate (cpm) 7.4 cpm  
 4 . Efficiency Inf.: (Daily Spike Source ID # 111)  
 Gross Spike Count Rate (cpm) 3388.1 cpm  
 Net Spike Count Rate (cpm) 3380.7 cpm  
 H3 Spike Activity (dpm on count date) 8340.7 dpm  
 Counter Efficiency 0.4053 cpm/dpm  
 5 . Sample Info:  
 Sample Gross Count Rate (cpm) 7.3 cpm  
 Sample Count Time (min.) 10.0 min.  
 Net Sample Count Rate (cpm) 0.0 cpm  
 6 . Critical Level:  
 Critical Level Count Rate (cpm) 2.0 cpm

Minimum Detectable Activity

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.12\text{E}-06 \text{ uCi/ml}$$

Sample Activity

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} < \text{MDA}$$

Technician  Date 2-5-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-45 061206

Sample Location (Well Number): EFT-45

1. Representative sample collected. Date/Time 06/12/06 1 14 22

Sample collected by: Jay Stabach / Jay Stabach Date: 06/12/06  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Freiling / Christopher Freiling Date: 08/02/06  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Ross Burger / Ross Burger Date: 8-3-06  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: K.J. LINDSAY / K.J. Lindsay Date: 2-21-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-4S
2 . Date Sampled	06/12/2006
3 . Time Sampled	14:42
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	08/03/2006
2 . Time Sample Counted	10:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.2 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3598.6 cpm
Net Spike Count Rate (cpm)	3591.4 cpm
H3 Spike Activity (dpm on count date)	8580.4 dpm
Counter Efficiency	0.4186 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	7.6 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.4 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

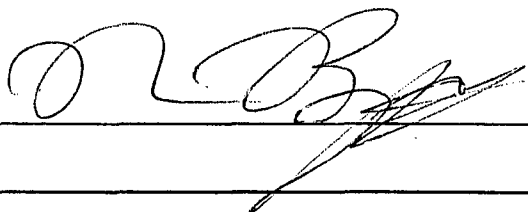
$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.07\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician



Date

8-3-06

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-45061206

Sample Location (Well Number): EFT-45

1. Representative sample collected. Date/Time 06/12/06 / 1422

Sample collected by: Day Slaback / Jay Marie Slaback Date: 06/12/06  
Printed Name / Signature <sup>Collection</sup>  
Signed 02/01/07

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: Christopher Freiling / Cheryl A. Enly Date: 08/02/06  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: RO Givens / RO Givens Date: 8-21-07  
Fermi 2 RP Printed Name Signature

Sample number: EFT-45061706

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard [Signature] Date: 7-10-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: [Signature] [Signature] Date: 8-21-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

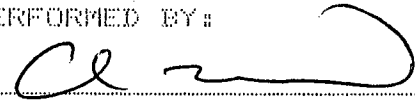
HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1 EFT-48061206

Sample End Time: 12-JUN-2006 14:22:00.00

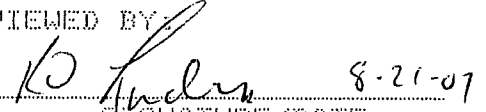
REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:



SIGNATURE

REVIEWED BY:



SIGNATURE/DATE

Sample ID : EF1 EFT-45061206

Acquisition date : 10-JUL-2007 09:19:32

Fermi 2 Radiation Protection Gamma Spectroscopy Report

Sample Parameters

Sample ID Number: EF1 EFT-45061206  
 Sample collection start date: 12-JUN-2006 14:22:00.00  
 Sample collection end date : 12-JUN-2006 14:22:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.000000E+03 CC  
 Sample geometry : MELL Operator: CMH

Acquisition Parameters

Detector number : DET 4 Acquire date : 10-JUL-2007 09:19:32.49  
 Preset live time : 0700:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:00.89 Percent dead time : 0.05 %

Calibration Parameters

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16  
 KeV/channel : 4.99804E-01 Zero offset: -3.08949E-01  
 Daily cal date : 10-JUL-2007 07:47:29.07

Peak Search Parameters

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

Nuclide Identification Parameters

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	140.13	44	75	0.94	200.90	275	12	2.43E-02	42.4	FWHM < 1 High error
2	0	510.99	139	20	3.13	1022.90	1015	16	8.83E-02	10.9	annihilation
3	0	550.87	61	34	2.25	1110.76	1110	19	3.41E-02	25.9	HWC
4	0	1460.95	59	0	1.91	2923.49	2916	16	3.20E-02	13.0	K-40

Sample Title : EF1 EFT-48061206  
Decay Time = 392 18:57:32.499

Page : 1  
Acquisition Time = 10-JUL-2007 09:19:32.4

9

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	XErr	Fit	Nuclides
0	140.13	44	75	0.94	200.90	275	12	42.4		
0	510.99	159	20	3.13	1022.90	1015	16	10.9		
0	550.07	61	34	2.25	1110.76	1110	19	25.9		
0	1460.95	59	0	1.91	2923.49	2916	16	13.0		K-40

Nuclide Line Activity Report  
Sample ID : EF1 EFT-46061206

Page : 2  
Acquisition date : 10-JUL-2007 09:19:32

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/CC	Decay Corr uCi/CC	1-Sigma %Error
K-40	1460.81	59	10.67*	2.501E+00	3.319E-07	3.319E-07	13.02

Flag: "\*" = Keyline

Summary of Nuclide Activity  
Sample ID : EF1 EFT-49061206

Page : 3  
Acquisition date : 10-JUL-2007 09:19:32

Total number of lines in spectrum : 4  
Number of unidentified lines : 0  
Number of lines tentatively identified by NID : 4 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/CC	Decay Corr uCi/CC	Decay Corr 1-Sigma Error	1-Sigma XError	Flags
K-40	1.00E+05Y	1.00	3.319E-07	3.319E-07	0.432E-07	13.0E	
Total Activity :			3.319E-07	3.319E-07			

Grand Total Activity : 3.319E-07 3.319E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Sample ID : E1 EFT-45061206

Acquisition date : 10-JUL-2007 09:19:32

Nuclide	Half-life	Ratio	Energy	%Abund	Activity (uCi/CC)	1-Sigma %Error	Rejected by
F-18	109.74M	5154.30	511.00*	193.46	1.000E+35	10.68	Decay
% Abundances Found = 100.00							
AS-76	26.32H	358.18	559.10*	44.70	1.000E+35	25.92	Decay, Abun.
			563.23	1.17	----	Not Found	----
			571.30	0.14	----	Not Found	----
			657.03	6.10	----	Not Found	----
			665.31	0.39	----	Not Found	----
			740.12	0.12	----	Not Found	----
			771.76	0.12	----	Not Found	----
			867.63	0.12	----	Not Found	----
			1129.07	0.14	----	Not Found	----
		>	1212.72	1.63	----	Not Found	----
			1216.02	3.84	----	Not Found	----
			1228.52	1.39	----	Not Found	----
			1439.13	0.33	----	Not Found	----
			1453.60	0.13	----	Not Found	----
			1787.67	0.33	----	Not Found	----
% Abundances Found = 73.70							
MO-99	66.02H	142.79	140.51	3.80	1.000E+35	42.400	Decay, Abun.
			181.06	6.20	----	Not Found	----
			366.43	1.37	----	Not Found	----
			739.58*	12.80	----	Not Found	----
			778.00	4.50	----	Not Found	----
% Abundances Found = 13.25							
TC-99M	6.02H	1565.98	140.50*	89.07	1.000E+35	42.40	Decay
% Abundances Found = 100.00							

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EF1 EFT-48061206

Page : 5  
Acquisition date : 10-JUL-2007 09:19:32

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	140.13	44	75	0.94	280.98	275	12	2.43E-02	42.4	6.40E+00	T
0	510.99	159	28	3.13	1022.98	1015	16	8.83E-02	10.9	4.80E+00	T
0	558.07	61	34	2.25	1118.76	1110	19	3.41E-02	25.9	4.60E+00	T

Flags: "T" = Tentatively associated

Sample ID : EF1-EFT-45061206

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
BE-7	27.	477.59	1.2605E-05
F-18	0.	511.00	<Half-Life too short
NA-22	5.	1274.54	1.0011E-08
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	6.	889.25	1.6773E-07
CR-51	0.	320.08	Half-Life too short
MN-54	0.	834.83	1.6016E-08
CO-56	12.	1238.25	4.8583E-07
MN-56 ?	0.	1810.69	Half-Life too short
NI-56	0.	158.38	Half-Life too short
CO-57	33.	122.06	2.4223E-08
CO-58	7.	810.76	3.0400E-07
FE-59	11.	1099.22	7.2284E-06
CO-60	13.	1332.49	1.2594E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1491.84	Half-Life too short
ZN-65	16.	1115.52	6.5840E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	43.	136.00	1.3036E-07
AG-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	47.	513.99	2.6722E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	47.	513.99	7.1937E-07
RB-86	0.	1076.63	Half-Life too short
KR-97	0.	482.50	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	4.	1036.01	1.0260E-07
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.80	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	17.	1204.90	4.0976E-04
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short



Sample ID : EF1 EFT-45061206

Acquisition date : 10-JUL-2007 09:19:32

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/Cs)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	13.	702.63	7.0759E-09
NB-95	0.	765.79	Half-Life too short
NB-95M	0.	235.69	Half-Life too short
ZR-95	18.	756.72	1.1320E-06
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	15.	497.08	7.2207E-06
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	14.	621.84	1.4162E-07
CD-109	39.	88.03	6.5203E-07
AG-110M	11.	937.48	7.4918E-08
SN-113	27.	391.69	1.2072E-07
SN-117M	0.	158.56	Half-Life too short
SB-122	0.	563.93	Half-Life too short
SB-124	30.	602.71	8.8193E-07
SB-125	25.	427.89	3.3120E-08
TE-125M	35.	109.28	3.4598E-04
TE-127	0.	417.90	Half-Life too short
TE-127M	21.	57.60	2.4769E-04
XE-127	0.	202.04	Half-Life too short
TE-129	0.	459.60	Half-Life too short
TE-129M	0.	695.88	Half-Life too short
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	0.	123.80	Half-Life too short
I-131	0.	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	0.	163.93	Half-Life too short
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	33.	302.84	4.4046E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	20.	604.70	1.1430E-08
I-134	0.	584.89	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
CS-136	0.	818.50	Half-Life too short
I-136	0.	1313.02	Half-Life too short
CS-137	16.	661.65	8.9335E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.06	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	41.	165.85	6.5160E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	0.	537.32	Half-Life too short
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	0.	145.44	Half-Life too short
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	42.	133.54	1.9124E-07
PR-144	0.	1489.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PM-148M	20.	550.27	5.6868E-06
EU-152	29.	344.27	2.9901E-08
EU-154	13.	1004.76	5.8197E-08
EU-156	0.	646.29	Half-Life too short
HF-181	29.	482.03	6.2012E-06
TA-182	8.	1221.42	3.4429E-07
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	38.	279.19	3.4055E-06
BI-207	22.	569.67	8.2882E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	59.	186.21	2.6432E-07
AC-228	37.	338.32	7.9644E-08
TH-228	40.	84.37	1.8354E-06
PA-234	0.	131.20	Half-Life too short
TH-234	0.	63.29	Half-Life too short
U-235	42.	143.76	7.2561E-08
NP-239	0.	106.13	Half-Life too short
AM-241	23.	59.54	1.5439E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-45 121406

Sample Location (Well Number): EFT-45

1. Representative sample collected. Date/Time 12/14/06 1 1335

Sample collected by: J. Slaback / Joy Mari Slaback Date: 02/01/07  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 2/2/07  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: D. Howard / DM Howard Date: APR 20 2007  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KJ Lindzey / KJ Lindzey Date: 11-14-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_



## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-45 121406

Sample Location (Well Number): EFT-45

1. Representative sample collected. Date/Time 12/14/06 1 1335

Sample collected by: J. Slaback / Amy Marie Slaback Date: 02/01/07  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 7/11/07  
2/2/07  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: R. Lindsey / R. Lindsey Date: 8-8-07  
Fermi 2 RP Printed Name Signature

Sample number: EFT-45121406

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard / [Signature] Date: 7-16-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: KD Lindsey / [Signature] Date: 8-8-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1 EFT-48121406

Sample End Time: 14-DEC-2006 13:35:00.00

REMARKS

PERFORMED BY:

SIGNATURE

REVIEWED BY:

SIGNATURE/DATE

Sample ID : EF1 EFT 4S121406

Acquisition date : 16-JUL-2007 14:16:40

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-4S121406
Sample collection start date: 14-DEC-2006 13:35:00.00
Sample collection end date : 14-DEC-2006 13:35:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.000000E+03 CC
Sample geometry : PELL Operator: CFM

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 16-JUL-2007 14:16:40.51
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:00.00 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16
Kev/channel : 4.09730E-01 Zero offset: -1.95000E-01
Daily cal date : 16-JUL-2007 08:37:10.01

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Table with 11 columns: Pk It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. Contains 5 rows of peak data with handwritten annotations like 'PA 238', 'annihilation', 'Huc', 'K-40'.



1

Post-MID Peak Search Report

It	Energy	Area	dBkgnd	FWHM	Channel	Left	Pw	NErr	Fit	Nuclides
0	199.61	57	58	3.29	399.81	394	11	29.2		
0	511.15	121	64	1.71	1023.21	1015	16	16.0		
0	559.26	90	37	1.90	1117.47	1100	17	20.9		
0	610.13	41	26	3.20	1221.26	1215	11	29.2		
0	1460.81	44	4	2.14	2923.36	2917	15	18.0		K-40

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/CC	Decay Corr uCi/CC	1-Sigma %Error
K-40	1460.81	44	10.67*	2.501E+00	2.462E-07	2.462E-07	10.00

Flags: "\*" = Keyline

Total number of lines in spectrum 5  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 5 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/CC	Decay Corr uCi/CC	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.462E-07	2.462E-07	0.443E-07	10.00	
Total Activity :			2.462E-07	2.462E-07			
Grand Total Activity :			2.462E-07	2.462E-07			

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Sample ID : EF1 EFT-49121406

Acquisition date : 16-JUL-2007 14:16:40

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/CC)	%Error	
F-18	109.74M	2800.61	511.00*	193.46	1.000E+35	16.05	Decay
		% Abundances	Found =	100.00			
SE-75	119.78D	1.79	66.05	1.02	---- Not Found ----		Abun.
			96.73	3.41	---- Not Found ----		
			121.12	16.70	---- Not Found ----		
			136.00*	59.20	---- Not Found ----		
			198.60	1.45	3.114E-06	29.21	
			264.65	59.80	---- Not Found ----		
			279.53	25.20	---- Not Found ----		
			303.91	1.32	---- Not Found ----		
			400.65	11.40	---- Not Found ----		
		% Abundances	Found =	0.81			
AS-76	26.32H	195.17	559.10*	44.70	1.000E+35	20.93	Decay, Abun.
			563.23	1.17	---- Not Found ----		
			571.30	0.14	---- Not Found ----		
			657.03	6.10	---- Not Found ----		
			665.31	0.39	---- Not Found ----		
			740.12	0.12	---- Not Found ----		
			771.76	0.12	---- Not Found ----		
			867.63	0.12	---- Not Found ----		
			1129.87	0.14	---- Not Found ----		
			1212.72	1.63	---- Not Found ----		
			1216.02	3.04	---- Not Found ----		
			1228.52	1.39	---- Not Found ----		
			1439.13	0.33	---- Not Found ----		
			1453.60	0.13	---- Not Found ----		
			1787.67	0.33	---- Not Found ----		
		% Abundances	Found =	73.70			
RU-103	39.35D	5.44	497.08*	89.00	---- Not Found ----		Abun.
			610.33	5.60	1.053E-05	29.22	
		% Abundances	Found =	5.92			
TE-131M	30.00H	171.23	102.00	7.90	---- Not Found ----		Decay, Abun.
			149.72	5.10	---- Not Found ----		
			200.63	7.56	1.000E+35	29.21	
			240.93	7.59	---- Not Found ----		
			334.27	9.60	---- Not Found ----		
			773.67*	38.20	---- Not Found ----		
			782.49	7.79	---- Not Found ----		
			793.75	13.90	---- Not Found ----		
			822.78	6.12	---- Not Found ----		
			852.21	20.70	---- Not Found ----		
			1125.46	11.40	---- Not Found ----		
			1206.60	9.80	---- Not Found ----		
		% Abundances	Found =	5.19			
TE-134	41.00M	7373.60	179.45	21.00	---- Not Found ----		Decay, Abun.
			180.89	10.00	---- Not Found ----		
			201.24	0.70	1.000E+35	29.21	

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/CC)	%Error	
TE-134	41.80M	7373.60	210.47*	21.90	----	Not Found	Decay, Abun.
			277.95	21.30	----	Not Found	
			435.06	18.60	----	Not Found	
			461.00	10.80	----	Not Found	
			464.64	5.10	----	Not Found	
			565.99	18.90	----	Not Found	
			742.59	14.70	----	Not Found	
			767.20	30.00	----	Not Found	
% Abundances Found =				4.60			
NE-135	9.11H	563.80	249.79*	89.90	----	Not Found	Decay, Abun.
			600.19	2.89	1.000E+35	29.22	
			% Abundances Found =				
PM-140M	41.30D	5.10	288.11	12.56	----	Not Found	Abun.
			414.07	18.66	----	Not Found	
			432.78	5.35	----	Not Found	
			501.26	6.75	----	Not Found	
			550.27*	94.90	----	Not Found	
			599.74	12.54	----	Not Found	
			611.26	5.48	9.003E-06	29.22	
			629.97	99.00	----	Not Found	
			725.70	32.80	----	Not Found	
			915.33	17.17	----	Not Found	
1013.81				28.30	----	Not Found	
% Abundances Found =				1.74			
BI-214	19.90M	15488.27	609.31*	46.30	1.000E+35	29.22	Decay
			768.36	5.84	----	Not Found	
			934.06	3.21	----	Not Found	
			1120.29	15.10	----	Not Found	
			1238.11	5.94	----	Not Found	
			1377.67	4.11	----	Not Found	
			1764.49	15.80	----	Not Found	
			% Abundances Found =				

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	199.61	57	58	3.29	399.91	394	11	3.19E-02	29.2	6.59E+00	T
0	511.15	121	64	1.71	1023.21	1015	16	6.72E-02	16.6	4.89E+00	T
0	550.26	80	37	1.80	1117.47	1100	17	4.44E-02	20.9	4.69E+00	T
0	610.13	41	26	3.28	1221.26	1215	11	2.27E-02	29.2	4.52E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
BE-7	22.	477.59	1.1324E-06
F-18	0.	511.00	Half-Life too short
NA-22	4.	1274.54	7.4412E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	19.	889.25	6.1468E-08
CR-51	24.	320.00	1.3822E-05
MN-54	11.	834.83	1.2632E-08
CO-56	11.	1230.25	9.7107E-09
MN-56	0.	1010.69	Half-Life too short
NI-56	0.	158.30	Half-Life too short
CO-57	43.	122.06	1.7330E-08
CO-58	11.	810.76	6.2138E-08
FE-59	13.	1099.22	4.9839E-07
CO-60	10.	1332.49	1.0900E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.04	Half-Life too short
ZN-65	0.	1115.52	2.9302E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	51.	136.00	5.0132E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	41.	513.99	2.4133E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	41.	513.99	9.9201E-08
RB-86	0.	1076.63	Half-Life too short
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	3.	1836.01	2.9608E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.08	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	14.	1204.90	4.5549E-05
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EF1 EFT-49121486

Acquisition date : 16-JUL-2007 14:16:46

Nuclide	Eckgnd Sum	Energy (keV)	MDA (uCi/CC)
SR-93	0.	598.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	17.	782.63	7.9189E-09
NB-95	13.	765.79	5.3349E-07
NB-95M	0.	235.69	Half-Life too short
ZR-95	6.	756.72	1.0452E-07
NB-97	0.	657.98	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	148.58	Half-Life too short
TC-101	0.	386.81	Half-Life too short
RU-103	23.	497.88	3.6917E-07
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.98	Half-Life too short
RU-105	8.	724.58	Half-Life too short
RU-106	23.	621.84	1.2803E-07
CD-109	36.	88.83	4.8387E-07
AG-110M	11.	937.48	4.5797E-08
SN-113	28.	391.69	4.1861E-08
SN-117M	0.	158.56	Half-Life too short
SB-122	0.	563.93	Half-Life too short
SB-124	18.	682.71	9.0836E-08
SB-125	29.	427.89	3.1864E-08
TE-125M	29.	189.28	3.7783E-05
TE-127	0.	417.98	Half-Life too short
TE-127M	32.	57.68	9.5642E-05
XE-127	43.	282.84	6.5866E-07
TE-129	0.	459.68	Half-Life too short
TE-129M	18.	695.88	2.0074E-05
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.89	Half-Life too short
BA-131	0.	123.88	Half-Life too short
I-131	<	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	0.	163.93	Half-Life too short
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	> 26.	382.84	3.8572E-08
BA-133M	0.	276.89	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.88	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	24.	684.78	1.0508E-08
I-134	0.	884.89	Half-Life too short
TE-134	0.	218.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1268.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short



Sample ID : EF1 EFT-49121406

Acquisition date : 10-JUL-2007 14:16:40

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/CC)
CS-136	0.	819.50	Half-Life too short
I-136	0.	1313.02	Half-Life too short
CS-137	15.	661.65	9.4829E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	38.	165.85	2.5499E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	0.	537.32	Half-Life too short
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	41.	145.44	1.4811E-06
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	48.	123.54	1.3084E-07
FR-144	0.	1489.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
FM-148M	28.	550.27	2.8697E-07
EU-152	26.	344.27	2.6800E-08
EU-154	11.	1004.76	5.0887E-08
EU-156	0.	646.29	Half-Life too short
HF-181	19.	492.03	2.7473E-07
TA-182	7.	1221.42	1.1114E-07
W-187	0.	695.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	42.	279.19	2.4966E-07
BI-207	23.	569.67	8.3252E-09
TL-208	0.	593.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	40.	186.21	2.0817E-07
AC-228	34.	338.32	7.2378E-08
TH-228	36.	84.37	1.4717E-06
PA-234	0.	131.20	Half-Life too short
TH-234	32.	63.29	4.9837E-04
U-235	50.	143.76	7.8366E-08
NP-239	0.	106.13	Half-Life too short
AM-241	22.	59.54	1.5177E-07

**EFT-4S**

**2007**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-45'7307

Sample Location (Well Number): EFT-45'

1. Representative sample collected. Date/Time 7/3/07 1:40p

Sample collected by: Jay Marie Slaback / Jay Marie Slaback Date: 12/10/07  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 12/10/07  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: R. Byrnes / [Signature] Date: 12/14/07  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: RD LINDSEY / [Signature] Date: 2-26-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location 4S  
 2 . Date Sampled 07/03/2007  
 3 . Time Sampled 14:02  
 4 . Sample Volume, (ml) 4 ml

**Instrument Count Data**

1 . Date Sample Counted 12/14/2007  
 2 . Time Sample Counted 08:00  
 3 . Background Inf.:  
     Minutes Counted 10 min.  
     Background Count Rate (cpm) 8.2 cpm  
 4 . Efficiency Inf.: (Daily Spike Source ID # 111)  
     Gross Spike Count Rate (cpm) 3189.3 cpm  
     Net Spike Count Rate (cpm) 3181.1 cpm  
     H3 Spike Activity (dpm on count date) 7944.9 dpm  
     Counter Efficiency 0.4004 cpm/dpm  
 5 . Sample Info:  
     Sample Gross Count Rate (cpm) 9.2 cpm  
     Sample Count Time (min.) 10.0 min.  
     Net Sample Count Rate (cpm) 1.0 cpm  
 6 . Critical Level:  
     Critical Level Count Rate (cpm) 0.21 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\frac{\text{(Bkg cpm)}}{\text{(Bkg min.)}} + \frac{\text{(Bkg cpm)}}{\text{(Smpl. min.)}}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.19\text{E}-06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician \_\_\_\_\_



Date 12-14-07

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-457307

Sample Location (Well Number): EFT-45

1. Representative sample collected. Date/Time 07/03/2007 / 1402

Sample collected by: J. Slaback / Joy Marie Slaback Date: 07/16/2007  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 7/16/2007  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: RD Lowrey / RD Lowrey Date: 8-8-07  
Fermi 2 RP Printed Name Signature

Sample number: EFT-457307

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard, Ce r n d Date: 7-18-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: RD Lindsey | RD Lindsey Date: 8-8-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1 EFT-487307

Sample End Time: 3-JUL-2007 14:02:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*[Handwritten Signature]*

SIGNATURE

REVIEWED BY:

*[Handwritten Signature]* 8-8-07

SIGNATURE/DATE

Sample ID : EF1 EFT-457307

Acquisition date : 10-JUL-2007 09:47:34

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-457307
Sample collection start date: 3-JUL-2007 14:02:00.00
Sample collection end date : 3-JUL-2007 14:02:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : MELL Operator: CMH

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 10-JUL-2007 09:47:34.43
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:00.91 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly caldate : 20-JUN-2007 12:16:46.16
KeV/channel : 4.99749E-01 Zero offset: -1.04251E-01
Daily cal date : 10-JUL-2007 07:51:31.39

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Table with 11 columns: Pk, It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. Contains 6 rows of peak data with handwritten annotations like 'RN-227', 'PB-214', 'annihilation', 'HwC', 'BI-214', 'K-40'.



Sample Title : EF1 EFT-497307  
Decay Time = 14 19:45:34.43

Page : 1  
Acquisition Time = 18-JUL-2007 09:47:34.1

3

Post-NID Peak Search Report

It	Energy	Area	Bgnd	FWHM	Channel	Left	Pw	XErr	Fit	Nuclides
0	66.66	40	25	1.47	133.75	131	6	25.7		
0	352.50	39	55	1.53	705.71	698	15	45.3		
0	511.02	144	66	3.40	1022.91	1014	19	15.9		
0	558.65	63	17	1.72	1119.21	1113	13	18.3		
0	609.34	61	19	1.85	1219.63	1212	15	30.0		
0	1461.90	30	16	1.39	2925.52	2919	13	20.5		K-40

Nuclide Line Activity Report  
Sample ID : EF1 EFT-457307

Page : 2  
Acquisition date : 10-JUL-2007 09:47:34

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.91	38	10.67*	2.500E+00	2.139E-07	2.139E-07	28.51

Flag: "\*" = Keyline

Summary of Nuclide Activity

Sample ID : CFI EFT-457307

Acquisition date : 18-JUL-2007 09:47:24

Total number of lines in spectrum 6  
 Number of unidentified lines 0  
 Number of lines tentatively identified by MID 6 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.139E-07	2.139E-07	0.610E-07	28.51	
Total Activity :			2.139E-07	2.139E-07			
Grand Total Activity :			2.139E-07	2.139E-07			

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Rejected Report  
 Sample ID : EF1 EFT-437307

Page : 4  
 Acquisition date : 19-JUL-2007 09:47:34

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
F-18	109.74M	194.65	511.00*	100.46	1.000E+35	15.00	Decay
% Abundances Found =				100.00			
GE-75	119.7AD	0.12	66.05	1.02	4.423E-06	25.69	Abun.
				96.73	3.41	---	Not Found
				121.12	16.70	---	Not Found
				136.00*	59.20	---	Not Found
				190.60	1.45	---	Not Found
				264.65	59.00	---	Not Found
				279.53	25.20	---	Not Found
				303.71	1.32	---	Not Found
				400.65	11.40	---	Not Found
% Abundances Found =				0.57			
AS-76	26.32H	13.53	559.10*	44.70	5.334E-04	10.27	Decay, Abun.
				563.23	1.17	---	Not Found
				571.30	0.14	---	Not Found
				657.03	6.10	---	Not Found
				665.31	0.39	---	Not Found
				740.12	0.12	---	Not Found
				771.76	0.12	---	Not Found
				867.63	0.12	---	Not Found
				1129.07	0.14	---	Not Found
				1212.72	1.63	---	Not Found
				1216.02	3.04	---	Not Found
				1220.52	1.39	---	Not Found
				1439.13	0.33	---	Not Found
				1453.60	0.13	---	Not Found
				1707.67	0.33	---	Not Found
% Abundances Found =				73.70			
BR-84	31.00M	671.72	604.00	1.00	---	---	Decay, Abun.
				736.50	1.31	---	Not Found
				802.20	6.10	---	Not Found
				881.50*	42.00	---	Not Found
				1015.90	6.20	---	Not Found
				1213.30	2.60	---	Not Found
				1403.00	2.00	1.000E+35	20.51
				1741.20	1.60	---	Not Found
				1977.50	1.14	---	Not Found
				1997.30	14.90	---	Not Found
				2029.60	2.10	---	Not Found
% Abundances Found =				8.45			
RU-103	39.35D	0.39	497.98*	89.00	---	---	Abun.
				610.33	5.60	4.732E-07	19.96
% Abundances Found =				5.92			
ME-135	9.11H	39.05	249.79*	99.90	---	---	Decay, Abun.
				600.19	2.99	4.100E+05	19.96
% Abundances Found =				3.11			

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
CS-136	13.16D	1.13	66.91	12.50	7.234E-07	25.69	Abun.
			86.29	6.30	----	Not Found	----
			153.22	7.46	----	Not Found	----
			163.09	4.61	----	Not Found	----
			176.55	13.56	----	Not Found	----
			273.65	12.66	----	Not Found	----
			340.57	40.50	----	Not Found	----
			510.50*	22.70	----	Not Found	----
			1040.07	79.60	----	Not Found	----
			1235.34	19.70	----	Not Found	----
% Abundances Found =				4.10			
PM-140M	41.30D	0.36	283.11	12.56	----	Not Found	Abun.
			414.07	18.66	----	Not Found	----
			432.70	5.35	----	Not Found	----
			501.26	6.75	----	Not Found	----
			550.27*	24.90	----	Not Found	----
			599.74	12.54	----	Not Found	----
			611.26	5.40	4.777E-07	19.96	
			629.97	89.00	----	Not Found	----
			725.70	32.00	----	Not Found	----
			915.33	17.17	----	Not Found	----
1013.91	20.30	----	Not Found	----			
% Abundances Found =				1.74			
TG-182	114.74D	0.13	67.75	42.30	1.070E-07	25.69	Abun.
			100.10	14.10	----	Not Found	----
			1189.05	16.30	----	Not Found	----
			1221.42*	27.10	----	Not Found	----
			1230.97	11.50	----	Not Found	----
% Abundances Found =				38.01			
BI-214	19.90M	1073.40	609.31*	46.30	1.000E+35	19.96	Decay
			768.36	5.04	----	Not Found	----
			934.06	3.21	----	Not Found	----
			1120.29	15.10	----	Not Found	----
			1230.11	5.94	----	Not Found	----
			1377.67	4.11	----	Not Found	----
			1764.49	15.00	----	Not Found	----
% Abundances Found =				48.40	(Abn. Limit = 48.40%)		
PE-214	26.80M	797.04	97.30	4.67	----	Not Found	Decay
			241.98	7.49	----	Not Found	----
			325.21	19.20	----	Not Found	----
			351.92*	37.20	1.000E+35	45.20	
			785.91	1.10	----	Not Found	----
% Abundances Found =				53.40	(Abn. Limit = 37.20%)		

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EF1 EFT-487307

Page : 6  
Acquisition date : 10-JUL-2007 09:47:34

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	66.66	40	25	1.47	133.75	131	6	2.22E-02	25.7	1.45E+00	T
0	352.50	39	55	1.53	705.71	698	15	2.19E-02	45.3	5.70E+00	T
0	511.02	144	66	3.40	1022.91	1014	19	0.02E-02	15.9	4.08E+00	T
0	558.65	63	17	1.72	1119.21	1113	13	3.50E-02	10.3	4.69E+00	T
0	609.34	61	19	1.05	1219.63	1212	15	3.41E-02	20.0	4.52E+00	T

Flag: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	21.	477.59	8.3120E-08
F-18	0.	511.00	Half-Life too short
NA-22	7.	1274.54	8.4466E-09
NA-24	0.	1360.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	18.	889.25	1.1583E-08
CR-51	28.	328.08	1.0168E-07
MN-54	22.	834.83	1.0874E-08
CO-56	13.	1238.25	1.0054E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	44.	150.38	4.1167E-08
CO-57	45.	122.06	1.0722E-08
CO-58	12.	818.76	9.1220E-09
FE-59	12.	1099.22	2.1601E-08
CO-60	8.	1332.49	8.9259E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	5.	1115.52	1.3910E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	40.	136.00	1.4089E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	47.	513.99	2.4787E-08
KR-85M	0.	151.18	Half-Life too short
SR-85	47.	513.99	1.2549E-08
RB-86	12.	1076.63	1.8525E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	6.	1830.01	1.0621E-08
KR-89	0.	228.90	Half-Life too short
RB-89	0.	1031.00	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	9.	1204.00	3.5940E-08
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	12.	702.63	6.9137E-09
NE-95	10.	765.79	9.1341E-09
NB-95M	35.	235.69	4.9457E-07
ZR-95	11.	756.72	1.5114E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	7.	739.58	1.9297E-06
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	26.	497.00	1.1713E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	21.	621.84	8.4064E-09
CD-109	32.	88.03	3.4070E-07
AG-110M	13.	937.40	2.7671E-08
SN-113	24.	391.69	1.1762E-08
SN-117M	43.	158.56	1.8307E-08
SB-122	11.	563.93	3.6902E-07
SB-124	27.	602.71	1.0041E-09
SB-125	19.	427.09	2.2294E-08
TE-125M	35.	100.20	3.0101E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	35.	57.60	2.7982E-05
XE-127	42.	202.84	1.4640E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	16.	695.88	3.1957E-07
XE-129M	52.	196.56	5.5024E-07
I-130	0.	536.09	Half-Life too short
BA-131	39.	123.80	6.7206E-08
I-131	34.	364.48	3.4963E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	42.	163.93	0.9220E-07
I-132	0.	667.69	Half-Life too short
TE-132	41.	229.16	2.0505E-07
BA-133	44.	302.84	4.7141E-08
BA-133M	53.	270.09	2.0114E-05
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	30.	01.00	2.8375E-07
XE-133M	33.	233.22	7.4324E-06
CS-134	22.	604.70	8.4549E-09
I-134	0.	004.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	260.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short



Nuclide	Decayd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	13.	810.50	1.8141E-08
I-136	0.	1313.02	Half-Life too short
CS-137	17.	661.65	8.8195E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	42.	165.85	9.8943E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	30.	537.32	6.5816E-08
LA-140	0.	1596.49	4.1769E-06
BA-141	0.	190.22	Half-Life too short
CE-141	44.	145.44	2.1865E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	40.	133.54	7.4370E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	24.	91.10	9.2089E-08
PM-148M	16.	550.27	9.1785E-09
EU-152	29.	344.27	2.7370E-08
EU-154	11.	1004.76	4.9702E-08
EU-156	21.	646.29	2.2614E-07
HF-181	22.	482.03	1.1252E-08
GA-182	11.	1221.42	3.9413E-08
I-187	0.	605.81	Half-Life too short
XE-188	0.	155.03	Half-Life too short
IC-203	39.	279.19	1.2401E-08
BI-207	21.	569.67	8.0212E-09
TL-208	0.	583.14	Half-Life too short
BE-212	0.	230.63	Half-Life too short
TI-214	0.	609.31	Half-Life too short
BE-214	0.	351.92	Half-Life too short
SA-224	41.	240.98	3.3550E-06
SA-226	42.	186.21	2.2488E-07
IC-228	37.	338.32	7.1031E-08
H-228	39.	84.37	1.2516E-06
TA-234	0.	131.20	Half-Life too short
H-234	42.	63.29	1.8200E-06
I-235	50.	143.76	7.8181E-08
IP-239	34.	106.13	3.1791E-06
MI-241	37.	59.54	1.8936E-07

**EFT-4S**

**2008**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-45 41508

Sample Location (Well Number): EFT-45

1. Representative sample collected. Date/Time 4/15/08 1 1535

Sample collected by: Joy Marie Staback / Joy Marie Staback Date: 04/21/08  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: S. Southward / S. Southward Date: 4/21/08  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Ross Buxton / [Signature] Date: 4-29-08  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: RO Lindroy / RO Lindroy Date: 4-28-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-4S41508
2 . Date Sampled	04/15/2008
3 . Time Sampled	15:35
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	04/22/2008
2 . Time Sample Counted	12:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.8 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3023.2 cpm
Net Spike Count Rate (cpm)	3015.4 cpm
H3 Spike Activity (dpm on count date)	7787.0 dpm
Counter Efficiency	0.3872 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	9.6 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	1.8 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

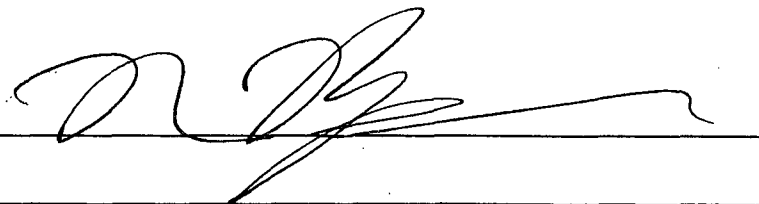
$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.20\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 uCi/ml x Sample Volume}} < \text{MDA}$$

Technician



Date

4-22-08

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-4541508

Sample Location (Well Number): EFT-45

1. Representative sample collected. Date/Time 4/15/08 1 1535

Sample collected by: Joy Marie Slaback / Joy Marie Slaback Date: 04/21/2008  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 4/21/08  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: J. Southward / J. Southward Date: 4/22/08  
Fermi 2 RP Printed Name Signature

Sample number: EFT-4541508

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: J. Southward | J. Southward Date: 4/22/08  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: K. Lindsey | K. Lindsey Date: 4-28-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFF 481500

Sample End Time: 15-APR-2008 15:25:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*J. Saittward*  
SIGNATURE

REVIEWED BY:

*KD Rudy* 4-28-08  
SIGNATURE/DATE

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number : EFT-0041500  
Sample collection start date : 19-APR-2000 15:35:00.00  
Sample collection end date : 19-APR-2000 15:35:00.00  
Type of sample : 1 L Mar. Liquid  
Sample quantity : 1.00000E+03 cc  
Sample geometry : PELL Operator : JHS

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 24-APR-2000 11:10:14.15  
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
Elapsed real time : 0 02:30:00.97 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:10:46.16  
KeV/channel : 5.00194E-01 Zero offset : -1.00000E-01  
Daily cal date : 24-APR-2000 06:17:06.67

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
Abundance limit : 75.00000 Library : dacmascer.nlb  
Efficiency file : E-FD4\_mall Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkg/d	FWHM	Channel	Left	Pw	Cts/Cac	REff	Flt
1	0	351.00	44	32	1.46	703.86	701	0	2.44E-02	25.7	
2	0	510.94	154	47	2.47	1021.85	1013	17	0.57E-02	13.3	
3	0	559.32	70	15	1.60	1116.57	1111	13	3.86E-02	16.8	
4	0	609.00	42	43	2.69	1219.67	1208	17	2.31E-02	29.2	
5	0	1460.66	53	4	1.53	2920.52	2912	17	2.94E-02	16.4	
6	0	1764.36	29	0	1.43	3527.66	3519	17	1.81E-02	19.6	



Sample Name : EFT-4841500  
Decay Time = 0 19:41:14.15

Page : 1  
Acquisition Time = 24 APR-2002 11:16:14.1

5

Post-NED Peak Search Report

ID	Energy	Area	Skwd	FWHM	Channel	Left	Pw	NErr	Fit	Nuclide
0	551.88	44	32	1.46	713.00	701	8	25.7		Pb-214
0	510.34	154	47	2.47	1021.05	1013	17	13.0		ANNI
0	550.32	70	15	1.66	1116.57	1111	13	10.0		HW C
0	529.09	42	13	2.69	1219.17	1208	17	39.2		B. 214
0	1400.66	53	4	1.53	2320.32	2312	17	12.4		K-40
0	1764.35	29	0	1.43	3527.66	3519	17	18.6		B. 214

Nuclide Types : natural

Nuclide	Energy	Area	Widn	SLF1	Uncorrected uCi/sec	Decay Corr uCi/sec	1-Sigma SE/val
K-40	1460.81	53	10.67%	2.5021E+00	2.976E-07	2.976E-07	16.00

Flag: "\*" = Keyline

Summary of Nuclide Activity  
 Sample ID : 1577 1041500

Page 4 of 5  
 Acquisition date : 01/09/2008 11:22:11

Total number of lines in spectrum 6  
 Number of unidentified lines 0  
 Number of lines tentatively identified by HIT 6 100.00%

nuclide type : natural

Nuclide	HLife	decay	Uncorrected Activity	Decay Corr Activity	Decay Corr 1-sigma Error	1 Sigma Activity	Flags
P-40	1.00E+05Y	1.00	2.976E-07	2.976E-07	6.407E-07	16.35	
Total Activity :			2.976E-07	2.976E-07			

Grand Total Activity : 2.976E-07 2.976E-07

Flags "K" = Keyline not found  
 "E" = Manually edited

"P" = Manually accepted  
 "G" = Nuclide specified above limit

Nuclide	Half-life	Ratio	Energy	%Abund	Activity (uCi/cc)	%Error	Rejected by
F-18	109.74M	115.00	511.00	100.00	1.866E+27	12.90	Decay
				% Abundances Found			
AS-76	26.30H	0.05	550.10*	44.70	1.233E 05	15.00	Abun.
			565.23	1.17	---	Not Found	---
			571.30	0.14	---	Not Found	---
			657.03	6.10	---	Not Found	---
			665.31	0.39	---	Not Found	---
			740.12	0.12	---	Not Found	---
			771.76	0.12	---	Not Found	---
			867.63	0.12	---	Not Found	---
			1129.87	0.14	---	Not Found	---
			1212.72	1.63	---	Not Found	---
			1216.06	3.04	---	Not Found	---
			1228.52	1.39	---	Not Found	---
			1439.13	0.33	---	Not Found	---
			1453.60	0.13	---	Not Found	---
			1767.67	0.33	---	Not Found	---
				% Abundances Found =	73.70		
RU-103	29.35D	0.22	497.06*	89.00	---	Not Found	---
			610.33	5.60	2.678E-07	39.20	Abun.
				% Abundances Found =	5.92		
XE-135	5.11H	23.26	249.79*	89.90	---	Not Found	---
			628.19	2.57	4.800E+00	39.20	Decay, Abun.
				% Abundances Found =	3.11		
Pr-140M	41.30D	0.21	283.11	12.56	---	Not Found	---
			414.07	19.66	---	Not Found	---
			432.70	5.35	---	Not Found	---
			501.26	6.75	---	Not Found	---
			550.27*	94.90	---	Not Found	---
			599.74	12.54	---	Not Found	---
			611.26	5.18	2.219E-07	39.20	---
			629.97	89.00	---	Not Found	---
			723.70	32.00	---	Not Found	---
			915.33	17.17	---	Not Found	---
			1013.81	20.30	---	Not Found	---
				% Abundances Found =	1.74		
Bi-214	19.90M	639.01	609.31*	46.30	1.000E+35	39.20	Decay
			769.36	5.04	---	Not Found	---
			934.06	3.21	---	Not Found	---
			1120.29	15.10	---	Not Found	---
			1236.11	5.94	---	Not Found	---
			1377.67	4.11	---	Not Found	---
			1764.49	15.00	1.000E+35	18.57	---
				% Abundances Found =	65.00 (Min. Limit = 45.43%)		
Pb-214	26.80M	174.49	37.30	4.67	---	Not Found	---
			241.08	7.49	---	Not Found	---

Rejected Report (continued)  
Sample ID : LST-4641503

Page : 5  
Acquisition date : 24-APR-2003 11:16:14

	Half-Life				Activity 1-Sigma	
Nuclide	Half-life	Ratio	Energy	Abund	(uCi/cc)	Reason Rejected by
PE-214	25.28M	474.40	295.21	19.20	---	Not Found --- Decay
			351.90*	37.20	1.000E+35	25.71
			705.91	1.10	---	Not Found ---
% Abundance Found =			53.40	(Abn. Limit = 37.30%)		

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EFP-4341505

Page # 6  
Acquisition date : 24-SEP-2000 11:10:14

Ch	Energy	Area	Bkgnd	FWHM	Channel	Left	W	Dec/Sec	%Err	KL1t	Flags
0	351.00	44	32	1.45	703.06	701	3	2.44E-02	25.7	2.70E+02	T
0	510.94	154	47	2.47	1021.55	1013	17	2.57E-02	13.0	4.50E+00	T
0	550.30	70	15	1.66	1116.57	1111	13	2.06E-02	16.9	4.60E+00	T
0	600.09	42	43	2.69	1219.67	1208	17	2.31E-02	39.2	4.00E+00	T
0	1754.36	29	0	1.43	3527.66	3519	17	1.51E-02	19.6	2.20E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Background Sum	Energy (keV)	MDA (uCi/cc)
BE-7	20.	477.59	7.5498E-08
F-18	0.	511.00	Half-Life too short
NA-22	12.	1274.54	1.8009E-08
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-30	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	13.	600.25	9.5128E-09
CR-51	31.	320.00	9.8003E-08
MN-54	7.	834.03	7.2634E-09
CO-56	15.	1239.25	1.5391E-08
MN-56	0.	1810.00	Half-Life too short
NI-56	45.	150.30	2.9953E-08
CO-57	41.	122.00	1.0034E-08
LU-58	11.	819.76	0.2441E-09
FD-59	12.	1000.22	1.9260E-08
CO-60	6.	1332.49	8.2558E-09
CU-64	0.	1345.00	Half-Life too short
NI-63	0.	1481.84	Half-Life too short
ZN-65	12.	1115.52	1.9654E-08
ZN-69M	0.	438.63	Half-Life too short
GE-75	29.	130.00	1.1799E-08
AS-76	63.	559.10	7.5319E-08
BR-82	12.	770.49	5.7453E-07
BR-83	0.	520.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	1002.41	Half-Life too short
KR-85	43.	513.99	2.3639E-08
KR-85M	0.	151.18	Half-Life too short
SR-85	43.	513.99	1.1330E-08
RD-86	4.	1076.63	9.5907E-08
KR-87	0.	402.50	Half-Life too short
SR-87M	0.	305.40	Half-Life too short
KR-88	0.	190.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	6.	1036.01	9.9340E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.08	Half-Life too short
KR-90	0.	1118.09	Half-Life too short
RB-90	0.	831.09	Half-Life too short
RB-90M	0.	834.23	Half-Life too short
Y-90U	0.	202.51	Half-Life too short
SR-91	0.	1024.00	Half-Life too short
Y-91	6.	1204.90	2.9371E-08
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.91	Half-Life too short
Y-92	0.	924.46	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page: 2

Sample ID : ETT 404522

Acquisition date : 24 APR 2000 11:16:11

Nuclide	Backgrd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	598.28	Half-Life too short
Y-93	0.	366.98	Half-Life too short
NE-94	15.	782.63	7.4878E-09
ND-95	10.	705.70	8.8864E-09
ND-95M	50.	235.69	1.3478E-07
ZR-95	10.	756.72	1.3486E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
NO-99	0.	739.58	8.4897E-07
TC-99M	0.	146.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	17.	457.02	8.8319E-09
TC-104	0.	357.00	Half-Life too short
RH-105	27.	318.90	2.2442E-06
RU-105	0.	724.50	Half-Life too short
RU-106	15.	621.84	7.2691E-08
CD-109	31.	88.03	3.3158E-07
SD-110M	10.	907.48	2.4227E-08
DM-113	26.	391.69	1.1786E-08
SM-117M	44.	159.56	1.3673E-08
SD-122	10.	563.98	7.6502E-08
SB-124	19.	602.71	8.0779E-09
SB-125	28.	427.89	2.6398E-08
TE-125M	37.	189.28	3.0284E-06
TE-127	0.	417.98	Half-Life too short
TE-127E	23.	57.68	2.2378E-05
XE-127	50.	282.04	1.4136E-08
TE-129	0.	459.08	Half-Life too short
TE-129M	20.	695.88	3.1829E-07
XE-129M	48.	196.56	3.3284E-07
I-130	0.	536.09	Half-Life too short
BA-131	41.	113.90	4.2137E-08
I-131	17.	364.48	1.5374E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	12.	773.67	2.5476E-06
XE-131M	41.	163.93	6.2147E-07
I-132	0.	667.69	Half-Life too short
TE-132	41.	228.16	5.0947E-08
DA-133	34.	302.84	4.1831E-08
BA-133M	35.	276.09	1.7838E-06
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	32.	81.00	1.3318E-07
XE-133M	45.	233.22	1.2762E-06
CS-134	16.	604.70	7.2959E-09
I-134	0.	804.09	Half-Life too short
TE-134	0.	219.47	Half-Life too short
DA-135M	30.	268.24	7.7182E-06
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	926.56	Half-Life too short



Sample ID : LFT-484158C

Acquisition date : 24-APR-2008 11:15:17

Isotope	Backgrd Cm	Energy (keV)	MDA (uCi/cc)
CS-132	15.	918.58	1.3883E-08
I-136	0.	1313.82	Half-Life too short
CS-137	14.	661.65	0.2294E-09
NE-137	0.	935.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
NE-138	0.	253.31	Half-Life too short
CS-139	0.	1420.58	Half-Life too short
CE-139	38.	165.65	0.2138E-07
CS-139	0.	1283.23	Half-Life too short
PG-140	10.	527.32	4.3226E-08
LS-140	5.	1596.49	3.4304E-07
BA-141	0.	190.22	Half-Life too short
CE-141	67.	145.44	1.9838E-08
LA-141	0.	1354.92	Half-Life too short
PA-141	0.	253.12	Half-Life too short
LA-142	9.	641.17	Half-Life too short
CE-143	41.	293.26	1.6329E-06
CE-144	44.	133.54	7.6661E-08
FR-144	0.	1489.15	Half-Life too short
ND-147	42.	91.18	0.1590E-08
PP-148M	16.	558.27	0.3397E-09
EU-152	36.	344.27	3.0116E-08
EU-154	8.	1004.76	4.3666E-08
EU-156	12.	646.29	1.3303E-07
HF-181	20.	482.03	9.9135E-09
TA-182	4.	1221.42	2.4655E-08
W-187	14.	685.81	1.1475E-05
RE-188	0.	155.83	Half-Life too short
HO-203	37.	279.19	1.1131E-08
BI-207	13.	569.67	6.4928E-09
TL-208	0.	583.14	Half-Life too short
PO-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PO-214	0.	351.92	Half-Life too short
RA-224	49.	240.98	1.1487E-06
RA-226	60.	186.21	2.6498E-07
AC-228	29.	338.32	6.3710E-08
TH-228	45.	84.37	1.3315E-06
PA-234	0.	131.20	Half-Life too short
TH-234	48.	63.29	1.5813E-06
U-235	40.	143.76	7.7454E-08
NP-239	39.	106.13	5.7885E-07
APF-241	27.	59.54	1.6592E-07

**EFT-4S**

**2009**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-45 031109

Sample Location (Well Number): EFT-45

1. Representative sample collected. Date/Time 3-11-09 / 10:10

Sample collected by: Chris Ellison / [Signature] Date: 3-11-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Proffitt / [Signature] Date: 4-17-09  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: D. Howard / [Signature] Date: 4-22-09  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: R. Berger / [Signature] Date: 4-22-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks: \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-4S031109
2 . Date Sampled	03/11/2009
3 . Time Sampled	10:10
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	04/21/2009
2 . Time Sample Counted	10:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.5 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2991.0 cpm
Net Spike Count Rate (cpm)	2983.5 cpm
H3 Spike Activity (dpm on count date)	7361.1 dpm
Counter Efficiency	0.4053 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	5.7 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

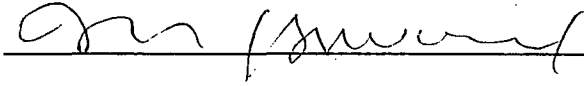
**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.12\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 uCi/ml x Sample Volume}} < \text{MDA}$$

Technician  Date 4-21-09

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-45031109

Sample Location (Well Number): EFT-45

1. Representative sample collected. Date/Time 3-11-09 / 10:10

Sample collected by: Cheryl Ellison / [Signature] Date: 3-11-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: Proffitt / [Signature] Date: 4-17-09  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Proffitt / [Signature] Date: 4-21-09  
Fermi 2 RP Printed Name Signature

Sample number: EFT-45031109

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: C. Probst | C. Probst Date: 4-21-09  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: K.D. Lindsay | K.D. Lindsay Date: 5-6-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT4S031109

Sample End Time: 11-MAR-2009 10:10:00.00

REMARKS

*K-40*

PERFORMED BY:

*Charles Proffitt*  
SIGNATURE

REVIEWED BY:

*B. L. ...* 5-6-09  
SIGNATURE/DATE

Sample ID : EFT48031109

Acquisition date : 5-MAY-2009 14:15:09

Fermi 2 Radiation Protection Gamma Spectroscopy Report

Sample Parameters

Sample ID Number: EFT48031109
Sample collection start date: 11-MAR-2009 10:10:00.00
Sample collection end date : 11-MAR-2009 10:10:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : MELL Operator: CLP

Acquisition Parameters

Detector number : DET 4 Acquire date : 5-MAY-2009 14:15:09.46
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:01.15 Percent dead time : 0.05 %

Calibration Parameters

Detector number : DET 4 Yearly cal date : 20-JUN-2000 12:00:00.00
Kev/channel : 5.00074E-01 Zero offset: 7.35546E-02
Daily cal date : 5-MAY-2009 13:14:54.49

Peak Search Parameters

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

Nuclide Identification Parameters

Energy tolerance : 1.75000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Table with 11 columns: Pk It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. It contains 5 rows of peak data.



Post-MID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	351.60	30	33	1.76	702.96	697	12	42.0		<i>Pb-214</i>
00	511.45	160	33	2.07	1022.61	1014	10	11.5		<i>Ann</i>
0	558.95	77	12	1.83	1117.59	1111	13	14.9		<i>HWC</i>
0	1001.19	11	8	1.23	2001.97	1995	11	60.3		<i>H<sub>1</sub> error</i>
0	1461.13	46	12	2.21	2921.75	2912	17	23.2		<i>K-40</i>

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	46	10.67*	2.501E+00	2.560E-07	2.560E-07	23.20

Flag: "\*" = Keyline

Total number of lines in spectrum 5  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 5 100.00%

Nuclide Type : natural

Nuclide	$\theta$ Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.560E-07	2.560E-07	0.596E-07	23.20	
Total Activity :			2.560E-07	2.560E-07			
Grand Total Activity :			2.560E-07	2.560E-07			

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
		Ratio				(uCi/cc)	%Error	
F-18	109.74M	724.08		511.06*	193.46	1.000E+35	11.78	Decay
				% Abundances Found = 100.00				
AS-76	26.32H	50.32		559.10*	44.70	7.727E+07	14.91	Decay, Abun.
				563.23	1.17	----	Not Found	----
				571.30	0.14	----	Not Found	----
				657.03	6.10	----	Not Found	----
				665.31	0.39	----	Not Found	----
				740.12	0.12	----	Not Found	----
				771.76	0.12	----	Not Found	----
				867.63	0.12	----	Not Found	----
				1129.87	0.14	----	Not Found	----
				1212.72	1.63	----	Not Found	----
				1216.02	3.84	----	Not Found	----
				1228.52	1.39	----	Not Found	----
				1439.13	0.33	----	Not Found	----
				1453.60	0.13	----	Not Found	----
				1787.67	0.33	----	Not Found	----
				% Abundances Found = 73.70				
BA-142	10.70M	7426.18		77.60	9.60	----	Not Found	Decay, Abun.
				231.52	10.10	----	Not Found	----
				255.12*	10.00	----	Not Found	----
				425.03	5.00	----	Not Found	----
				894.90	11.00	----	Not Found	----
				948.75	0.90	----	Not Found	----
				1000.86	7.80	1.000E+35	60.28	
				1078.48	9.30	----	Not Found	----
				1202.20	5.30	----	Not Found	----
				1284.06	14.00	----	Not Found	----
				% Abundances Found = 7.88				
PE-214	26.00M	2964.93		87.30	4.67	----	Not Found	Decay
				241.98	7.49	----	Not Found	----
				295.21	19.20	----	Not Found	----
				351.92*	37.20	1.000E+35	42.04	
				785.91	1.10	----	Not Found	----
				% Abundances Found = 53.40 (Abn. Limit = 37.20%)				

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	351.60	30	33	1.76	762.96	697	12	1.66E-02	42.0	5.70E+00	T
0	511.45	160	33	2.07	1022.61	1014	10	8.99E-02	11.0	4.66E+00	T
0	550.95	77	12	1.03	1117.59	1111	13	4.27E-02	14.9	4.68E+00	T
0	1001.19	11	0	1.23	2001.97	1995	11	5.95E-03	60.3	3.08E+00	T

Flags: "T" = Tentatively associated

\* Sample ID : EFT4SD31109 \*

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	13.	477.59	1.1465E-07
F-19	0.	511.00	Half-Life too short
NA-22	9.	1274.54	9.6679E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	0.	889.25	1.1460E-08
CR-51	35.	320.08	3.1115E-07
MN-54	11.	834.83	8.6516E-09
CO-56	13.	1238.25	2.5566E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	46.	158.38	4.1146E-06
CO-57	40.	122.06	1.1220E-08
CO-58	10.	810.76	1.2723E-08
FE-59	11.	1099.22	3.9350E-08
CO-60	12.	1332.49	1.0954E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	17.	1115.52	2.5866E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	34.	136.00	1.6517E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	51.	513.99	2.5903E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	51.	513.99	2.0042E-08
RB-86	9.	1076.63	7.3744E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	9.	1836.01	1.6048E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	11.	1204.90	6.3422E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	15.	702.63	7.5545E-09
NB-95	10.	765.79	2.0551E-08
NB-95M	0.	235.69	Half-Life too short
ZR-95	14.	756.72	2.6017E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.53	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	21.	497.00	2.1659E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	10.	621.84	< 8.5350E-08
CD-109	25.	88.83	3.2087E-07
AG-110M	13.	937.40	3.1244E-08
SN-113	25.	391.69	1.5326E-08
SN-117M	40.	150.56	1.5003E-07
SB-122	0.	563.93	Half-Life too short
SB-124	23.	602.71	1.5047E-08
SB-125	22.	427.89	2.4867E-08
TE-125M	44.	109.20	6.0133E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	26.	57.60	3.1920E-05
XE-127	31.	202.84	2.7647E-08
TE-129	0.	459.00	Half-Life too short
TE-129M	25.	695.80	8.0713E-07
XE-129M	57.	196.56	1.3369E-05
I-130	0.	536.09	Half-Life too short
BA-131	50.	123.00	7.9991E-07
I-131	21.	364.40	9.1055E-07
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	49.	163.93	1.0209E-05
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	20.	302.84	3.0740E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
Te-133M	0.	912.50	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	20.	604.70	8.4734E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT48031109

Acquisition date : 5-MAY-2009 16:15:09

Nuclide	Backgd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	9.	818.50	1.3070E-07
I-136	0.	1313.02	Half-Life too short
CS-137	0 16.	661.65	8.6006E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	259.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	50.	165.85	1.3040E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	21.	537.32	5.9857E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	41.	145.44	5.0197E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	34.	133.54	7.5967E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	31.	91.10	1.3154E-06
PM-148M	10.	550.27	1.4855E-08
EU-152	26.	344.27	2.6217E-08
EU-154	7.	1004.76	4.2396E-08
EU-155	44.	105.31	5.1000E-08
EU-156	17.	646.29	1.2979E-06
HF-181	17.	482.03	1.9296E-08
TA-182	0.	1221.42	4.4316E-08
W-187	0.	685.01	Half-Life too short
RE-190	0.	155.03	Half-Life too short
HG-203	39.	279.19	2.2681E-08
BI-207	12.	569.67	6.3333E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	230.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	56.	186.21	2.5686E-07
AC-228	30.	338.32	6.5634E-08
TH-228	46.	84.37	1.4093E-06
PA-234	0.	131.20	Half-Life too short
TH-234	33.	63.29	5.2139E-06
U-235	41.	143.76	7.2008E-08
NP-239	0.	106.13	Half-Life too short
AM-241	26.	59.54	1.6131E-07



## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT 45 9 9 09

Sample Location (Well Number): 45

1. Representative sample collected. Date/Time 9/9/09 1 16 40

Sample collected by: Brian Jardie / [Signature] Date: 9/9/09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 9/21/09  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: [Signature] Date: 9-22-09  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray / [Signature] Date: 10-13-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT4S9909
2 . Date Sampled	09/09/2009
3 . Time Sampled	16:40
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	09/21/2009
2 . Time Sample Counted	14:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.7 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2763.5 cpm
Net Spike Count Rate (cpm)	2755.8 cpm
H3 Spike Activity (dpm on count date)	7189.1 dpm
Counter Efficiency	0.3833 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	7.6 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.20\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician \_\_\_\_\_

Date 9-22-09

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT 4 S 9909

Sample Location (Well Number): 45

1. Representative sample collected. Date/Time 9/9/09 1 1640

Sample collected by: Brina Janine / [Signature] Date: 9/9/09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 9/24/09  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Southward / Southward Date: 10/21/09  
Fermi 2 RP Printed Name Signature

Sample number: EFT 459909

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Southernward, Southernward Date: 10/21/09  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. G. R. R. R. Date: 11-18-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT4S9909

Sample End Time: 9-SEP-2009 16:40:00.00

REMARKS Re Count

PERFORMED BY:

*Santhosh*

SIGNATURE

REVIEWED BY:

SIGNATURE/DATE

Sample ID : EFT4S9909

Acquisition date : 18-NOV-2009 00:33:39

\*\*\*\*\*  
 Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT4S9909  
 Sample collection start date: 9-SEP-2009 16:40:00.00  
 Sample collection end date : 9-SEP-2009 16:40:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : M2LL Operator: JNS

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 18-NOV-2009 00:33:39.60  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:01.02 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 3-JUN-2009 17:37:00.00  
 KeV/channel : 5.00036E-01 Zero offset: 9.60554E-02  
 Daily cal date : 18-NOV-2009 00:27:52.41

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 > Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	351.40	40	30	1.41	702.71	690	12	2.67E-02	29.0	
2	0	7511.03	165	45	2.25	1021.00	1013	10	9.14E-02	12.3	
3	0	559.13	36	40	1.56	1117.99	1111	16	1.90E-02	41.6	
4	0	610.01	46	37	2.45	1219.72	1200	10	2.50E-02	33.0	

Sample Title : EFT489909  
Decay Time = 69 15:53:39.60

Page : 1  
Acquisition Time = 18-NOV-2009 08:33:39.6

0

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	XErr	Fit	Nuclides
0	351.48	48	38	1.41	702.71	698	12	29.0	<del>_____</del>	Pb-214
0	511.03	165	45	2.25	1021.00	1013	18	12.3	<del>_____</del>	ANN.
0	559.13	36	40	1.56	1117.99	1111	16	41.6	<del>_____</del>	HWC
0	610.01	46	37	2.45	1219.72	1208	18	33.8		Bi-214

f - 11-18-09

Nuclide Line Activity Report  
Sample ID : EFT4S9909

Page : 2  
Acquisition date : 10-NOV-2009 00:33:39

Flag: "\*" = Keyline



Summary of Nuclide Activity

Sample ID : EFT4S9909

Acquisition date : 18-NOV-2009 08:33:39

Total number of lines in spectrum	4	
Number of unidentified lines	0	
Number of lines tentatively identified by NID	4	100.00%

\*\*\*\* There are no nuclides meeting summary criteria \*\*\*\*

Flags: "K" = Keyline not found                    "M" = Manually accepted  
      "E" = Manually edited                     "A" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by	
F-18	109.74M	914.24	511.00*	193.46	1.000E+35	12.34	Decay	
			% Abundances Found = 100.00					
AS-76	26.32H	63.53	559.10*	44.70	3.412E+11	41.56	Decay, Abun.	
			>	563.23	1.17	----	Not Found	----
				571.30	0.14	----	Not Found	----
				657.03	6.10	----	Not Found	----
				665.31	0.39	----	Not Found	----
				740.12	0.12	----	Not Found	----
				771.76	0.12	----	Not Found	----
				867.63	0.12	----	Not Found	----
				1129.87	0.14	----	Not Found	----
				1212.72	1.63	----	Not Found	----
				1216.02	3.84	----	Not Found	----
				1228.52	1.39	----	Not Found	----
				1439.13	0.33	----	Not Found	----
				1453.60	0.13	----	Not Found	----
	1787.67	0.33	----	Not Found	----			
			% Abundances Found = 73.70					
RU-103	39.35D	1.77	497.08*	89.00	----	Not Found	----	
				610.33	5.60	9.389E-07	33.76	Abun.
			% Abundances Found = 5.92					
PM-148M	41.30D	1.69	288.11	12.56	----	Not Found	----	
				414.07	18.66	----	Not Found	----
				432.78	5.35	----	Not Found	----
				501.26	6.75	----	Not Found	----
				550.27*	94.90	----	Not Found	----
				599.74	12.54	----	Not Found	----
				611.26	5.48	9.055E-07	33.76	Abun.
				629.97	89.00	----	Not Found	----
				725.70	32.80	----	Not Found	----
				4	915.33	17.17	----	Not Found
		1013.81	20.30	----	Not Found	----		
			% Abundances Found = 1.74					
BI-214	19.90M	5041.64	609.31*	46.30	1.000E+35	33.76	Decay	
				768.36	5.04	----	Not Found	----
				934.06	3.21	----	Not Found	----
				1120.29	15.10	----	Not Found	----
				1238.11	5.94	----	Not Found	----
				1377.67	4.11	----	Not Found	----
				1764.49	15.80	----	Not Found	----
			% Abundances Found = 48.48 (Abn. Limit = 48.48%)					
PB-214	26.80M	3743.61	87.30	4.67	----	Not Found	----	
				241.98	7.49	----	Not Found	----
				295.21	19.20	----	Not Found	----
				351.92*	37.20	1.000E+35	28.99	Decay
				785.91	1.10	----	Not Found	----
			% Abundances Found = 53.40 (Abn. Limit = 37.20%)					

Rejected Report (continued)  
Sample ID : EFT489909

Page : 5  
Acquisition date : 18-NOV-2009 08:33:39

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EFT4S9909

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Acquisition date : 10-NOV-2009 08:33:39

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	351.40	40	30	1.41	702.71	690	12	2.67E-02	29.0	5.70E+00	T
0	511.03	165	45	2.25	1021.00	1013	10	9.14E-02	12.3	4.90E+00	T
0	559.13	36	40	1.56	1117.99	1111	16	1.90E-02	41.6	4.60E+00	T
0	610.01	46	37	2.45	1219.72	1200	10	2.50E-02	33.0	4.52E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	27.	477.59	1.8874E-07
F-18	0.	511.00	Half-Life too short
NA-22	5.	1274.54	7.6616E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
K-40	51.	1460.81	2.0202E-07
AR-41	0.	1293.64	Half-Life too short
SC-46	13.	889.25	1.5719E-08
CR-51	32.	320.00	4.3141E-07
PN-54	16.	834.83	1.0584E-08
CO-56	14.	1238.25	3.0027E-08
PN-56	0.	1010.69	Half-Life too short
NI-56	0.	158.38	Half-Life too short
CO-57	41.	122.06	1.1706E-08
CO-58	8.	810.76	1.3127E-08
FE-59	5.	1099.22	3.5085E-08
CO-60	8.	1332.49	9.2386E-09
CU-64	8 0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	10.	1115.52	2.1839E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	43.	136.00	1.9923E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	55.	513.99	2.6941E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	55.	513.99	2.4276E-08
RB-86	10.	1076.63	1.3529E-06
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	7.	1836.01	1.5711E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	7.	1204.90	6.1208E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1303.94	Half-Life too short

Sample ID : EFT4S9909

Acquisition date : 18-NOV-2009 08:33:39

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
Y-92	0.	934.46	Half-Life too short
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NE-94	14.	702.63	7.2470E-09
NE-95	11.	765.79	2.8728E-08
NE-95M	0.	235.69	Half-Life too short
ZR-95	18.	756.72	3.3600E-08
NE-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	22.	497.00	2.8624E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	16.	621.84	8.3851E-08
CD-109	36.	88.03	3.8964E-07
AG-110M	6.	937.48	2.3771E-08
SN-113	27.	391.69	1.7233E-08
SN-117M	33.	158.56	2.6644E-07
SB-122	0.	563.93	Half-Life too short
SB-124	27.	602.71	2.0148E-08
SB-125	20.	427.89	2.4070E-08
TE-125M	47.	109.28	8.3139E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	33.	57.60	3.8579E-05
XE-127	43.	202.84	4.1963E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	11.	695.88	8.5006E-07
XE-129M	46.	196.56	3.7604E-05
I-130	0.	536.09	Half-Life too short
BA-131	44.	123.80	1.7731E-06
I-131	34.	364.48	3.9681E-06
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	43.	163.93	2.2502E-05
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	28.	302.84	3.8931E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	17.	604.70	7.9495E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short

Sample ID : EFT4S9909

Acquisition date : 18-NOV-2009 08:33:39

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
XE-135M	0.	526.56	Half-Life too short
CS-136	12.	819.50	3.1481E-07
I-136	0.	1313.02	Half-Life too short
CS-137	18.	661.65	9.0753E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.06	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	38.	165.85	1.2376E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	20.	537.32	1.3037E-06
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	45.	145.44	7.1697E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	35.	133.54	7.9950E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	27.	91.10	3.1110E-06
PM-148M	17.	550.27	2.3448E-09
EU-152	21.	344.27	2.3994E-08
EU-154	11.	1004.76	5.0325E-08
EU-155	24.	105.31	3.9463E-08
EU-156	13.	646.29	2.2074E-06
HF-181	16.	482.03	2.4390E-08
TA-182	10.	1221.42	5.3446E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	35.	279.19	2.6807E-08
BI-207	22.	569.67	8.1407E-09
TL-208	0.	583.14	Half-Life too short
PE-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PE-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	40.	186.21	2.2086E-07
AC-228	47.	338.32	8.0797E-08
TH-228	42.	84.37	1.3671E-06
PA-234	0.	131.20	Half-Life too short
TH-234	31.	63.29	7.6782E-06
U-235	56.	143.76	8.2755E-08
NP-239	0.	106.13	Half-Life too short
AM-241	25.	59.54	1.5995E-07

**EFT-4S**

**2010**



## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EF1-52510-45

Sample Location (Well Number): 45

1. Representative sample collected. Date/Time 5/25/10 1 1550

Sample collected by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: John M. Yokum / [Signature] Date: 7-2-10  
Fermi 2 Chemistry Printed Name / Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray / [Signature] Date: 10-5-10  
Fermi 2 Printed Name / Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EF1-52510-4S
2 . Date Sampled	05/25/2010
3 . Time Sampled	15:50
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

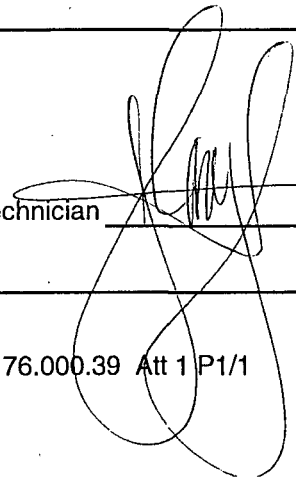
1 . Date Sample Counted	06/30/2010
2 . Time Sample Counted	23:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	8.6 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2673.2 cpm
Net Spike Count Rate (cpm)	2664.6 cpm
H3 Spike Activity (dpm on count date)	6882.6 dpm
Counter Efficiency	0.3871 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	7.3 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.1 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.26\text{E}-06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician  Date 7-2-10

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EF1-52510-45

Sample Location (Well Number): 45

1. Representative sample collected. Date/Time 5/25/10 1 1550

Sample collected by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Charles Proffitt / Charles Proffitt Date: 9-13-10  
Fermi 2 RP Printed Name Signature

Sample number: EF1-52510-45

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Charles Proffitt | Charles Proffitt Date: 9-13-10  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C Hegler | Robert C Hegler Date: 10-5-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1-52510-4S

Sample End Time: 25-MAY-2010 15:50:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*Charles Puffin*  
SIGNATURE

REVIEWED BY:

*[Signature]*  
SIGNATURE/DATE

Sample ID : EF1-52510-4S

Acquisition date : 13-SEP-2010 11:18:09

\*\*\*\*\*  
 Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1-52510-4S  
 Sample collection start date: 25-MAY-2010 15:50:00.00  
 Sample collection end date : 25-MAY-2010 15:50:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : NELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 13-SEP-2010 11:18:09.96  
 Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00  
 Elapsed real time : 0 00:45:00.89 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 23-JUN-2010 12:28:00.00  
 KeV/channel : 5.00035E-01 Zero offset: 1.90339E-01  
 Daily cal date : 13-SEP-2010 10:15:31.59

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	66.85	40	85	0.89	133.30	129	8	1.48E-02	44.0	
2	0	140.00	49	126	1.25	279.60	273	12	1.81E-02	48.1	
3	0	197.59	50	137	1.19	394.77	388	13	1.86E-02	49.9	
4	0	352.17	75	77	1.81	703.91	694	17	2.76E-02	29.3	
5	0	511.29	281	61	2.35	1022.13	1012	23	1.04E-01	9.5	
6	0	558.64	107	55	1.64	1116.84	1110	13	3.96E-02	17.3	
7	0	652.10	22	24	1.67	1303.91	1296	11	8.26E-03	47.9	
8	0	1461.10	73	15	1.30	2921.71	2911	19	2.72E-02	17.0	

Sample Title : EF1-52510-48  
Decay Time = 110 19:28:09.96

Page : 1  
Acquisition Time = 13-SEP-2010 11:10:09.9

6

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	<del>66.85</del>	<del>40</del>	<del>65</del>	<del>0.89</del>	<del>133.30</del>	<del>129</del>	<del>0</del>	<del>44.0</del>	<del>-</del>	<del>Low FWHM/High %err</del>
0	140.00	49	126	1.25	279.60	273	12	48.1	-	HWC
0	197.59	50	137	1.19	394.77	388	13	49.9	-	HWC
0	352.17	75	77	1.81	703.91	694	17	29.3	-	Pb-214
0	511.29	291	61	2.35	1022.13	1012	23	9.5	-	ANN.
0	558.64	107	55	1.64	1116.84	1110	13	17.3	-	HWC
0	652.18	22	24	1.67	1303.91	1296	11	47.9	-	HWC
0	1461.10	73	15	1.30	2921.71	2911	19	17.0		K-40

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected	Decay Corr	1-Sigma
					uCi/cc	uCi/cc	%Error
K-40	1460.81	73	10.67*	2.501E+00	2.755E-07	2.755E-07	16.99

Flag: "\*" = Keyline



Summary of Nuclide Activity

Sample ID : EF1-52510-4S

Acquisition date : 13-SEP-2010 11:10:09

Total number of lines in spectrum 8  
 Number of unidentified lines 0  
 Number of lines tentatively identified by MID 8 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.755E-07	2.755E-07	0.468E-07	16.99	
Total Activity :			2.755E-07	2.755E-07			

Grand Total Activity : 2.755E-07 2.755E-07

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Sample ID : EF1-52510-4S

Acquisition date : 13-SEP-2010 11:10:09

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	1454.26	511.00*	193.46	1.000E+35	9.45	Decay
% Abundances			Found = 100.00				
SE-75	119.78D	0.93	66.05	1.02	5.068E-06	43.96	Abun.
			96.73	3.41	----	Not Found	----
			121.12	16.70	----	Not Found	----
			136.00*	59.20	----	Not Found	----
			198.60	1.45	9.982E-07	49.93	
			264.65	59.80	----	Not Found	----
			279.53	25.20	----	Not Found	----
			303.91	1.32	----	Not Found	----
			400.65	11.40	----	Not Found	----
% Abundances			Found = 1.38				
AS-76	26.32H	101.06	559.10*	44.70	1.348E+23	17.30	Decay, Abun.
			563.23	1.17	----	Not Found	----
			571.30	0.14	----	Not Found	----
			657.03	6.10	----	Not Found	----
			665.31	0.39	----	Not Found	----
			740.12	0.12	----	Not Found	----
			771.76	0.12	----	Not Found	----
			867.63	0.12	----	Not Found	----
			1129.87	0.14	----	Not Found	----
			1212.72	1.63	----	Not Found	----
			1216.02	3.84	----	Not Found	----
			1228.52	1.39	----	Not Found	----
			1439.13	0.33	----	Not Found	----
			1453.60	0.13	----	Not Found	----
			1787.67	0.33	----	Not Found	----
% Abundances			Found = 73.70				
KR-88	2.84H	936.56	165.98	3.10	----	Not Found	Decay, Abun.
			196.32*	26.00	1.000E+35	49.93	
			362.23	2.25	----	Not Found	----
			834.83	13.00	----	Not Found	----
			985.78	1.31	----	Not Found	----
			1141.33	1.28	----	Not Found	----
			1179.51	1.00	----	Not Found	----
			1250.67	1.12	----	Not Found	----
			1369.50	1.48	----	Not Found	----
			1518.39	2.15	----	Not Found	----
			1529.77	10.90	----	Not Found	----
			2029.84	4.53	----	Not Found	----
			2035.41	3.74	----	Not Found	----
% Abundances			Found = 36.18				
SR-91	9.50H	279.98	274.70	1.00	----	Not Found	Decay, Abun.
			620.10	1.72	----	Not Found	----
			652.30	2.89	1.000E+35	47.86	
			652.90	7.80	1.000E+35	47.86	
			749.80	23.00	----	Not Found	----
			925.80	3.74	----	Not Found	----

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
SR-91	9.50H	279.98	1024.30*	32.50	---- Not Found ----	----	Decay, Abun.
	% Abundances Found =			14.71			
MO-99	66.02H	40.29	140.51	3.80	2.703E+05	48.11	Decay, Abun.
			181.06	6.20	---- Not Found ----	----	
			366.43	1.37	---- Not Found ----	----	
			739.50*	12.80	---- Not Found ----	----	
			778.00	4.50	---- Not Found ----	----	
	% Abundances Found =			13.25			
TC-99M	6.02H	441.83	140.50*	89.07	1.000E+35	48.11	Decay
	% Abundances Found =			100.00			
XE-129M	8.89D	12.47	196.56*	4.74	9.100E-04	49.93	Decay
	% Abundances Found =			100.00			
CS-136	13.16D	8.42	66.91	12.50	7.467E-05	43.96	Abun.
			86.29	6.30	---- Not Found ----	----	
			153.22	7.46	---- Not Found ----	----	
			163.89	4.61	---- Not Found ----	----	
			176.55	13.56	---- Not Found ----	----	
			273.65	12.66	---- Not Found ----	----	
			340.57	48.50	---- Not Found ----	----	
			818.50*	99.70	---- Not Found ----	----	
			1048.07	79.60	---- Not Found ----	----	
			1235.34	19.70	---- Not Found ----	----	
	% Abundances Found =			4.10			
TA-182	114.74D	0.97	67.75	42.30	1.257E-07	43.96	Abun.
			100.10	14.10	---- Not Found ----	----	
			1189.05	16.30	---- Not Found ----	----	
			1221.42*	27.10	---- Not Found ----	----	
			1230.97	11.50	---- Not Found ----	----	
	% Abundances Found =			38.01			
PB-214	26.00M	5954.88	87.30	4.67	---- Not Found ----	----	Decay
			241.98	7.49	---- Not Found ----	----	
			295.21	19.20	---- Not Found ----	----	
			351.92*	37.20	1.000E+35	29.29	
			785.91	1.10	---- Not Found ----	----	
	% Abundances Found =			53.40	(Abn. Limit =	37.20%)	

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EF1-S2510-48

Page : 6  
Acquisition date : 13-SEP-2010 11:18:09

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	66.85	40	85	0.89	133.30	129	0	1.48E-02	44.0	1.47E+00	T
0	140.00	49	126	1.25	279.60	273	12	1.81E-02	48.1	6.40E+00	T
0	197.59	50	137	1.19	394.77	388	13	1.86E-02	49.9	6.61E+00	T
0	352.17	75	77	1.81	703.91	694	17	2.76E-02	29.3	5.70E+00	T
0	511.29	281	61	2.35	1022.13	1012	23	1.04E-01	9.5	4.88E+00	T
0	558.64	107	55	1.64	1116.84	1110	13	3.96E-02	17.3	4.69E+00	T
0	652.18	22	24	1.67	1303.91	1296	11	8.26E-03	47.9	4.39E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	33.	477.59	2.3703E-07
F-10	0.	511.00	Half-Life too short
NA-22	7.	1274.54	6.0394E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	14.	889.25	1.5506E-08
CR-51	42.	320.00	9.0971E-07
MN-54	24.	834.83	9.3897E-09
CO-56	16.	1238.25	3.0691E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	0.	158.30	Half-Life too short
CO-57	50.	122.06	9.5594E-09
CO-58	18.	810.76	1.8516E-08
FE-59	17.	1099.22	7.4950E-08
CO-60	13.	1332.49	7.6004E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	19.	1115.52	2.1493E-08
ZN-69M	0.	430.63	Half-Life too short
SE-75	65.	136.00	2.0522E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	83.	513.99	2.1926E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	83.	513.99	3.0452E-08
RE-86	23.	1076.63	5.0754E-06
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RE-88	0.	1382.39	Half-Life too short
Y-88	5.	1836.01	1.2753E-08
KR-89	0.	220.90	Half-Life too short
RE-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RE-90	0.	831.69	Half-Life too short
RE-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	21.	1204.90	1.0573E-05
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page : 2

Sample ID : EF1-52510-48

Acquisition date : 13-SEP-2010 11:18:09

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	23.	702.63	6.1270E-09
NB-95	20.	765.79	5.5445E-08
NB-95M	0.	235.69	Half-Life too short
ZR-95	12.	756.72	2.9366E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	21.	497.08	3.0855E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	20.	621.84	6.5880E-08
CD-109	53.	88.83	3.2938E-07
AG-110M	21.	937.48	3.0252E-08
SN-113	38.	391.69	1.7210E-08
SN-117M	80.	158.56	2.1857E-06
SB-122	0.	563.93	Half-Life too short
SB-124	48.	602.71	2.8132E-08
SB-125	43.	427.89	2.2997E-08
TE-125M	50.	109.28	9.3799E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	37.	57.60	3.5436E-05
XE-127	70.	202.84	7.7052E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	23.	695.88	1.8030E-06
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	63.	123.80	1.5645E-05
I-131	0.	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	70.	163.93	2.0872E-04
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	49.	302.84	3.3631E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	38.	604.70	7.8866E-09
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EF1-52510-48

Acquisition date : 13-SEP-2010 11:18:09

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	18.	818.50	2.1910E-06
I-136	0.	1313.02	Half-Life too short
CS-137	15.	661.65	5.6758E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	59.	165.85	1.2440E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	31.	537.32	9.7914E-06
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	67.	145.44	1.3810E-07
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	69.	133.54	8.0717E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PM-148M	28.	550.27	3.9109E-08
EU-152	64.	344.27	2.6719E-08
EU-154	19.	1004.76	4.2767E-08
EU-155	48.	105.31	3.6371E-08
EU-156	29.	646.29	1.3835E-05
HF-181	29.	482.03	4.0906E-08
TA-182	15.	1221.42	5.3677E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HO-203	69.	279.19	4.5031E-08
BI-207	29.	569.67	6.1398E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	70.	186.21	1.9005E-07
AC-228	46.	338.32	5.3913E-08
TH-228	57.	84.37	1.0936E-06
PA-234	0.	131.20	Half-Life too short
TH-234	65.	63.29	2.3546E-05
U-235	70.	143.76	6.1420E-08
NP-239	0.	106.13	Half-Life too short
AM-241	45.	59.54	1.3844E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT 102010-4/S

Sample Location (Well Number): 4S

1. Representative sample collected. Date/Time 11-11-10 1 13:27

Sample collected by: C Proffitt / C Proffitt Date: 11-11-10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: C Proffitt / Duffin Date: 11-11-10  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: S.R. Dyer / S.R. Dyer Date: 11-12-10  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Biggs / Robert C. Biggs Date: 12-27-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_



Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT EFT 102010-4/S
2 . Date Sampled	11/15/10 11/11/2010
3 . Time Sampled	13:27
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	11/11/2010
2 . Time Sample Counted	22:08
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.2 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2546.6 cpm
Net Spike Count Rate (cpm)	2539.4 cpm
H3 Spike Activity (dpm on count date)	6741.6 dpm
Counter Efficiency	0.3767 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	8.1 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.9 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

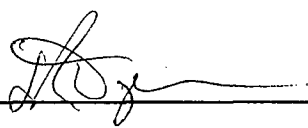
**Minimum Detectable Activity**

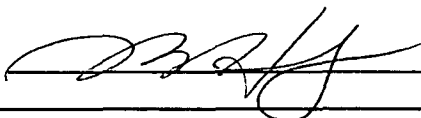
$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.18\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician  Date 11-12-10

Reviewed By:  Date 11/15/10

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-102010-415

Sample Location (Well Number): 4/5

1. Representative sample collected. Date/Time 10/20/10 1 11:50

Sample collected by: Thomas Mowl / [Signature] Date: 11/11/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: C. Proffitt / [Signature] Date: 12-9-10  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: C. Proffitt / [Signature] Date: 12-9-10  
Fermi 2 RP Printed Name / Signature

Sample number: EFT-1020-4/S

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: C. Proffitt 1 C. Proffitt Date: 12-9-10  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gage [Signature] Date: 1-11-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DETOIT EDISON FERMI-2 POWER PLANT

11-JAN-2011 17:23:56.40

RADIATION PROTECTION DEPARTMENT  
GAMMA SPECTROSCOPY ANALYSIS REPORT  
HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT 102010 4/S

Sample End Time: 20-OCT-2010 11:50:00.00

REMARKS

PERFORMED BY:

*D. Bayens*

SIGNATURE

REVIEWED BY:

*[Signature]*

SIGNATURE DATE

Sample ID : EFT 102010 4/S

Acquisition date : 11-JAN-2011 16:38:54

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT 102010 4/S  
 Sample collection start date: 20-OCT-2010 11:50:00.00  
 Sample collection end date : 20-OCT-2010 11:50:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.000000E+03 cc  
 Sample geometry : MELL Operator: DP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 11-JAN-2011 16:38:54.07  
 Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00  
 Elapsed real time : 0 00:45:00.71 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 23-JUN-2010 12:28:00.00  
 Kev/channel : 5.00344E-01 Zero offset: 9.81000E-02  
 Daily cal date : 11-JAN-2011 11:03:02.81

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_mell Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	XErr	Fit
1	0	77.34	32	120	0.93	154.30	151	7	1.10E-02	60.0	
2	0	242.99	48	136	1.59	485.44	478	11	1.77E-02	50.0	
3	0	295.40	195	84	1.53	590.37	585	12	7.21E-02	11.9	
4	0	352.16	292	66	1.66	703.65	697	14	1.00E-01	0.3	
5	0	511.40	194	00	2.60	1022.07	1013	20	7.10E-02	13.6	
6	0	609.17	210	24	1.82	1217.31	1209	14	7.77E-02	0.7	
7	0	1120.10	57	32	2.40	2230.50	2220	21	3.12E-02	27.9	
8	0	1461.65	62	19	2.64	2921.10	2910	21	2.20E-02	22.5	
9	0	1765.06	46	14	2.12	3527.61	3517	10	1.71E-02	23.0	

Minimum Detectable Activity Report

Nuclide	Backgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	40.	477.59	1.8021E-07
F-19	0.	511.00	Half-Life too short
NA-22	13.	1274.54	7.7934E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	21.	889.25	1.4577E-08
CR-51	44.	320.00	4.6192E-07
MN-54	18.	834.93	7.7829E-09
CO-56	30.	1238.25	3.1710E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	0.	158.30	Half-Life too short
CO-57	62.	122.06	9.8536E-09
CO-58	14.	910.76	1.2622E-08
FE-59	21.	1099.22	5.3219E-08
CO-60	15.	1332.49	8.0303E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	18.	1115.52	1.9225E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	73.	136.00	1.8482E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	661.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	75.	513.99	2.0901E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	75.	513.99	2.1715E-08
RB-86	10.	1076.63	1.4896E-06
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	12.	1036.01	1.4547E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1110.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	14.	1204.90	6.5290E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	24.	702.63	6.1701E-09
NB-95	28.	765.79	3.7454E-08
NB-95M	0.	235.69	Half-Life too short
ZR-95	16.	756.72	2.4697E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.59	Half-Life too short
TC-99M	0.	149.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	33.	497.08	2.8979E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	30.	621.84	7.5358E-08
CD-109	59.	88.83	3.3313E-07
AG-110M	15.	937.48	2.4165E-08
SN-113	41.	391.69	1.5045E-08
SN-117M	84.	158.56	5.4610E-07
SB-122	0.	563.93	Half-Life too short
SB-124	24.	602.71	1.5009E-08
SB-125	37.	427.89	2.1094E-08
TE-125M	59.	109.28	7.2594E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	46.	57.60	3.2666E-05
XE-127	64.	202.84	4.3635E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	28.	695.88	1.1123E-06
XE-129M	77.	196.56	9.1605E-05
I-130	0.	536.89	Half-Life too short
BA-131	55.	123.80	2.9120E-06
I-131	0.	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	69.	163.93	4.0958E-05
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	61.	302.84	3.6914E-08
BA-133M	0.	276.89	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.80	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	20.	604.70	5.7902E-09
I-134	0.	884.89	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	15.	818.50	4.6567E-07
I-136	0.	1313.02	Half-Life too short
CS-137	22.	661.65	6.6482E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	59.	165.85	1.0013E-08
CS-139	0.	1203.23	Half-Life too short
BA-140	28.	537.32	2.0715E-06
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	71.	145.44	7.8590E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	64.	133.54	7.2966E-08
FR-144	0.	1489.15	Half-Life too short
HD-147	56.	91.10	6.7950E-06
FM-148M	28.	550.27	2.4767E-08
EU-150	47.	344.27	2.2920E-08
EU-154	11.	1004.76	3.3890E-08
EU-155	54.	105.31	3.7982E-08
EU-156	25.	646.29	3.7148E-06
HF-181	33.	482.03	2.7769E-08
TA-182	17.	1221.42	4.8677E-08
W-187	0.	605.01	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	61.	279.19	2.0112E-08
BI-207	35.	569.67	6.7393E-09
TL-208	0.	503.14	Half-Life too short
FB-212	0.	230.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PO-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	80.	186.21	2.0209E-07
AC-228	52.	330.32	5.6323E-08
TH-228	41.	84.37	9.1194E-07
PA-234	0.	131.20	Half-Life too short
TH-234	59.	63.29	1.0201E-05
U-235	63.	143.76	5.8431E-08
NP-239	0.	106.13	Half-Life too short
AM-241	53.	59.54	1.4998E-07



Sample Title : EFT 102010 4/S  
Decay Time = 03 04:48:54.07

Page : 1  
Acquisition Time = 11-JAN-2011 16:30:54.0

7

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	77.34	32	120	0.03	154.30	151	7	60.0	_____	Pb-212
0	242.99	40	136	1.39	405.44	470	11	50.0	_____	Pb-214
0	295.40	195	04	1.53	590.37	505	12	11.9	_____	Pb-214
0	352.16	292	66	1.66	703.65	697	14	0.3	_____	Pb-214
0	511.40	194	00	2.60	1022.07	1013	20	13.6	_____	Ann Peak
0	609.17	210	24	1.02	1217.31	1209	14	0.7	_____	Bi-214
0	1120.10	57	32	2.40	2230.50	2220	21	27.9	_____	Bi-214
0	1461.65	62	19	2.64	2921.10	2910	21	22.5	_____	K-40
0	1765.06	46	14	2.12	3527.61	3517	10	23.0	_____	Bi-214

J. 1-11-11

Nuclide Line Activity Report  
Sample ID : EFT 102010 4/S

Page : 2  
Acquisition date : 11-JAN-2011 16:30:54

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	62	10.67*	2.501E+00	2.300E-07	2.300E-07	22.48

Flag: "\*" = Keyline

Summary of Nuclide Activity

Sample ID : EFT 102019 4/9

Acquisition date : 11-JAN-2011 16:30:54

Total number of lines in spectrum 9  
 Number of unidentified lines 0  
 Number of lines tentatively identified by NID 9 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.300E-07	2.300E-07	0.519E-07	22.48	
Total Activity :			2.300E-07	2.300E-07			

Grand Total Activity : 2.300E-07 2.300E-07

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Rejected Report

Sample ID : EFT 102010 4/8

Acquisition date : 11-JAN-2011 16:38:54

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	1091.96	511.00*	193.46	1.000E+35	13.64	Decay
		% Abundances	Found = 100.00				
SC-46	93.93D	0.99	142.53	62.70	---- Not Found ----		Abun.
			889.25*	99.98	---- Not Found ----		
			1120.51	99.99	3.931E-08	27.87	
		% Abundances	Found = 38.87				
KR-90	32.32S	222459.31	121.82	32.00	---- Not Found ----		Decay, Abun.
			539.49	29.00	---- Not Found ----		
			1110.69*	37.00	1.000E+35	27.87	
		% Abundances	Found = 37.76				
SR-92	2.71H	736.97	241.52	3.00	1.000E+35	49.97	Decay, Abun.
			430.56	3.30	---- Not Found ----		
			953.32	3.60	---- Not Found ----		
			1142.30	2.90	---- Not Found ----		
			1303.94*	90.00	---- Not Found ----		
		% Abundances	Found = 2.92				
RU-103	39.35D	2.11	497.00*	09.00	---- Not Found ----		Abun.
			610.33	5.60	3.594E-06	0.69	
		% Abundances	Found = 5.92				
BA-131	11.50D	7.05	78.76	0.73	2.205E-04	60.85	Abun.
			92.29	0.64	---- Not Found ----		
			123.80*	29.00	---- Not Found ----		
			133.61	2.16	---- Not Found ----		
			216.07	19.70	---- Not Found ----		
			239.62	2.40	---- Not Found ----		
			249.43	2.82	---- Not Found ----		
			373.24	14.00	---- Not Found ----		
			404.04	1.31	---- Not Found ----		
			400.40	0.32	---- Not Found ----		
			406.51	2.07	---- Not Found ----		
			496.31	46.00	---- Not Found ----		
			572.67	0.16	---- Not Found ----		
			595.03	1.22	---- Not Found ----		
			620.10	1.36	---- Not Found ----		
			923.85	0.73	---- Not Found ----		
			1047.57	1.17	---- Not Found ----		
		% Abundances	Found = 0.50				
XE-135	9.11H	219.23	249.79*	09.90	---- Not Found ----		Decay, Abun.
			600.19	2.89	1.000E+35	0.69	
		% Abundances	Found = 3.11				
XE-138	14.13M	8480.64	153.75	5.95	---- Not Found ----		Decay, Abun.
			242.56	3.50	1.000E+35	49.97	
			258.31*	31.50	---- Not Found ----		
			396.43	6.30	---- Not Found ----		
			401.36	2.17	---- Not Found ----		

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma XError	Rejected by
XE-138	14.13M	8480.64	434.49	20.30	----	Not Found	Decay, Abun.
			1114.29	1.47	----	Not Found	
			1768.26	16.70	----	Not Found	
			1050.86	1.42	----	Not Found	
			2004.75	5.35	----	Not Found	
			2015.82	12.30	----	Not Found	
			% Abundances Found =			3.27	
BA-142	10.70M	11199.20	77.60	9.60	1.000E+35	60.85	Decay, Abun.
			231.52	10.10	----	Not Found	
			255.12*	10.00	----	Not Found	
			425.03	5.00	----	Not Found	
			894.90	11.00	----	Not Found	
			948.75	8.90	----	Not Found	
			1000.86	7.80	----	Not Found	
			1070.48	9.30	----	Not Found	
			1202.20	5.30	----	Not Found	
1204.06	14.00	----	Not Found				
% Abundances Found =			9.70				
EU-152	13.60Y	0.02	121.78	20.40	----	Not Found	Abun.
			244.69	7.49	1.024E-07	49.97	
			344.27*	26.50	----	Not Found	
			770.89	12.74	----	Not Found	
			867.32	4.16	----	Not Found	
			964.01	14.40	----	Not Found	
			1005.70	10.00	----	Not Found	
			1112.02	13.30	----	Not Found	
1407.95	20.70	----	Not Found				
% Abundances Found =			5.44				
PB-212	10.64M	107.65	74.81	10.70	----	Not Found	Decay, Abun.
			77.11	10.00	1.000E+35	60.85	
			97.30	0.00	----	Not Found	
			115.19	0.60	----	Not Found	
			230.63*	44.60	----	Not Found	
			300.09	3.41	----	Not Found	
% Abundances Found =			21.10	(Abn. Limit = 44.60%)			
BI-214	19.90M	6021.60	609.31*	46.30	1.000E+35	0.69	Decay
			760.36	5.04	----	Not Found	
			934.06	3.21	----	Not Found	
			1120.29	15.10	1.000E+35	27.87	
			1230.11	5.94	----	Not Found	
			1377.67	4.11	----	Not Found	
			1764.49	15.00	1.000E+35	23.79	
% Abundances Found =			00.04	(Abn. Limit = 40.40%)			
PB-214	26.00M	4471.32	87.30	4.67	----	Not Found	Decay
			241.90	7.49	1.000E+35	49.97	
			295.21	19.20	1.000E+35	11.93	
			351.92*	37.20	1.000E+35	0.32	

Rejected Report (continued)  
Sample ID : EFT 102010 4/3

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Acquisition date : 11-JAN-2011 16:30:54

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma	
	Half-life	Ratio			(uCi/cc)	*Error Rejected by
PE-214	26.80M	4471.32	765.91	1.10	--- Not Found ---	Decay
% Abundances Found =				91.72	(Abn. Limit = 37.20%)	

Flags "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EFT 102010 4/S

Page : 7  
Acquisition date : 11-JAN-2011 16:38:54

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	77.34	32	120	0.83	154.38	151	7	1.18E-02	60.0	2.54E+00	T
0	242.99	48	136	1.59	485.44	478	11	1.77E-02	50.0	6.31E+00	T
0	295.48	195	84	1.53	596.37	585	12	7.21E-02	11.9	6.09E+00	T
0	352.16	292	66	1.66	703.65	697	14	1.08E-01	8.3	5.70E+00	T
0	511.48	194	90	2.68	1022.07	1013	20	7.19E-02	13.6	4.90E+00	T
0	689.17	210	24	1.82	1217.31	1209	14	7.77E-02	8.7	4.52E+00	T
0	1120.10	57	32	2.48	2238.50	2228	21	2.12E-02	27.9	2.90E+00	T
0	1765.06	46	14	2.12	3527.61	3517	18	1.71E-02	23.8	2.26E+00	T

Flags: "T" = Tentatively associated

**EFT-4S**

**2011**



## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-661145

Sample Location (Well Number): 45

1. Representative sample collected. Date/Time 6-9-11 1 09:30

Sample collected by: Prottin / [Signature] Date: 6-9-11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Prottin / [Signature] Date: 6-9-11  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Russ Bennett / [Signature] Date: 6-10-11  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. [Signature] / [Signature] Date: 6-13-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks W / A 6-13-11

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-6611 4S
2 . Date Sampled	06/09/2011
3 . Time Sampled	09:30
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	06/09/2011
2 . Time Sample Counted	14:55
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	5.8 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2424.5 cpm
Net Spike Count Rate (cpm)	2418.7 cpm
H3 Spike Activity (dpm on count date)	6526.4 dpm
Counter Efficiency	0.3706 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	6.6 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.8 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	1.8 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.08\text{E}-06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 6-10-11

Reviewed By: 

Date 6-13-11

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-661145

Sample Location (Well Number): 4/S

1. Representative sample collected. Date/Time 6-6-11 1 10:20

Sample collected by: Thomas Mow / [Signature] Date: 6-7-11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: Proffitt / [Signature] Date: 6-7-11  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Proffitt / [Signature] Date: 6-13-11  
Fermi 2 RP Printed Name Signature

Sample number: EFT-66114S

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: C Proffitt , C Proffitt Date: 6-13-11  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert Begley , [Signature] Date: 6-17-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

*[Handwritten: 6-17-11]*

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-6611-4S

Sample End Time: 6-JUN-2011 10:20:00.00

REMARKS *Natural*

PERFORMED BY:  
*Charles Proffus*  
SIGNATURE

REVIEWED BY:  
*[Signature]*  
SIGNATURE/DATE

Sample ID : EFT-6611-4S

Acquisition date : 13-JUN-2011 11:31:54

```

*****
Fermi 2 Radiation Protection Gamma Spectroscopy Report
*****

```

```

***** Sample Parameters *****

```

```

Sample ID Number: EFT-6611-4S
Sample collection start date: 6-JUN-2011 10:20:00.00
Sample collection end date : 6-JUN-2011 10:20:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : M2LL Operator: CLP

```

```

***** Acquisition Parameters *****

```

```

Detector number : DET 4 Acquire date : 13-JUN-2011 11:31:54.85
Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00
Elapsed real time : 0 00:45:00.64 Percent dead time : 0.03 %

```

```

***** Calibration Parameters *****

```

```

Detector number : DET 4 Yearly cal date : 23-JUN-2010 12:28:00.00
KeV/channel : 5.00022E-01 Zero offset: 1.96812E-01
Daily cal date : 13-JUN-2011 08:58:17.00

```

```

***** Peak Search Parameters *****

```

```

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

```

```

***** Nuclide Identification Parameters *****

```

```

Energy tolerance : 1.75000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4_m211 Efficiencies at : Peak energy

```

```

*****

```

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	198.75	36	84	0.81	397.09	392	9	1.34E-02	48.3	
2	0	352.33	60	51	1.59	704.25	699	11	2.24E-02	26.4	
3	0	511.62	195	34	3.01	1022.85	1013	24	7.23E-02	10.8	
4	0	609.18	57	46	1.67	1217.98	1212	13	2.11E-02	27.8	
5	0	1461.26	75	20	1.75	2922.36	2912	20	2.79E-02	18.5	

Sample Title : EFT-6611-48  
Decay Time = 7 01:11:54.85

Page : 1  
Acquisition Time = 13-JUN-2011 11:31:54.8

5

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	198.75	36	84	0.81	397.09	392	9	48.3		Low FWHM
0	352.33	60	51	1.59	704.25	699	11	26.4		Pb-214
0	511.62	195	34	3.01	1022.85	1013	24	10.8		Ann. PaK
0	609.18	57	46	1.67	1217.98	1212	13	27.8		Bi-214
0	1461.26	75	20	1.75	2922.36	2912	20	18.5		K-40

*f-6-13-11*

Nuclide Line Activity Report  
Sample ID : EFT-6611-4S

Page : 2  
Acquisition date : 13-JUN-2011 11:31:54

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	75	10.67*	2.501E+00	2.825E-07	2.825E-07	10.54

Flag: "\*" = Keyline



Summary of Nuclide Activity

Sample ID : EFT-6611-4S

Acquisition date : 13-JUN-2011 11:31:54

Total number of lines in spectrum 5  
 Number of unidentified lines 0  
 Number of lines tentatively identified by NID 5 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.825E-07	2.825E-07	0.524E-07	18.54	
Total Activity :			2.825E-07	2.825E-07			

Grand Total Activity : 2.825E-07 2.825E-07

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Rejected Report

Sample ID : EFT-6611-4S

Acquisition date : 13-JUN-2011 11:31:54

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by	
	Half-life	Ratio			(uCi/cc)	%Error		
F-18	109.74M	92.71	511.00*	193.46	1.677E+20	10.80	Decay	
% Abundances Found = 100.00								
SE-75	119.78D	0.06	66.05	1.02	----	Not Found	----	Abun.
			96.73	3.41	----	Not Found	----	
			121.12	16.70	----	Not Found	----	
			136.00*	59.20	----	Not Found	----	
			198.60	1.45	3.956E-07	48.31		
			264.65	59.80	----	Not Found	----	
			279.53	25.20	----	Not Found	----	
			303.91	1.32	----	Not Found	----	
400.65	11.40	----	Not Found	----				
% Abundances Found = 0.81								
RU-103	39.35D	0.18	497.00*	89.00	----	Not Found	----	Abun.
			610.33	5.60	2.554E-07	27.78		
			% Abundances Found = 5.92					
XE-135	9.11H	18.61	249.79*	89.90	----	Not Found	----	Decay, Abun.
			608.19	2.89	1.753E-01	27.78		
			% Abundances Found = 3.11					
BI-214	19.90M	511.28	609.31*	46.30	1.000E+35	27.78	Decay	
			768.36	5.04	----	Not Found		----
			934.06	3.21	----	Not Found		----
			1120.29	15.10	----	Not Found		----
			1238.11	5.94	----	Not Found		----
			1377.67	4.11	----	Not Found		----
			1764.49	15.80	----	Not Found		----
% Abundances Found = 48.48 (Abn. Limit = 48.48%)								
PB-214	26.80M	379.64	87.30	4.67	----	Not Found	----	Decay
			241.98	7.49	----	Not Found	----	
			295.21	19.20	----	Not Found	----	
			351.92*	37.20	1.000E+35	26.41		
			785.91	1.10	----	Not Found	----	
% Abundances Found = 53.40 (Abn. Limit = 37.20%)								

Flag: "\*" = Keyline

## Unidentified Energy Lines

Page : 5

Sample ID : EFT-6611-4S

Acquisition date : 13-JUN-2011 11:31:54

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	198.75	36	04	0.81	397.09	392	9	1.34E-02	48.3	6.60E+00	T
0	352.33	60	51	1.59	704.25	699	11	2.24E-02	26.4	5.70E+00	T
0	511.62	195	34	3.01	1022.05	1013	24	7.23E-02	10.8	4.88E+00	T
0	609.18	57	46	1.67	1217.98	1212	13	2.11E-02	27.8	4.52E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	24.	477.59	5.3752E-08
F-18	0.	511.00	Half-Life too short
NA-22	11.	1274.54	6.8426E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	16.	889.25	6.8698E-09
CR-51	43.	320.08	6.7994E-08
MN-54	25.	834.83	7.5018E-09
CO-56	16.	1238.25	1.2267E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	62.	158.38	1.3285E-08
CO-57	39.	122.06	6.5434E-09
CO-58	24.	810.76	7.6719E-09
FE-59	15.	1099.22	1.4026E-08
CO-60	14.	1332.49	7.6246E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	14.	1115.52	1.3934E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	33.	136.00	8.2669E-09
AS-76	47.	559.10	1.4361E-06
BR-82	12.	776.49	1.6876E-07
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	66.	513.99	1.9368E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	66.	513.99	9.0365E-09
RB-86	13.	1076.63	9.8155E-08
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	8.	1836.01	7.6786E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	16.	1204.90	2.7584E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page : 2

Sample ID : EFT-6611-4S

Acquisition date : 13-JUN-2011 11:31:54

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NE-94	26.	702.63	6.4200E-09
NE-95	20.	765.79	7.2059E-09
NE-95M	54.	235.69	9.0600E-08
ZR-95	14.	756.72	1.0410E-08
NE-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	22.	739.58	2.9271E-07
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	26.	497.00	6.8210E-09
TC-104	0.	357.99	Half-Life too short
RH-105	46.	318.90	8.3693E-07
RU-105	0.	724.50	Half-Life too short
RU-106	31.	621.04	6.5794E-08
CD-109	35.	88.03	2.3413E-07
AG-110M	19.	937.48	2.1790E-08
SN-113	22.	391.69	7.2240E-09
SN-117M	62.	158.56	9.7826E-09
SB-122	26.	563.93	4.9632E-08
SB-124	42.	602.71	7.9895E-09
SB-125	28.	427.89	1.7765E-08
TE-125M	49.	109.28	2.6793E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	39.	57.60	1.8666E-05
XE-127	69.	202.84	1.0603E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	29.	695.88	2.3470E-07
XE-129M	54.	196.56	2.0507E-07
I-130	0.	536.09	Half-Life too short
BA-131	42.	123.80	2.9202E-08
I-131	34.	364.48	1.2039E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	16.	773.67	7.3914E-07
XE-131M	45.	163.93	3.9075E-07
I-132	0.	667.69	Half-Life too short
TE-132	52.	228.16	2.8987E-08
BA-133	51.	302.84	3.3372E-08
BA-133M	37.	276.09	5.6790E-07
I-133	20.	529.87	1.6075E-06
TE-133M	0.	912.58	Half-Life too short
XE-133	27.	81.00	6.4830E-08
XE-133M	46.	233.22	4.9127E-07
CS-134	32.	604.70	6.6300E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	43.	268.24	2.0036E-06
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page : 3

Sample ID : EFT-6611-4S

Acquisition date : 13-JUN-2011 11:31:54

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	20.	818.50	9.5653E-09
I-136	0.	1313.02	Half-Life too short
CS-137	26.	661.65	7.1672E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	47.	165.85	6.6676E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	19.	537.32	2.8432E-08
LA-140	4.	1596.49	9.8868E-08
BA-141	0.	190.22	Half-Life too short
CE-141	47.	145.44	1.2761E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	41.	293.26	4.4912E-07
CE-144	37.	133.54	4.7209E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	33.	91.10	4.3333E-08
PM-148M	30.	550.27	7.0555E-09
EU-152	31.	344.27	1.0955E-08
EU-154	19.	1004.76	4.1694E-08
EU-155	42.	105.31	3.2918E-08
EU-156	23.	646.29	1.1118E-07
HF-181	25.	482.03	7.0881E-09
TA-182	12.	1221.42	2.5904E-08
W-187	23.	685.81	2.8437E-06
RE-188	52.	155.03	3.6826E-05
AU-199	62.	158.38	7.6020E-08
HG-203	45.	279.19	7.9270E-09
BI-207	26.	569.67	5.8350E-09
TL-208	0.	583.14	Half-Life too short
PE-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PE-214	0.	351.92	Half-Life too short
RA-224	43.	240.98	5.1371E-07
RA-226	63.	186.21	1.8139E-07
AC-228	39.	338.32	4.8106E-08
TH-228	40.	84.37	8.3311E-07
PA-234	0.	131.20	Half-Life too short
TH-234	45.	63.29	1.0032E-06
U-235	45.	143.76	4.9625E-08
NP-239	45.	106.13	2.4342E-07
AM-241	35.	59.54	1.2324E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-101211-45

Sample Location (Well Number): EFT-4/S

1. Representative sample collected. Date/Time 10/12/11 1 10:55

Sample collected by: Thomas Mow / [Signature] Date: 10/12/11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Thomas Mow / [Signature] Date: 10/25/11  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Tom M. York / [Signature] Date: 11-1-11  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Geyser / [Signature] Date: 11-2-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks W/A

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-4/S
2 . Date Sampled	10/12/2011
3 . Time Sampled	10:55
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	10/30/2011
2 . Time Sample Counted	13:40
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.5 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2548.6 cpm
Net Spike Count Rate (cpm)	2541.1 cpm
H3 Spike Activity (dpm on count date)	6383.7 dpm
Counter Efficiency	0.3981 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	6.0 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

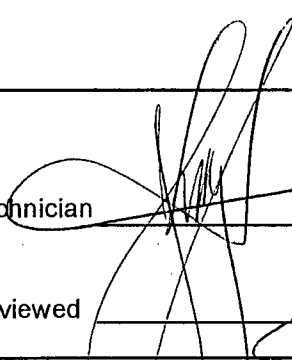
**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.14\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 11-1-11

Reviewed 

Date NOV 01 2011



## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-101211-45

Sample Location (Well Number): EFT-45

1. Representative sample collected. Date/Time 10/12/11 1 10:55

Sample collected by: Thomas Mow / [Signature] Date: 10/25/11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Thomas Mow / [Signature] Date: 10/25/11  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function.

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: C. Proffitt / [Signature] Date: 11-1-11  
Fermi 2 RP Printed Name Signature

Sample number: EFF101211-45

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: C. Proffitt | [Signature] Date: 11-1-11  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gley SR | [Signature] Date: 11-2-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ *n IA* \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-101211-48

Sample End Time: 12-OCT-2011 10:55:00.00

REMARKS *No Point Related Toxins*

PERFORMED BY:

*Charles Proffitt*  
SIGNATURE

REVIEWED BY:

*[Signature]*  
SIGNATURE/DATE

Sample ID : EFT-101211-45

Acquisition date : 1-NOV-2011 15:29:30

\*\*\*\*\*

## Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-101211-45  
 Sample collection start date: 12-OCT-2011 10:55:00.00  
 Sample collection end date : 12-OCT-2011 10:55:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc ✓  
 Sample geometry : PELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 ✓ Acquire date : 1-NOV-2011 15:29:30.76  
 Preset live time : 0 00:45:00.00 ✓ Elapsed live time : 0 00:45:00.00  
 Elapsed real time : 0 00:45:00.62 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 14-JUN-2011 ✓ 14:50:56.41  
 KeV/channel : 5.00032E-01 Zero offset: -5.54949E-01  
 Daily cal date : 1-NOV-2011 07:48:09.27 ✓

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 ✓ Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	511.27	190	24	2.48	1023.50	1015	18	7.03E-02	9.7	
2	0	596.24	33	10	0.89	1193.51	1186	13	1.23E-02	26.1	
3	0	610.06	46	30	1.23	1221.16	1213	18	1.70E-02	35.6	
4	0	1461.01	77	4	2.16	2922.99	2914	17	2.85E-02	12.9	

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	511.27	190	24	2.40	1023.50	1015	10	9.7		
0	596.24	33	10	0.89	1193.51	1186	13	26.1		
0	610.06	46	30	1.23	1221.16	1213	10	35.6		
0	1461.01	77	4	2.16	2922.99	2914	17	12.9		

*Ann Peak.*  
*Ge-11-8*  
*Bi-214*  
*K-40*  
*1-11-2-11*

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected	Decay Corr	1-Sigma
					uCi/cc	uCi/cc	%Error
K-40	1460.81	77	10.67*	2.353E+00	3.071E-07	3.071E-07	12.92

Flag: "\*" = Keyline

Sample ID : EFT-101211-4S

Acquisition date : 1-NOV-2011 15:29:30

Total number of lines in spectrum 4  
 Number of unidentified lines 0  
 Number of lines tentatively identified by NID 4 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma XError	Flags
K-40	1.00E+05Y	1.00	3.071E-07	3.071E-07	0.397E-07	12.92	
Total Activity :			3.071E-07	3.071E-07			

Grand Total Activity : 3.071E-07 3.071E-07

Flags: "K" = Keyline not found  
 "E" = Manually edited

"H" = Manually accepted  
 "A" = Nuclide specific abn. limit

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
F-18	109.74M	265.15	511.00*	193.46	1.000E+35	9.65	Decay
	% Abundances Found =		100.00				
RU-103	39.35D	0.51	497.09*	89.00	---	Not Found	---
			610.33	5.60	2.754E-07	35.60	Abun.
	% Abundances Found =		5.92				
I-134	52.60M	553.18	135.40	3.76	---	Not Found	---
			235.47	1.98	---	Not Found	---
			405.45	7.30	---	Not Found	---
			540.83	7.80	---	Not Found	---
			595.36	11.40	1.000E+35	26.05	Decay, Abun.
			621.79	10.60	---	Not Found	---
			677.34	8.50	---	Not Found	---
			766.68	4.10	---	Not Found	---
			847.03	95.41	---	Not Found	---
			857.29	6.96	---	Not Found	---
			884.09*	65.30	---	Not Found	---
			947.86	4.04	---	Not Found	---
			1072.55	15.30	---	Not Found	---
			1136.16	9.70	---	Not Found	---
			1613.80	4.36	---	Not Found	---
			1806.84	5.70	---	Not Found	---
	% Abundances Found =		4.35				
PM-148M	41.30D	0.49	288.11	12.56	---	Not Found	---
			414.07	18.66	---	Not Found	---
			432.78	5.35	---	Not Found	---
			501.26	6.75	---	Not Found	---
			550.27*	94.90	---	Not Found	---
			599.74	12.54	---	Not Found	---
			611.26	5.48	2.768E-07	35.60	Abun.
			629.97	89.00	---	Not Found	---
			725.70	32.00	---	Not Found	---
			915.33	17.17	---	Not Found	---
			1013.81	20.30	---	Not Found	---
	% Abundances Found =		1.74				
BI-214	19.90M	1462.16	609.31*	46.30	1.000E+35	35.60	Decay
			768.36	5.04	---	Not Found	---
			934.06	3.21	---	Not Found	---
			1120.29	15.10	---	Not Found	---
			1238.11	5.94	---	Not Found	---
			1377.67	4.11	---	Not Found	---
			1764.49	15.00	---	Not Found	---
	% Abundances Found =		48.48 (Abn. Limit = 48.48%)				

Flag: "\*" = Keyline



It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	511.27	190	24	2.40	1023.58	1015	10	7.03E-02	9.7	4.59E+00	T
0	596.24	33	10	0.09	1193.51	1186	13	1.23E-02	26.1	4.20E+00	T
0	610.06	46	30	1.23	1221.16	1213	10	1.70E-02	35.6	4.25E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	19.	477.59	6.1248E-08
F-18	0.	511.00	Half-Life too short
NA-22	11.	1274.54	7.1262E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	14.	889.25	7.6685E-09
CR-51	30.	320.00	9.3933E-08
MN-54	25.	834.83	8.1605E-09
CO-56	19.	1238.25	1.5947E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	50.	158.38	5.6146E-08
CO-57	39.	122.06	7.1994E-09
CO-58	20.	810.76	8.4248E-09
FE-59	15.	1099.22	1.8206E-08
CO-60	18.	1332.49	9.1326E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	17.	1115.52	1.6716E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	45.	136.00	1.0919E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	55.	513.99	1.8977E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	55.	513.99	1.0166E-08
RB-86	16.	1076.63	1.8414E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	6.	1036.01	7.7225E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	16.	1204.90	3.3084E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT-101211-48

Acquisition date : 1-NOV-2011 15:29:30

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	17.	702.63	5.6155E-09
NB-95	24.	765.79	1.0566E-08
NB-95M	42.	235.69	1.0491E-06
ZR-95	16.	756.72	1.3163E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	17.	739.50	7.5111E-06
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	36.	497.00	1.0623E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	26.	621.04	6.6751E-08
CD-109	39.	88.03	2.6093E-07
AG-110M	0.	937.40	1.6190E-08
SN-113	25.	391.69	8.6968E-09
SN-117M	51.	150.56	1.0216E-08
SB-122	26.	563.93	1.5302E-06
SB-124	39.	602.71	9.5512E-09
SB-125	26.	427.09	1.8425E-08
TE-125M	37.	109.20	2.9266E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	26.	57.60	1.9632E-05
XE-127	60.	202.04	1.3269E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	31.	695.00	3.3562E-07
XE-129M	67.	196.56	6.5399E-07
I-130	0.	536.09	Half-Life too short
BA-131	40.	123.00	6.6150E-08
I-131	44.	364.40	4.4405E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	44.	163.93	8.6721E-07
I-132	0.	667.69	Half-Life too short
TE-132	43.	220.16	4.5295E-07
BA-133	39.	302.04	3.0907E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.07	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	40.	81.00	4.5910E-07
XE-133M	44.	233.22	3.2052E-05
CS-134	29.	604.70	6.7665E-09
I-134	0.	004.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	260.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT-101211-4S

Acquisition date : 1-NOV-2011 15:29:30

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	9.	818.50	1.4603E-08
I-136	0.	1313.02	Half-Life too short
CS-137	24.	661.65	7.2793E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	42.	165.85	7.0513E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	28.	537.32	7.2339E-08
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	51.	145.44	1.8486E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	45.	133.54	5.6184E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	39.	91.10	1.1202E-07
PM-148M	24.	550.27	8.4857E-09
EU-152	40.	344.27	2.2272E-08
EU-154	17.	1004.76	4.1942E-08
EU-155	34.	105.31	3.1825E-08
EU-156	23.	646.29	2.1545E-07
HF-181	30.	402.03	1.0005E-08
TA-182	12.	1221.42	3.0089E-08
W-187	0.	685.91	Half-Life too short
RE-188	0.	155.03	Half-Life too short
AU-199	50.	158.38	1.3127E-06
HG-203	44.	279.19	9.9026E-09
BI-207	30.	569.67	6.5774E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	57.	240.98	7.5657E-06
RA-226	69.	186.21	1.9653E-07
AC-228	39.	338.32	5.0972E-08
TH-228	40.	94.37	8.7679E-07
PA-234	0.	131.20	Half-Life too short
TH-234	50.	63.29	1.6407E-06
U-235	54.	143.76	5.7387E-08
NP-239	44.	106.13	1.2168E-05
AM-241	29.	59.54	1.2556E-07

**GEL LAB RESULTS**

**EFT-4S 2009**

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Company : Detroit Edison - Fermi 1  
Address : PO Box 44440  
Detroit, Michigan 48244

Report Date: February 17, 2010

Contact: Mr. Tom Mow  
Project: Fermi 1 - PO# 4700246055

Client Sample ID: EF1-4S-D  
Sample ID: 245517022  
Matrix: Ground Water  
Collect Date: 29-DEC-09 08:45  
Receive Date: 25-JAN-10  
Collector: Client

Project: ROIT00116  
Client ID: ROIT001

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
<b>Rad Gas Flow Proportional Counting</b>											
<i>GFPC, Gross A/B, liquid "As Received"</i>											
Alpha	U	0.592	+/-2.04	3.96	5.00	pCi/L		DXF3 02/11/10	1934	945896	1
Beta	U	2.48	+/-1.81	2.79	5.00	pCi/L					

### The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EPA 900.0	

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

**Certificate of Analysis**

Company : Detroit Edison - Fermi 1  
 Address : PO Box 44440  
 Detroit, Michigan 48244  
 Contact: Mr. Tom Mow  
 Project: Fermi 1 - PO# 4700246055

Report Date: December 30, 2010

Client Sample ID: EFT-102010-4/S Project: ROIT00116  
 Sample ID: 268144004 Client ID: ROIT001  
 Matrix: Water  
 Collect Date: 20-OCT-10 11:50  
 Receive Date: 06-DEC-10  
 Collector: Client

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Gas Flow Proportional Counting</b>												
<i>GFPC, Gross A/B, liquid "As Received"</i>												
Alpha	U	1.40	+/-1.69	2.78	5.00	pCi/L		VXC2	12/27/10	1248	1059089	1
Beta		7.44	+/-2.51	3.55	5.00	pCi/L						

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	EPA 900.0/SW846 9310	

**EFT-4D**

**2006**



## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-4D 061206D

Sample Location (Well Number): EFT-4D Duplicate

1. Representative sample collected. Date/Time 06/12/06 11:08

Sample collected by: Jay Slobach / J. Slobach Date: 06/12/06  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples.

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only.

Sample sealed by: Christopher Freiling / Chris Freiling Date: 08/02/06  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Russ Bump / Russ Bump Date: 8-3-06  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: R. D. Lindsay / R. D. Lindsay Date: 2-25-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1. Sample Location	EFT-4D Duplicate
2. Date Sampled	06/12/2006
3. Time Sampled	11:08
4. Sample Volume, (ml)	4 ml

**Instrument Count Data**

1. Date Sample Counted	08/03/2006
2. Time Sample Counted	12:30
3. Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	8.3 cpm
4. Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3619.6 cpm
Net Spike Count Rate (cpm)	3611.3 cpm
H3 Spike Activity (dpm on count date)	8580.4 dpm
Counter Efficiency	0.4209 cpm/dpm
5. Sample Info:	
Sample Gross Count Rate (cpm)	8.2 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6. Critical Level:	
Critical Level Count Rate (cpm)	2.1 cpm

**Minimum Detectable Activity**

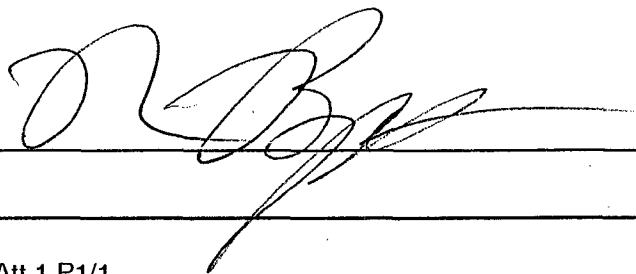
$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.14\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician



Date

8-3-06

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-4D061206D

Sample Location (Well Number): EFT-4D Duplicate

1. Representative sample collected. Date/Time 06/12/06 / 1108

Sample collected by: Jay Slebeck / [Signature] Date: 06/12/06  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Freiling / Clifton A. Ertja Date: 08/02/06  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Abere / [Signature] Date: 8-5-06  
Fermi 2 RP Printed Name Signature

Sample number: EFT-4D061206 D

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Abere | Aber Date: 8-5-06  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: KD LINDSEY | KD Lindsey Date: 2-25-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EIT-40001295 EF1

Sample End Time: 10-JUN-2006 11:00:00.00

REMARKS:

PERFORMED BY:

*Andrew Hure*

SIGNATURE

REVIEWED BY:

*Roh Palsy*

2-25-08

SIGNATURE/DATE

\*\*\*\*\*

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-40061206 EF1
Sample collection start date: 12-JUN-2006 11:00:00.00
Sample collection end date : 12-JUN-2006 11:00:00.00
Type of samp : 1 L FLU. L...
Sample quantity : 1.00000E+03 cc
Sample geometry : PELL Operator: AKG

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 5-AUG 2006 14:36:06
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:01.08 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 26 APR 2006 13:58:42
KeV/channel : 5.00143E-01 Zero offset: -2.30456E-03
Daily cal date : 5 APR 2006 00:20:12.42

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iteration to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

Table with 11 columns: Pk, It, Energy, Area, Elugd, FWHM, Channel, Left, Po, Cts/Sec, %Err, Fit. It lists 6 peaks with their respective energy, area, and error values.

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	SEr	Fit	Nuclides
0	130.13	45	04	1.90	200.22	273	12	43.2		<del>3.205</del>
0	134.11	27	01	1.51	337.16	394	0	53.4		> 509, error
0	511.32	101	66	2.15	1022.66	1017	13	19.2		Annihilation
0	550.72	50	33	1.78	1117.50	1112	11	26.4		idw c
0	1461.33	71	3	2.46	2924.35	2918	12	12.8		K-40
0	1765.35	29	6	2.05	3533.37	3527	13	25.6		<del>2.222</del> 2.22-05 13.214

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	71	10.67*	2.380E+00	4.322E-07	4.322E-07	12.85

Flag: "\*" = Keyline



Total number of lines in spectrum 6  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 6 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+09Y	1.00	4.323E-07	4.323E-07	0.556E-07	12.85	
Total Activity :			4.323E-07	4.323E-07			
Grand Total Activity :			4.323E-07	4.323E-07			

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	XAbund	Activity (uCi/g)	1 Sigma	SE, or	Rejected by
F-18	109.74M	718.62	511.00*	100.00	1.000E+35	19.23		Decay
% Abundances Found =			100.00					
SE-75	119.76E	0.13	67.04	1.02	---	Not Found	---	Abun.
			96.73	3.41	---	Not Found	---	
			121.12	16.70	---	Not Found	---	
			136.00*	59.20	---	Not Found	---	
			198.60	1.45	6.282E+07	53.39		
			264.65	59.00	---	Not Found	---	
			279.53	25.20	---	Not Found	---	
			303.91	1.32	---	Not Found	---	
			400.65	11.40	---	Not Found	---	
% Abundances Found =			0.01					
AS-76	26.32H	49.38	559.10*	44.70	2.857E+07	26.36		Decay, Abun.
			563.23	1.17	---	Not Found	---	
			571.30	0.14	---	Not Found	---	
			657.03	6.10	---	Not Found	---	
			665.31	0.07	---	Not Found	---	
			740.12	0.12	---	Not Found	---	
			771.76	0.12	---	Not Found	---	
			867.63	0.12	---	Not Found	---	
			1129.87	0.14	---	Not Found	---	
			1212.72	1.63	---	Not Found	---	
			1216.02	3.84	---	Not Found	---	
			1228.52	1.39	---	Not Found	---	
			1439.13	0.33	---	Not Found	---	
			1453.60	0.13	---	Not Found	---	
			1787.67	0.33	---	Not Found	---	
% Abundances Found =			73.70					
NO-99	66.02H	19.69	140.51	3.00	2.574E+01	43.21		Decay, Abun.
			181.06	6.20	---	Not Found	---	
			366.43	1.37	---	Not Found	---	
			739.58*	12.80	---	Not Found	---	
			778.00	4.50	---	Not Found	---	
% Abundances Found =			13.25					
IS-99M	6.02H	215.90	140.50*	99.07	1.000E+35	43.21		Decay
% Abundances Found =			100.00					
BI-214	19.90M	3918.75	609.31*	46.30	---	Not Found	---	Decay, Abun.
			768.36	5.04	---	Not Found	---	
			934.06	3.21	---	Not Found	---	
			1120.29	15.10	---	Not Found	---	
			1238.11	5.94	---	Not Found	---	
			1377.67	4.11	---	Not Found	---	
			1764.49	15.80	1.000E+35	23.61		
% Abundances Found =			16.54 (Abn. Limit = 48.48%)					

Flag: "\*" = Keyline

It	Energy	Area	Width	FWHM	Channel	Left	Pr	Cts/Sec	%Err	%Eff	Flags
0	140.13	45	84	1.98	200.22	273	12	2.51E-02	43.2	5.85E+00	T
0	198.61	27	61	1.51	397.16	394	8	1.49E-02	53.4	6.03E+00	T
0	511.32	101	66	2.15	1022.66	1017	13	5.62E-02	19.2	4.40E+00	T
0	558.72	50	33	1.78	1117.50	1112	11	2.78E-02	26.4	4.31E+00	T
0	1765.35	29	6	2.85	3533.37	3527	13	1.63E-02	25.6	2.00E+00	T

Flags: "T" = Tentatively associated.



Sample ID : EFT-40061206 EFL

Acquisition date : 5-AUG-2006 14:36:06

Nuclide	Segmnt Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	27.	700.63	1.0600E-00
NB-95	22.	765.79	3.0751E-00
ND-95M	7.	835.69	Half-Life too short
ZR-95	10.	756.72	3.0960E-00
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
ND-99	0.	739.50	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	29.	497.00	2.6907E-00
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	20.	621.84	9.6734E-00
CD-109	45.	88.03	4.7215E-07
AG-110M	11.	937.40	3.2139E-00
SN-113	32.	391.69	1.8454E-00
SN-117M	66.	150.56	1.8136E-07
OF-120	0.	563.93	Half-Life too short
SB-124	31.	602.71	1.9707E-00
SB-125	34.	427.89	3.2740E-00
TE-125M	50.	109.20	7.9373E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	31.	57.60	3.2701E-05
XE-127	40.	202.84	3.6021E-00
TE-129	0.	459.60	Half-Life too short
TE-129M	19.	695.80	0.4100E-07
XE-129M	54.	196.56	1.3150E-05
I-130	0.	500.00	Half-Life too short
BA-131	30.	123.00	7.3611E-07
I-131	41.	364.40	1.2401E-00
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	56.	163.93	1.1120E-05
I-132	0.	667.69	Half-Life too short
TE-132	0.	220.16	Half-Life too short
BA-133	40.	302.84	5.0352E-00
BA-133M	0.	276.00	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	0.	01.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	22.	604.70	9.4452E-09
I-134	0.	004.09	Half-Life too short
Tl-134	0.	210.47	Half-Life too short
BA-135M	0.	260.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	16.	818.50	1.7265E-07
CS-136	0.	1313.02	Half-Life too short
CS-137	17.	661.65	9.6491E-09
XE-137	0.	455.40	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	250.31	Half-Life too short
BA-139	3.	1420.50	Half-Life too short
CE-139	58.	165.85	1.5156E-08
CS-139	0.	1263.23	Half-Life too short
BA-140	19.	537.32	5.9087E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	43.	145.41	5.5003E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	44.	133.54	9.3971E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	34.	91.10	1.4503E-06
PM-148M	25.	550.27	2.3646E-08
EU-152	44.	344.27	3.6773E-08
EU-154	13.	1004.76	5.0147E-08
EU-156	13.	646.29	1.2002E-06
HF-181	27.	452.02	2.5630E-08
TA-182	9.	1221.42	5.0676E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
DS-203	43.	279.19	2.6126E-08
FI-207	26.	569.67	9.6020E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	230.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	50.	186.21	2.8510E-07
AC-228	36.	338.32	7.7895E-08
TH-228	33.	84.37	1.3360E-06
PA-234	0.	131.20	Half-Life too short
TH-234	45.	63.29	6.2271E-06
U-235	48.	143.76	8.4285E-08
NP-239	0.	106.13	Half-Life too short
AM-241	31.	59.54	1.7622E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-40 061206D

Sample Location (Well Number): EFT-40 Duplicate

1. Representative sample collected. Date/Time 06/12/06 / 1108

Sample collected by: Jay Slaback / Don Main Slaback Collection Date: 06/12/06  
Printed Name / Signature Signed: 02/01/07

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Friling / Christopher Friling Date: 08/02/06  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Duss Bueger Date: 2-5-7  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: William V. Linton Date: 2/15/07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks No tritium detected. William V. Linton 2/15/07

Tritium Activity Calculation

WE EF104-052  
pg 2 of 2

**Sample Information**

1. Sample Location EFT-4D061206D  
 2. Date Sampled 06/12/2006  
 3. Time Sampled 11:08  
 4. Sample Volume, (ml) 4 ml

**Instrument Count Data**

1. Date Sample Counted 02/02/2007  
 2. Time Sample Counted 10:00  
 3. Background Inf.:  
     Minutes Counted 10 min.  
     Background Count Rate (cpm) 7.4 cpm  
 4. Efficiency Inf.: (Daily Spike Source ID # 111)  
     Gross Spike Count Rate (cpm) 3388.1 cpm  
     Net Spike Count Rate (cpm) 3380.7 cpm  
     H3 Spike Activity (dpm on count date) 8340.7 dpm  
     Counter Efficiency 0.4053 cpm/dpm  
 5. Sample Info:  
     Sample Gross Count Rate (cpm) 7.7 cpm  
     Sample Count Time (min.) 10.0 min.  
     Net Sample Count Rate (cpm) 0.3 cpm  
 6. Critical Level:  
     Critical Level Count Rate (cpm) 2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.12\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 dpm/uCi x Sample Volume}} < \text{MDA}$$

Technician \_\_\_\_\_

Date

2-5-7



## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-4D061206D

Sample Location (Well Number): EFT-4D Duplicate

1. Representative sample collected. Date/Time 06/12/06 / 1108

Sample collected by: Jay Slaback / Jay Main Slaback Date: 06/12/06  
Printed Name / Signature Collection Signed 02/01/07

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Freiling / Christopher A Freiling Date: 08/02/06  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: KD LINDSEY / KD Lindsey Date: 8-21-07  
Fermi 2 RP Printed Name Signature

Sample number: EFT-4D061206 D

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard | [Signature] Date: 7-10-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: [Signature] | [Signature] Date: 7-17-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1 EFT-4D161206D

Sample End Time: 12-JUN-2006 11:09:00.00

REMARKS

PERFORMED BY:

*[Handwritten Signature]*

SIGNATURE

REVIEWED BY:

*[Handwritten Signature]*

7-17-07

SIGNATURE/DATE

Sample ID : EF1 EFT-4D161206

Acquisition date : 2-JUL-2007 14:05:39

## Fermi 2 Radiation Protection Gamma Spectroscopy Report

## \*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-4D161206D  
 Sample collection start date: 12-JUN-2006 11:00:00.00  
 Sample collection end date : 12-JUN-2006 11:00:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 CC  
 Sample geometry : PELL Operator: CMH

## \*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 2-JUL-2007 14:05:39.26  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:00.07 Percent dead time : 0.05 %

## \*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16  
 Kev/channel : 4.99646E-01 Zero offset: 5.21199E-02  
 Daily cal date : 2-JUL-2007 10:33:40.58

## \*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

## \*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

PK	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	66.01	69	41	1.40	132.01	126	11	3.83E-02	21.7	1N-227
2	0	352.13	60	32	1.32	704.64	699	14	3.33E-02	23.6	Pb-214
3	0	511.24	162	49	2.35	1023.00	1014	22	9.02E-02	13.5	annihilation
4	0	609.71	23	24	1.22	1220.14	1216	9	1.26E-02	44.8	Bi-214
5	5	1459.15	29	1	2.29	2920.00	2915	15	1.60E-02	24.2	2.16E+00
6	5	1460.15	5	3	2.29	2922.00	2915	15	2.69E-03	169.1	K-40
7	5	1461.24	24	3	1.35	2924.19	2915	15	1.31E-02	30.9	

## Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	66.01	69	41	1.40	132.01	126	11	21.7		
0	352.13	60	32	1.32	704.64	699	14	23.0		
0	511.24	162	49	2.35	1023.00	1014	22	13.5		
0	609.71	23	24	1.22	1220.14	1216	9	44.0		
5	1459.15	29	1	2.29	2920.00	2915	15	24.2	2.16E+00	
5	1460.15	5	3	2.29	2922.00	2915	15	169.1		
5	1461.24	24	3	1.35	2924.19	2915	15	30.9		K-40

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/CC	Decay Corr uCi/CC	1-Sigma %Error
K-40	1460.81	24	10.67*	2.501E+00	1.324E-07	1.324E-07	30.93

Flag: "\*" = Keyline

Total number of lines in spectrum 7  
Number of unidentified lines 1  
Number of lines tentatively identified by NID 6 85.71%

Nuclide Type : natural

Nuclide	Half-life	Decay	Uncorrected uCi/CC	Decay Corr uCi/CC	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	1.324E-07	1.324E-07	0.410E-07	30.93	
Total Activity :			1.324E-07	1.324E-07			

Grand Total Activity : 1.324E-07 1.324E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Sample ID : EF1 EFT-4D161206

Acquisition date : 2-JUL-2007 14:05:39

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/CC)	1-Sigma %Error	Rejected by
F-18	109.74M	5053.70	511.00*	193.46	1.000E+35	13.53	Decay
		% Abundances	Found = 100.00				
SE-75	119.78D	3.22	66.05	1.02	6.820E-05	21.69	Abun.
			96.73	3.41	----	Not Found	----
			121.12	16.70	----	Not Found	----
			136.00*	59.20	----	Not Found	----
			190.60	1.45	----	Not Found	----
			264.65	59.00	----	Not Found	----
			279.53	25.20	----	Not Found	----
			303.91	1.32	----	Not Found	----
			400.65	11.40	----	Not Found	----
		% Abundances	Found = 0.57				
RU-103	39.35D	9.79	497.00*	89.00	----	Not Found	----
			610.33	5.60	1.187E-04	44.76	Abun.
		% Abundances	Found = 5.92				
I-135	6.61H	1398.37	200.45	3.09	----	Not Found	----
			417.63	3.52	----	Not Found	----
			526.56	13.33	----	Not Found	----
			546.56	7.12	----	Not Found	----
			836.80	6.67	----	Not Found	----
			1030.76	7.90	----	Not Found	----
			1124.00	3.60	----	Not Found	----
			1131.51	22.50	----	Not Found	----
			1260.41*	20.60	----	Not Found	----
			1457.56	0.60	1.000E+35	24.16	Decay, Abun.
			1678.03	9.50	----	Not Found	----
			1706.46	4.09	----	Not Found	----
			1791.20	7.70	----	Not Found	----
		% Abundances	Found = 6.81				
XE-135	9.11H	1014.62	249.79*	89.90	----	Not Found	----
			600.19	2.89	1.000E+35	44.76	Decay, Abun.
		% Abundances	Found = 3.11				
CS-136	13.16D	29.27	66.91	12.50	3.067E+02	21.69	Decay, Abun.
			86.29	6.30	----	Not Found	----
			153.22	7.46	----	Not Found	----
			163.89	4.61	----	Not Found	----
			176.55	13.56	----	Not Found	----
			273.65	12.66	----	Not Found	----
			340.57	48.50	----	Not Found	----
			810.50*	99.70	----	Not Found	----
			1040.07	79.60	----	Not Found	----
			1235.34	19.70	----	Not Found	----
		% Abundances	Found = 4.10				
PM-140M	41.30D	9.33	200.11	12.56	----	Not Found	----
			414.07	10.66	----	Not Found	----
			432.70	5.35	----	Not Found	----



Sample ID : EF1 EFT-4D161206

Acquisition date : 2-JUL-2007 14:05:39

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by	
	Half-life	Ratio			(uCi/CC)	%Error		
PM-148M	41.300	9.33	501.26	6.75	----	Not Found	----	Abun.
			550.27*	94.90	----	Not Found	----	
			599.74	12.54	----	Not Found	----	
			611.26	5.40	8.007E-05	44.76		
			629.97	89.00	----	Not Found	----	
			725.70	32.00	----	Not Found	----	
			915.33	17.17	----	Not Found	----	
			1013.01	20.30	----	Not Found	----	
% Abundances Found =			1.74					
TA-102	114.740	3.36	67.75	42.30	1.014E-06	21.69		Abun.
			100.10	14.10	----	Not Found	----	
			1109.05	16.30	----	Not Found	----	
			1221.42*	27.10	----	Not Found	----	
			1230.97	11.50	----	Not Found	----	
			% Abundances Found =			38.01		
BI-214	19.90M	27868.98	609.31*	46.30	1.000E+35	44.76		Decay
			768.36	5.04	----	Not Found	----	
			934.06	3.21	----	Not Found	----	
			1120.29	15.10	----	Not Found	----	
			1238.11	5.94	----	Not Found	----	
			1377.67	4.11	----	Not Found	----	
			1764.49	15.00	----	Not Found	----	
% Abundances Found =			48.48	(Abn. Limit =	48.48%)			
PB-214	26.80M	20693.76	07.30	4.67	----	Not Found	----	Decay
			241.90	7.49	----	Not Found	----	
			295.21	19.20	----	Not Found	----	
			351.92*	37.20	1.000E+35	23.76		
			705.91	1.10	----	Not Found	----	
			% Abundances Found =			53.40	(Abn. Limit =	

Flag: "\*" = Keyline

## Unidentified Energy Lines

Page # 6

Sample ID : EF1 EFT-4D161206

Acquisition date : 2-JUL-2007 14:05:39

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	66.01	69	41	1.40	132.01	126	11	3.03E-02	21.7	1.30E+00	T
0	352.13	60	32	1.32	704.64	699	14	3.33E-02	23.0	5.70E+00	T
0	511.24	162	49	2.35	1023.00	1014	22	9.02E-02	13.5	4.00E+00	T
0	609.71	23	24	1.22	1220.14	1216	9	1.26E-02	44.0	4.52E+00	T
5	1459.15	29	1	2.29	2920.00	2915	15	1.60E-02	24.2	2.50E+00	T
5	1460.15	5	3	2.29	2922.00	2915	15	2.69E-03	***	2.50E+00	

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
BE-7	22.	477.59	1.0356E-05
F-18	0.	511.00	Half-Life too short
NA-22	6.	1274.54	1.0393E-06
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	20.	889.25	2.5937E-07
CR-51	0.	320.00	Half-Life too short
NN-54	13.	834.83	1.9611E-06
CO-56	10.	1238.25	4.1514E-07
NN-56	0.	1010.69	Half-Life too short
HI-56	0.	158.30	Half-Life too short
CO-57	47.	122.06	2.8191E-08
CO-58	10.	810.76	3.1498E-07
FE-59	6.	1099.22	5.2260E-06
CO-60	8.	1332.49	1.0128E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	8.	1115.52	4.7824E-06
ZN-69M	0.	438.63	Half-Life too short
SE-75	38.	136.00	1.1710E-07
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	40.	513.99	2.4504E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	40.	513.99	6.1007E-07
RB-86	0.	1076.63	Half-Life too short
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	2.	1836.01	7.4493E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	14.	1204.90	3.4156E-04
Y-91M	0.	555.68	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EF1 EFT-4D161206

Acquisition date : 2-JUL-2007 14:05:39

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NE-94	13.	702.63	7.1330E-09
NE-95	0.	765.79	Half-Life too short
NE-95M	0.	235.69	Half-Life too short
ZR-95	14.	756.72	9.3565E-07
NE-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	16.	497.00	6.3834E-06
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	18.	621.04	1.5907E-07
CD-109	31.	88.03	5.8318E-07
AG-110M	10.	937.40	7.0404E-08
SN-113	20.	391.69	1.0126E-07
SN-117M	0.	158.56	Half-Life too short
SB-122	0.	563.93	Half-Life too short
SB-124	25.	602.71	7.3430E-07
SB-125	26.	427.09	3.3102E-08
TE-125M	49.	109.28	3.7024E-04
TE-127	0.	417.90	Half-Life too short
TE-127M	24.	57.60	2.4960E-04
XE-127	0.	202.04	Half-Life too short
TE-129	0.	459.60	Half-Life too short
TE-129M	0.	695.80	Half-Life too short
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	0.	123.00	Half-Life too short
I-131	0.	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	0.	163.93	Half-Life too short
I-132	0.	667.69	Half-Life too short
TE-132	0.	220.16	Half-Life too short
BA-133	30.	302.04	4.2024E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	19.	604.70	1.1170E-08
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	260.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EF1 EFT-4D161206

Acquisition date : 2-JUL-2007 14:05:39

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
CS-136	0.	810.50	Half-Life too short
I-136	0.	1313.02	Half-Life too short
CS-137	7.	661.65	6.1486E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.06	Half-Life too short
XE-138	0.	250.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	37.	165.05	6.0002E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	0.	537.32	Half-Life too short
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	0.	145.44	Half-Life too short
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	36.	133.54	1.7501E-07
PR-144	0.	1489.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PM-148M	14.	550.27	4.3529E-06
EU-152	26.	344.27	2.7720E-08
EU-154	10.	1004.76	5.1489E-08
EU-156	0.	646.29	Half-Life too short
HF-181	26.	482.03	5.2226E-06
TA-182	5.	1221.42	2.6375E-07
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	25.	279.19	2.5273E-06
BI-207	24.	569.67	8.6348E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	42.	186.21	2.2507E-07
AC-228	20.	330.32	6.9754E-08
TH-228	30.	84.37	1.5905E-06
PA-234	0.	131.20	Half-Life too short
TH-234	0.	63.29	Half-Life too short
U-235	33.	143.76	6.5035E-08
NP-239	0.	106.13	Half-Life too short
AM-241	26.	59.54	1.6163E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-4D 121406

Sample Location (Well Number): EFT-4D

1. Representative sample collected. Date/Time 12/14/06 1 1527

Sample collected by: J. Slaback / Joy Marie Slaback Date: 12/14/07  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 2/2/07  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: D. Howard / D. Howard Date: APR 20 2007  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: K. Lindsay / K. Lindsay Date: 11-14-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_



## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-4D 121406

Sample Location (Well Number): EFT-4D

1. Representative sample collected. Date/Time 12/14/06 1 1527

Sample collected by: J. Slaback / Jay Main Slaback Date: 02/01/07  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 7/11/07  
Printed Name / Signature ~~2/2/07~~

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: R.D. Lindsey / R.D. Lindsey Date: 8-8-07  
Fermi 2 RP Printed Name Signature



Sample number: EFT-4D 121406

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard | [Signature] Date: 7-16-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: R. H. W. S. U. Y. | [Signature] Date: 8-8-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DETOIT EDISON FERMI-2 POWER PLANT

16-JUL-2007 14:15:41.04

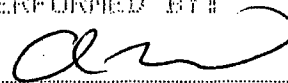
RADIATION PROTECTION DEPARTMENT  
GAMMA SPECTROSCOPY ANALYSIS REPORT  
HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1 EFT-40121406

Sample End Time: 14-DEC-2006 15:27:00.00

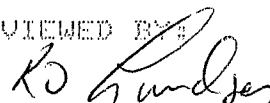
REMARKS

PERFORMED BY:



SIGNATURE

REVIEWED BY:



8-8-07

SIGNATURE/DATE

Sample ID : EF1 EFT-4D121406

Acquisition date : 16-JUL-2007 13:45:30

## Fermi 2 Radiation Protection Gamma Spectroscopy Report

## \*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-4D121406  
 Sample collection start date: 14-DEC-2006 15:27:00.00  
 Sample collection end date : 14-DEC-2006 15:27:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 CC  
 Sample geometry : MELL Operator: CMH

## \*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 16-JUL-2007 13:45:30.51  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:00.09 Percent dead time : 0.05 %

## \*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16  
 KeV/channel : 4.93730E-01 Zero offset: -1.95000E-01  
 Daily cal date : 16-JUL-2007 00:37:10.01

## \*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

## \*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	66.72	39	77	1.51	133.90	127	11	2.10E-02	46.2	Rn-227
2	0	199.55	46	51	1.33	399.70	395	11	2.57E-02	33.5	PA238
3	0	511.39	136	50	2.66	1023.60	1015	20	7.53E-02	16.4	annihilation
4	00	558.09	39	27	1.58	1118.73	1112	12	2.17E-02	31.1	H2C
5	0	1461.13	44	3	2.06	2923.99	2917	14	2.42E-02	17.6	K-40

Sample Title : EF1 EFT-4D121406  
Decay Time = 213 22:10:30.51

Page : 1  
Acquisition Time = 16-JUL-2007 13:45:30.5

1

### Post-MID Peak Search Report

It	Energy	Area	Ekgrnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	66.72	39	77	1.51	133.90	127	11	46.2		
0	199.55	46	51	1.33	399.70	395	11	33.5		
0	511.39	136	58	2.66	1023.68	1015	20	16.4		
0	558.99	39	27	1.50	1110.73	1112	12	31.1		
0	1461.13	44	3	2.06	2923.99	2917	14	17.6		K-40

Nuclide Line Activity Report  
Sample ID : EF1 EFT-40121406

Page : 2  
Acquisition date : 16-JUL-2007 13:45:38

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/CC	Decay Corr uCi/CC	1-Sigma %Error
K-40	1460.81	44	10.67*	2.501E+00	2.455E-07	2.455E-07	17.64

Flag: "\*" = Keyline

Summary of Nuclide Activity  
Sample ID : EF1 EFT-4D121406

Page : 3  
Acquisition date : 16-JUL-2007 13:45:38

Total number of lines in spectrum 5  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 5 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/CC	Decay Corr uCi/CC	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.455E-07	2.455E-07	0.433E-07	17.64	
Total Activity :			2.455E-07	2.455E-07			

Grand Total Activity : 2.455E-07 2.455E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Rejected Report

Sample ID : EF1 EFT-4D121406

Acquisition date : 16-JUL-2007 13:45:38

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/CC)	1-Sigma %Error	Rejected by
F-18	109.74M	2887.31	511.00*	193.46	1.000E+35	16.39	Decay
				% Abundances Found = 100.00			
SE-75	119.78D	1.79	66.05	1.02	1.366E-05	46.18	Abun.
				96.73	3.41	----	Not Found
				121.12	16.70	----	Not Found
				136.00*	59.20	----	Not Found
				198.60	1.45	2.508E-06	33.52
				264.65	59.00	----	Not Found
				279.53	25.20	----	Not Found
				303.91	1.32	----	Not Found
				400.65	11.40	----	Not Found
				% Abundances Found = 1.38			
AS-76	26.32H	195.00	559.10*	44.70	1.000E+35	31.11	Decay, Abun.
				563.23	1.17	----	Not Found
				571.30	0.14	----	Not Found
				657.03	6.10	----	Not Found
				665.31	0.39	----	Not Found
				740.12	0.12	----	Not Found
				771.76	0.12	----	Not Found
				867.63	0.12	----	Not Found
				1129.87	0.14	----	Not Found
				1212.72	1.63	----	Not Found
				1216.02	3.84	----	Not Found
				1228.52	1.39	----	Not Found
				1439.13	0.33	----	Not Found
				1453.60	0.13	----	Not Found
				1797.67	0.33	----	Not Found
				% Abundances Found = 73.70			
TE-131M	30.00H	171.15	102.06	7.90	----	Not Found	Decay, Abun.
				149.72	5.10	----	Not Found
				200.63	7.56	1.000E+35	33.52
				240.93	7.59	----	Not Found
				334.27	9.60	----	Not Found
				773.67*	38.20	----	Not Found
				782.49	7.79	----	Not Found
				793.75	13.90	----	Not Found
				822.76	6.12	----	Not Found
				852.21	20.70	----	Not Found
				1125.46	11.40	----	Not Found
				1206.60	9.60	----	Not Found
				% Abundances Found = 5.19			
TE-134	41.00M	7370.18	79.45	21.00	----	Not Found	Decay, Abun.
				180.89	18.00	----	Not Found
				201.24	3.70	1.000E+35	33.52
				210.47*	21.90	----	Not Found
				277.95	21.30	----	Not Found

Rejected Report (continued)  
 Sample ID : EF1 EFT-4D121406

Page : 5  
 Acquisition date : 16-JUL-2007 13:45:30

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/CC)	%Error	
TE-134	41.80M	7370.18	464.64	5.10	----	Not Found	Decay, Abun.
			565.99	10.90	----	Not Found	
			742.59	14.70	----	Not Found	
			767.20	30.00	----	Not Found	
			% Abundances Found =			4.60	
CS-136	13.16D	16.26	66.91	12.50	2.531E-02	46.18	Decay, Abun.
			86.29	6.30	----	Not Found	
			153.22	7.40	----	Not Found	
			163.09	4.61	----	Not Found	
			176.55	13.56	----	Not Found	
			273.65	12.66	----	Not Found	
			340.57	40.50	----	Not Found	
			818.50*	99.70	----	Not Found	
			1048.07	79.60	----	Not Found	
			1235.34	19.70	----	Not Found	
% Abundances Found =			4.10				
TA-182	114.74D	1.86	67.75	42.30	3.479E-07	46.18	Abun.
			100.10	14.10	----	Not Found	
			1199.05	16.30	----	Not Found	
			1221.42*	27.10	----	Not Found	
			1230.97	11.50	----	Not Found	
% Abundances Found =			30.01				

Flags "\*" = Keyline



## Unidentified Energy Lines

Page # 6

Sample ID : EF1 EFT-4D121406

Acquisition date : 16-JUL-2007 13:45:38

It	Energy	Area	Skdnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	66.72	39	77	1.51	133.90	127	11	2.10E-02	46.2	1.46E+00	T
0	199.55	46	51	1.33	399.70	395	11	2.57E-02	33.5	6.59E+00	T
0	511.39	136	58	2.66	1023.60	1015	20	7.53E-02	16.4	4.80E+00	T
0	558.89	39	27	1.58	1118.73	1112	12	2.17E-02	31.1	4.68E+00	T

Flags: "T" = Tentatively associated

\* Detroit Edison Fermi 2 MDA Report, Generated 16-JUL-2007 14:15:45.70 \*  
 \* Sample ID # EF1 EFT-4D121406 \*

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
BE-7	25.	477.59	1.1837E-06
F-18	0.	511.00	Half-Life too short
NA-22	6.	1274.54	8.9950E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1814.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	13.	809.25	5.2311E-08
CR-51	32.	320.08	1.5767E-05
MN-54	7.	834.83	1.0566E-08
CO-56	11.	1238.25	9.6459E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	0.	158.38	Half-Life too short
CO-57	36.	122.06	1.5963E-08
CO-58	14.	810.76	6.8346E-08
FE-59	7.	1099.22	3.8839E-07
CO-60	5.	1332.49	8.3117E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	8.	1115.52	3.0020E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	42.	136.00	4.5443E-08
AS-76	0.	559.10	Half-Life too short
DR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
ER-84	0.	881.50	Half-Life too short
ER-85	0.	982.41	Half-Life too short
KR-85	46.	513.99	2.5568E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	46.	513.99	1.0499E-07
RB-86	0.	1076.63	Half-Life too short
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	3.	1836.01	2.9588E-08
KR-89	0.	228.98	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.38	Half-Life too short
Y-91	11.	1204.90	4.0569E-05

SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Minimum Detectable Activity Report (continued)

Sample ID : EF1 EFT-4D121406

Acquisition date : 16-JUL-2007 13:45:30

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/CC)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	10.	702.63	6.4475E-09
NB-95	11.	785.79	5.0286E-07
NB-95M	0.	235.69	Half-Life too short
ZR-95	16.	756.72	1.5128E-07
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	19.	497.08	3.3750E-07
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	17.	621.84	1.1303E-07
CD-109	30.	88.03	4.4630E-07
AG-110M	11.	937.48	4.5937E-08
SN-113	31.	391.69	4.3544E-08
SN-117M	0.	158.56	Half-Life too short
SB-122	0.	563.93	Half-Life too short
SB-124	26.	602.71	1.0501E-07
SB-125	15.	427.89	2.2944E-08
TE-125M	44.	109.28	4.5519E-05
TE-127	0.	417.90	Half-Life too short
TE-127M	30.	57.60	9.2327E-05
XE-127	35.	202.84	5.9291E-07
TE-129	0.	459.60	Half-Life too short
TE-129M	10.	695.88	2.0480E-05
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	0.	123.00	Half-Life too short
I-131	0.	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	0.	163.93	Half-Life too short
I-132	0.	667.69	Half-Life too short
TE-132	0.	220.16	Half-Life too short
BA-133	38.	302.84	4.5431E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CG-134	21.	604.70	1.0030E-08
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-life too short

## Minimum Detectable Activity Report (continued)

Page : 3

Sample ID : EF1 EFT-4D121406

Acquisition date : 16-JUL-2007 13:45:30

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/CC)
CS-136	0.	818.50	Half-Life too short
I-135	0.	1313.02	Half-Life too short
CS-137	10.	661.65	9.2439E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.06	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	45.	165.85	2.7678E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	0.	537.32	Half-Life too short
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	39.	145.44	1.4552E-06
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	44.	133.54	1.2628E-07
PR-144	0.	1489.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PM-148M	0.	550.27	1.8834E-07
EU-152	21.	344.27	2.4406E-08
EU-154	14.	1004.76	5.7579E-08
EU-156	0.	646.29	Half-Life too short
HF-181	22.	482.03	2.9355E-07
TA-182	11.	1221.42	1.2960E-07
W-187	0.	685.01	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	31.	279.19	2.1723E-07
BI-207	16.	569.67	7.1931E-09
TL-208	0.	583.14	Half-Life too short
PD-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	56.	186.21	2.5638E-07
AC-228	20.	338.32	6.6280E-08
TH-228	25.	84.37	1.2414E-06
PA-234	0.	131.20	Half-Life too short
TH-234	39.	63.29	5.3859E-04
U-235	50.	143.76	7.0691E-08
NP-239	0.	106.13	Half-Life too short
AM-241	29.	59.54	1.7051E-07

**EFT-4D**

**2007**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-4D7307

Sample Location (Well Number): EFT-4D

1. Representative sample collected. Date/Time 7/3/07 1 1452

Sample collected by: Joy Marie Saback / Joy Marie Saback Date: 12/10/2007  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: S. Southward / S. Southward Date: 12/10/07  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: R. Berger / [Signature] Date: 12/14/07  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KD Lindsey / [Signature] Date: 2-26-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

\_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1. Sample Location 4D  
 2. Date Sampled 07/03/2007  
 3. Time Sampled 14:52  
 4. Sample Volume, (ml) 4 ml

**Instrument Count Data**

1. Date Sample Counted 12/14/2007  
 2. Time Sample Counted 08:00  
 3. Background Inf.:  
     Minutes Counted 10 min.  
     Background Count Rate (cpm) 8.2 cpm  
 4. Efficiency Inf.: (Daily Spike Source ID # 111)  
     Gross Spike Count Rate (cpm) 3189.3 cpm  
     Net Spike Count Rate (cpm) 3181.1 cpm  
     H3 Spike Activity (dpm on count date) 7944.9 dpm  
     Counter Efficiency 0.4004 cpm/dpm  
 5. Sample Info:  
     Sample Gross Count Rate (cpm) 8.4 cpm  
     Sample Count Time (min.) 10.0 min.  
     Net Sample Count Rate (cpm) 0.2 cpm  
 6. Critical Level:  
     Critical Level Count Rate (cpm) 2.1 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Smpl min.})}{\text{Efficiency} \times 2.22\text{E6 dpm/uCi} \times \text{Sample Volume}}}}{\text{Efficiency} \times 2.22\text{E6 dpm/uCi} \times \text{Sample Volume}} = 1.19\text{E-06 uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E6 uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 12/14/07

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT- 4D 7307

Sample Location (Well Number): EFT- 4D

1. Representative sample collected. Date/Time 07/03/2007 1452

Sample collected by: J. Slaback / Jay Marie Slaback Date: 07/10/2007  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 08/08/07  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: W Lindsey / RO Rudy Date: 8-8-07  
Fermi 2 RP Printed Name Signature



Sample number: EFT-4D7307

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard / [Signature] Date: 7-19-07  
Fermi 2 RP      Printed Name                      Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: RD Lindsay / [Signature] Date: 8-8-07  
Fermi 2              Printed Name                      Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
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RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

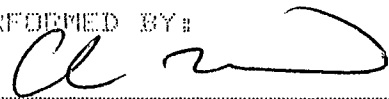
HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1 EFT-4D7307

Sample End Time: 3-JUL-2007 14:52:00.00

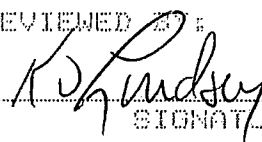
REMARKS

PERFORMED BY:



SIGNATURE

REVIEWED BY:



8-8-07

SIGNATURE/DATE

Sample ID : EF1 EFT-4D7307

Acquisition date : 19-JUL-2007 11:54:21

Fermi 2 Radiation Protection Gamma Spectroscopy Report

Sample Parameters

Sample ID Number: EF1 EFT-4D7307
Sample collection start date: 3-JUL-2007 14:52:00.00
Sample collection end date : 3-JUL-2007 14:52:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.000000E+03 cc
Sample geometry : MELL Operator: CMH

Acquisition Parameters

Detector number : DET 4 Acquire date : 19-JUL-2007 11:54:21.94
Preset live>time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:00.92 Percent dead time : 0.05 %

Calibration Parameters

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16
Kev/channel : 4.99741E-01 Zero offsets -1.77476E-01
Daily cal date : 19-JUL-2007 03:20:24.04

Peak Search Parameters

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

Nuclide Identification Parameters

Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFT4\_mell Efficiencies at : Peak energy

Table with 11 columns: Pk, It, Energy, Area, Bk, FWHM, Channel, Left, Pw, Cts/Sec, XErr, Fit. Contains 4 rows of peak data with handwritten annotations like 'PB-214 annihilation', 'H2C', and 'K-40'.

Sample Title : EF1 EFT-407307  
Decay Time = 15 21:02:21.94

Page : 1  
Acquisition Time = 19-JUL-2007 11:54:21.9

4

Post-MID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	351.06	61	44	1.78	704.43	697	16	27.3		
0	511.05	167	65	4.05	1022.97	1013	20	14.1		
0	550.96	84	16	1.61	1110.03	1110	17	15.6		
0	1461.20	62	5	3.20	2924.13	2916	19	15.3		K-40

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected	Decay Corr	1-Sigma
					uCi/cc	uCi/cc	%Error
K-40	1460.61	62	10.67*	2.501E+00	3.470E-07	3.470E-07	15.34

Flags "\*" = Keyline

Total number of lines in spectrum 4  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 4 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma Error	Flags
K-40	1.00E+05Y	1.00	3.470E-07	3.470E-07	0.532E-07	15.34	
Total Activity :			3.470E-07	3.470E-07			
Grand Total Activity :			3.470E-07	3.470E-07			

Flags: "RE"==Radionuclide found

"NA"==Nuclide accepted abn. limit

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
F-18	109.74M	200.47	511.00*	100.00	1.000E+35	14.14	Decay
% Abundances Found =			100.00				
As-76	26.32H	14.49	559.10*	44.70	1.302E-03	15.64	Decay, Abun.
			563.23	1.17	---	Not Found	---
			571.30	0.14	---	Not Found	---
			657.03	6.10	---	Not Found	---
			665.31	0.39	---	Not Found	---
			740.12	0.12	---	Not Found	---
			771.76	0.12	---	Not Found	---
			867.63	0.12	---	Not Found	---
			1129.07	0.14	---	Not Found	---
			1212.72	1.63	---	Not Found	---
			1216.02	3.04	---	Not Found	---
			1220.52	1.39	---	Not Found	---
			1439.13	0.33	---	Not Found	---
			1453.60	0.13	---	Not Found	---
			1707.67	0.33	---	Not Found	---
% Abundances Found =			73.70				
Ps-214	26.00M	853.63	87.30	4.67	---	Not Found	Decay
			241.98	7.49	---	Not Found	---
			295.21	19.20	---	Not Found	---
			351.92*	37.20	1.000E+35	27.32	
			705.91	1.10	---	Not Found	---
% Abundances Found =			53.40 (Abn. Limit = 37.20%)				

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	MErr	MEff	Flags
0	351.06	61	44	1.70	704.43	697	16	3.41E-02	27.3	5.70E+00	T
0	511.05	167	65	4.05	1022.97	1013	20	9.27E-02	14.1	4.62E+00	T
0	550.96	84	16	1.61	1110.03	1110	17	4.66E-02	15.6	4.62E+00	T

Flags: "T" = Tentatively associated



Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	23.	477.59	8.8577E-08
F-18	0.	511.00	Half-Life too short
NA-22	0.	1274.54	8.9316E-09
NA-24	0.	1360.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-30	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	16.	869.25	1.1221E-08
CR-51	30.	320.00	1.0866E-07
MN-54	12.	634.83	2.3970E-09
CO-56	6.	1238.25	1.3258E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	44.	158.39	4.6231E-08
CO-57	30.	122.06	9.8711E-09
CO-58	10.	810.76	8.6414E-09
FE-59	15.	1099.22	2.3829E-08
CO-60	7.	1332.49	8.8466E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	11.	1115.52	1.9302E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	64.	136.00	1.7615E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	62.	513.99	2.8237E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	62.	513.99	1.4480E-08
RB-86	9.	1076.63	1.7736E-07
KR-87	0.	482.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	3.	1836.01	8.1627E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.08	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RD-90	0.	331.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	9.	1204.90	3.5231E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EF1 EFT-4D7307

Acquisition date : 19-JUL-2007 11:54:21

Nuclide	Bckgrnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	21.	702.63	5.7390E-09
NB-95	17.	765.79	1.1911E-08
NB-95M	46.	235.69	6.8520E-07
ZR-95	15.	756.72	1.7361E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	14.	739.50	3.2910E-06
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	25.	497.00	1.1667E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	15.	621.94	7.3445E-08
CD-109	30.	80.03	3.2951E-07
AG-110M	10.	937.40	2.5032E-08
SN-113	19.	391.69	1.0590E-08
SN-117M	42.	150.56	1.9221E-08
SB-122	13.	563.93	5.2700E-07
SB-124	20.	602.71	9.4585E-09
SB-125	22.	427.09	2.3751E-08
TE-125M	46.	109.30	4.3306E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	40.	57.60	2.9091E-05
XE-127	41.	202.04	1.4709E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	19.	695.02	3.5104E-07
XE-129M	50.	196.56	6.3030E-07
I-130	0.	536.09	Half-Life too short
BA-131	40.	123.00	7.3333E-08
I-131	26.	364.40	3.4230E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	51.	163.93	1.0379E-06
I-132	0.	667.69	Half-Life too short
TE-132	30.	220.16	2.4534E-07
BA-133	36.	302.04	4.3114E-08
BA-133M	46.	276.09	4.1000E-05
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	31.	81.00	3.3179E-07
XE-133M	37.	233.22	1.0005E-05
CS-134	17.	604.70	7.6311E-09
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	260.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EF1 EFT-4D7307

Acquisition date : 19-JUL-2007 11:54:21

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	17.	816.50	2.1477E-08
I-136	0.	1313.02	Half-Life too short
CS-137	15.	661.65	8.4863E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	48.	165.85	1.0564E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	13.	537.32	5.7378E-08
LA-140	7.	1596.49	6.9850E-06
BA-141	0.	190.22	Half-Life too short
CE-141	48.	145.44	2.3356E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	46.	133.54	7.9681E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	48.	91.10	1.2359E-07
PM-148M	17.	558.27	9.6214E-09
EU-152	31.	344.27	2.8116E-08
EU-154	6.	1004.76	3.8780E-08
EU-156	5.	646.29	1.2728E-07
HF-181	26.	482.83	1.2510E-08
TA-182	12.	1221.42	4.1751E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.83	Half-Life too short
HG-203	40.	279.19	1.2716E-08
DI-207	26.	569.67	8.7869E-09
TL-208	0.	583.14	Half-Life too short
PD-212	0.	338.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PD-214	0.	351.92	Half-Life too short
RA-224	35.	248.98	3.7899E-06
RA-226	50.	186.21	2.4400E-07
AC-228	43.	338.32	7.5953E-08
TH-230	39.	84.37	1.2579E-06
PA-234	0.	131.20	Half-Life too short
TH-234	33.	63.29	1.6724E-06
U-235	49.	143.76	7.7734E-08
NP-239	29.	186.13	4.0368E-06
AM-241	31.	59.54	1.7524E-07

**EFT-4D**

**2008**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-4D41508

Sample Location (Well Number): EFT-4D

1. Representative sample collected. Date/Time 4/15/08 1 1645

Sample collected by: Joy Marie Slaback / Joy Marie Slaback Date: 04/21/2008  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 4/21/08  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Russ Bengtson / [Signature] Date: 4-22-08  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: RD Lewasey / [Signature] Date: 4-28-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-4D41508
2 . Date Sampled	04/15/2008
3 . Time Sampled	16:45
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	04/22/2008
2 . Time Sample Counted	12:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.8 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3023.2 cpm
Net Spike Count Rate (cpm)	3015.4 cpm
H3 Spike Activity (dpm on count date)	7787.0 dpm
Counter Efficiency	0.3872 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	8.1 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.3 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}}{\text{Efficiency} \times 2.22\text{E6 dpm/uCi} \times \text{Sample Volume}} = 1.20\text{E-06 uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E6 uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 4-22-08

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-4D41508

Sample Location (Well Number): EFT- 4D

1. Representative sample collected. Date/Time 4/15/08 1 1645

Sample collected by: Joy Marie Slaback / Joy Marie Slaback Date: 04/21/2008  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J Southward Date: 4/21/08  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: J-Southward / J Southward Date: 4/22/08  
Fermi 2 RP Printed Name Signature

Sample number: EFT-41D 41508

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: J. Southward J. Southward Date: 4/22/08  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: KD LINDSEY KD Lindsey Date: 4-28-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



RADIATION PROTECTION DEPARTMENT

COMPA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Numbers: ETT-4041500

Sample End Times: 15-APR-2008 16:45:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*J. Sattward*  
SIGNATURE

REVIEWED BY:

*W. P. Dy* 4-28-08  
SIGNATURE/DATE

Sample ID : EFT-4041508

Acquisition date : 24 APR 2008 10:43:50

0 Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-4041508  
 Sample collection start date: 15-APR-2008 16:45:00.00  
 Sample collection end date : 15-APR-2008 16:45:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : PELL Operator: JNS

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 24-APR-2008 10:43:56.15  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:01.00 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20 JUN 2007 12:16:46.16  
 KeV/channel : 5.00104E-01 Zero offset: -1.00000E-01  
 Daily cal date : 24-APR-2008 06:17:06.67

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFT04\_mell Efficiencies at : Peak energy

PK	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	511.25	143	47	2.61	1022.47	1014	17	7.04E-02	13.0	
2	0	609.91	32	34	1.39	1219.71	1214	14	1.80E-02	42.4	
3	0	1461.39	50	9	1.72	2921.96	2912	17	3.10E-02	18.6	

Sample Title : EFT-4D41508  
Decay Time = 8 17:50:56.15

Page : 1  
Acquisition Time = 24-09-2008 10:43:56.1

Post-NID Peak Search Report

It	Energy	Area	El.gnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	511.25	143	47	2.61	1002.47	1014	17	13.0		Ann
0	609.91	32	34	1.39	1210.71	1214	14	42.4		B-214
0	1461.30	56	9	1.72	2921.98	2912	17	18.0		K-42

Nuclide Type : natural

Nuclide	Energy	Area	Eff	SEff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma SError
K-40	1460.81	56	10.67*	2.501E+00	3.141E-07	3.141E-07	18.02

Flag: "\*" = Keyline

Summary of Nuclide Activity

Sample ID : EFT-4D41308

Acquisition date : 24-APR-2008 10:43:56

Total number of lines in spectrum 3  
 Number of unidentified lines 0  
 Number of lines tentatively identified by MID 3 100.00%

Nuclide type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	3.141E-07	3.141E-07	9.566E-07	10.00	
Total Activity :			3.141E-07	3.141E-07			

Grand Total Activity : 3.141E-07 3.141E-07

Flags: "K" = Keyline not found  
 "E" = Manually edited

"P" = Manually accepted  
 "A" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	114.94	511.00*	100.46	9.875E+26	13.79	Decay
		% Abundances Found =		100.00			
RU-103	39.35D	0.22	497.03*	89.00	---	Not Found	Abun.
			610.33	5.60	2.245E-07	42.36	
		% Abundances Found =		5.92			
XE-135	9.11H	23.08	249.79*	89.90	---	Not Found	Decay, Abun.
			600.19	2.89	3.296E+00	42.36	
		% Abundances Found =		3.11			
PM-140M	41.30D	0.21	268.11	12.56	---	Not Found	Abun.
			414.07	18.66	---	Not Found	
			432.70	5.35	---	Not Found	
			501.26	6.75	---	Not Found	
			550.27*	94.90	---	Not Found	
			599.74	12.54	---	Not Found	
			611.26	5.48	2.277E-07	42.36	
			629.97	89.00	---	Not Found	
			725.70	32.00	---	Not Found	
			915.33	17.17	---	Not Found	
			1013.01	20.30	---	Not Found	
		% Abundances Found =		1.74			
BI-214	19.90M	633.87	609.31*	40.30	1.000E+35	42.36	Decay
			760.36	5.04	---	Not Found	
			934.06	3.21	---	Not Found	
			1120.29	15.10	---	Not Found	
			1230.11	5.04	---	Not Found	
			1377.67	4.11	---	Not Found	
			1764.49	15.00	---	Not Found	
		% Abundances Found =		40.48		(Abn. Limit = 40.40%)	

Flags "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EFT-4D41500

Page . 5  
Acquisition date : 24-APR-2008 10:43:56

Id	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%err	%Eff	Flags
0	511.25	143	47	2.61	1222.47	1214	17	7.24E-02	13.0	4.89E+00	T
0	689.91	32	34	1.39	1219.71	1214	14	1.00E-02	42.4	4.52E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
SE-7	15.	477.53	6.5689E-08
F-18	9.	511.00	Half-Life too short
NA-22	9.	1274.54	9.1459E-09
NA-24	0.	1350.53	Half-Life too short
NO-27	0.	1014.44	Half-Life too short
CL-32	0.	1642.42	Half-Life too short
AR-41	0.	1293.04	Half-Life too short
SC-46	7.	889.25	7.2312E-09
CR-51	29.	320.00	8.9788E-08
MN-54	13.	834.03	8.6637E-09
CO-56	15.	1238.25	1.8269E-08
MH-58	0.	1010.69	Half-Life too short
NI-56	43.	150.38	2.0337E-08
CO-57	50.	122.00	1.1000E-08
CO-58	13.	810.76	8.7898E-09
FE-59	5.	1099.22	1.3373E-08
CU-60	10.	1032.49	1.0023E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1401.84	Half-Life too short
ZH-65	12.	1115.52	1.9456E-08
ZH-69M	0.	430.63	Half-Life too short
SE-75	50.	130.00	1.6119E-08
AG-76	52.	559.10	6.6428E-06
DR-82	13.	776.49	5.9006E-07
BR-83	0.	520.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	800.41	Half-Life too short
KR-85	45.	515.99	2.4465E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	45.	513.99	1.1620E-08
RB-86	10.	1076.63	1.4029E-07
KR-87	0.	402.50	Half-Life too short
SR-87M	0.	308.40	Half-Life too short
KR-88	0.	196.30	Half-Life too short
RE-88	0.	1382.39	Half-Life too short
Y-88	2.	1836.01	7.1844E-09
KR-89	0.	220.90	Half-Life too short
RD-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RE-90	0.	031.69	Half-Life too short
RE-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1824.30	Half-Life too short
Y-91	2.	1204.30	2.7904E-06
Y-91M	0.	555.60	Half-Life too short
CI-92	0.	1303.74	Half-Life too short
Y-92	0.	351.46	Half-Life too short



## Minimum Detectable Activity Report (continued)

Page : 2

Sample ID : EFT-4041002

Acquisition date : 24-APR-2000 10:43:50

Nuclide	Background Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.98	Half-Life too short
NB-94	16.	762.63	7.7784E-09
NB-95	10.	765.79	8.2759E-09
NB-95M	35.	235.69	1.5398E-07
ER-95	9.	750.72	1.3071E-08
HE-97	0.	657.90	Half-Life too short
ER-97	0.	743.36	Half-Life too short
HO-99	> 11.	739.58	4.8978E-07
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	300.81	Half-Life too short
RU-103	18.	497.08	8.8676E-07
TC-104	0.	357.99	Half-Life too short
RH-105	3.	318.90	2.3834E-06
KU-105	0.	724.50	Half-Life too short
RU-106	23.	621.84	8.6219E-08
CD-109	39.	80.03	3.6757E-07
NO-110M	12.	937.48	2.6978E-06
SH-113	20.	391.69	1.1723E-08
SN-117M	40.	158.56	1.3086E-08
SB-122	10.	563.93	9.1227E-08
SB-124	19.	602.71	8.6868E-09
SB-125	19.	427.89	2.2893E-08
TE-125M	43.	109.28	3.8838E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	26.	57.60	2.3492E-05
XE-127	42.	202.84	1.3071E-08
TE-127	0.	459.00	Half-Life too short
TE-129M	11.	695.80	2.4180E-07
XE-129M	49.	196.56	3.3453E-07
I-130	0.	536.23	Half-Life too short
HA-131	47.	123.80	5.1279E-08
I-131	20.	364.48	1.8361E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	18.	773.67	2.3431E-06
XE-131M	42.	163.93	6.2921E-07
I-132	0.	567.69	Half-Life too short
TE-132	45.	220.16	5.8570E-06
DA-133	29.	302.84	3.8889E-08
DA-133M	28.	270.89	1.5640E-06
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	28.	81.00	1.2352E-07
XE-133M	37.	233.22	1.1352E-06
CS-134	15.	604.70	7.0469E-09
I-134	0.	804.09	Half-Life too short
TE-134	0.	218.47	Half-Life too short
DO-135M	41.	268.24	7.8183E-06
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.50	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page 3

Sample ID : EFT-4D41599

Acquisition date : 24-MAR-2008 10:43:56

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	7.	816.50	9.8014E-09
I-136	0.	1310.02	Half-Life too short
CS-137	16.	661.05	8.7263E-09
XC-137	0.	455.49	Half-Life too short
CO-138	0.	1435.06	Half-Life too short
AL-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	35.	165.05	8.7355E-09
CS-139	0.	1283.23	Half-Life too short
SA-140	18.	537.32	4.5047E-08
LA-140	7.	1596.49	3.6222E-07
SA-141	0.	190.22	Half-Life too short
CE-141	52.	145.44	2.0060E-08
LA-141	0.	1354.52	Half-Life too short
DA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	28.	293.26	1.3145E-06
CE-144	40.	133.54	7.3094E-08
PR-144	0.	1439.15	Half-Life too short
ND-147	30.	91.10	7.7697E-08
FM-148M	10.	550.27	8.7153E-09
EU-152	25.	344.27	2.5475E-08
EU-154	9.	1064.76	4.5021E-08
EU-156	13.	646.29	1.4015E-07
HF-101	24.	402.03	1.0701E-08
IA-182	0.	1221.42	3.4149E-08
W-187	12.	685.01	1.0459E-05
RE-188	0.	135.03	Half-Life too short
UG-203	34.	272.19	1.0631E-08
BT-207	14.	560.67	6.7026E-09
TL-208	0.	583.14	Half-Life too short
PE-212	0.	238.63	Half-Life too short
BT-214	0.	609.31	Half-Life too short
PD-214	0.	351.92	Half-Life too short
RA-224	47.	240.98	1.1176E-06
RA-226	52.	106.21	2.4830E-07
AC-228	24.	338.32	5.8436E-08
TH-228	40.	64.37	1.2521E-06
PA-234	0.	131.20	Half-Life too short
TH-234	52.	63.29	1.6640E-06
U-235	44.	143.76	7.4147E-08
HP-239	36.	106.13	3.4604E-07
AM-241	27.	59.54	1.6492E-07

**EFT-4D**

**2009**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-4D031109

Sample Location (Well Number): EFT-4D

1. Representative sample collected. Date/Time 3-11-09 / 8:50

Sample collected by: Chris Ellison / [Signature] Date: 3-11-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Proffitt / [Signature] Date: 4-17-09  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: D. Howard / [Signature] Date: 4-22-09  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: R. Bryan / [Signature] Date: 4-22-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-4D031109
2 . Date Sampled	03/11/2009
3 . Time Sampled	08:50
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	04/21/2009	
2 . Time Sample Counted	09:50	
3 . Background Inf.:		
Minutes Counted	10	min.
Background Count Rate (cpm)	7.5	cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)		
Gross Spike Count Rate (cpm)	2991.0	cpm
Net Spike Count Rate (cpm)	2983.5	cpm
H3 Spike Activity (dpm on count date)	7361.1	dpm
Counter Efficiency	0.4053	cpm/dpm
5 . Sample Info:		
Sample Gross Count Rate (cpm)	6.4	cpm
Sample Count Time (min.)	10.0	min.
Net Sample Count Rate (cpm)	0.0	cpm
6 . Critical Level:		
Critical Level Count Rate (cpm)	2.0	cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.12\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 uCi/ml x Sample Volume}} < \text{MDA}$$

Technician AM / Howard Date 4-21-09

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-4D 031109

Sample Location (Well Number): EFT-4D

1. Representative sample collected. Date/Time 3-11-09 / 8:50

Sample collected by: Chris Ellison / [Signature] Date: 3-11-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: Proffitt / [Signature] Date: 4-17-09  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Proffitt / [Signature] Date: 4-21-09  
Fermi 2 RP Printed Name / Signature

Sample number: EFT-4D031109

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Proffitt | Proffitt Date: 4-21-09  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Blindsey | [Signature] Date: 4-22-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_





## Fermi 2 Radiation Protection Gamma Spectroscopy Report

## \*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT4D031109  
 Sample collection start date: 11-MAR-2009 00:50:00.00  
 Sample collection end date : 11-MAR-2009 00:50:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : MELL Operator: CLP

## \*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 5-MAY-2009 15:55:38.19  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:01.01 Percent dead time : 0.05 %

## \*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2000 12:00:00.00  
 KeV/channel : 5.00074E-01 Zero offset: 7.35546E-02  
 Daily cal date : 5-MAY-2009 13:14:54.49

## \*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

## \*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	68.36	38	86	3.30	136.56	128	13	2.11E-02	53.9	
2	2	511.26	83	14	2.31	1022.23	1013	19	4.59E-02	17.3	2.15E+00
3	2	512.14	26	11	1.91	1024.00	1013	19	1.46E-02	50.2	
4	0	558.75	66	33	1.78	1117.19	1111	13	3.64E-02	21.8	
5	0	1120.41	21	7	1.55	2240.38	2236	10	1.16E-02	32.6	

## Post-MID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	68.36	38	86	3.30	136.56	129	13	53.9		<i>4 error</i>
2	511.26	83	14	2.31	1022.23	1013	19	17.3	2.15E+00	<i>&gt; Ann</i>
2	512.14	26	11	1.91	1024.00	1013	19	50.2		
0	558.75	66	33	1.78	1117.19	1111	13	21.8	<	<i>HW c</i>
0	1120.41	21	7	1.55	2240.38	2236	10	32.6		<i>B. -214</i>

Sample ID : EFT40031109

Acquisition date : 5-MAY-2009 15:55:30

Flag: '\*' = Keyline

Sample ID : EFT4D831129

Acquisition date : 5-MAY-2009 15:55:30

Total number of lines in spectrum	5	
Number of unidentified lines	1	
Number of lines tentatively identified by NID	4	80.00%

\*\*\*\* There are no nuclides meeting summary criteria \*\*\*\*

Flags: "K" = Keyline not found                    "M" = Manually accepted  
      "E" = Manually edited                     "A" = Nuclide specific abn. limit

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
F-18	109.74M	725.72	511.00*	193.46	1.000E+35	17.28	Decay
	% Abundances		Found = <100.00				
SC-46	83.83D	0.66	142.53	62.70	---- Not Found ----		Abun.
			889.25*	99.98	---- Not Found ----		
			1120.51	99.99	1.715E-08	32.61	
	% Abundances		Found = 38.07				
AS-76	26.32H	50.43	559.10*	44.70	7.129E+07	21.79	Decay, Abun.
			563.23	1.17	---- Not Found ----		
			571.30	0.14	---- Not Found ----		
			657.03	6.10	---- Not Found ----		
			665.31	0.39	---- Not Found ----		
			740.12	0.12	---- Not Found ----		
			771.76	0.12	---- Not Found ----		
			867.63	0.12	---- Not Found ----		
			1129.87	0.14	---- Not Found ----		
			1212.72	1.63	---- Not Found ----		
			1216.02	3.84	---- Not Found ----		
			1228.52	41.39	---- Not Found ----		
			1439.13	0.33	---- Not Found ----		
			1453.60	0.13	---- Not Found ----		
			1787.67	0.33	---- Not Found ----		
	% Abundances		Found = 73.70				
KR-90	32.32S	147847.75	121.82	32.00	---- Not Found ----		Decay, Abun.
			539.49	29.00	---- Not Found ----		
			1118.69*	37.00	1.000E+35	32.61	
	% Abundances		Found = 37.76				
CS-136	13.16D	4.20	66.91	12.50	5.162E-06	53.87	Abun.
			86.29	6.30	---- Not Found ----		
			153.22	7.46	---- Not Found ----		
			163.89	4.61	---- Not Found ----		
			176.55	13.56	---- Not Found ----		
			273.65	12.66	---- Not Found ----		
			340.57	48.50	---- Not Found ----		
			818.50*	99.70	---- Not Found ----		
			1048.07	79.60	---- Not Found ----		
			1235.34	19.70	---- Not Found ----		
	% Abundances		Found = 4.10				
TA-182	114.74D	0.48	67.75	42.30	1.157E-07	53.87	Abun.
			100.10	14.10	---- Not Found ----		
			1189.05	16.30	---- Not Found ----		
			1221.42*	27.10	---- Not Found ----		
			1230.97	11.50	---- Not Found ----		
	% Abundances		Found = 38.71				
BI-214	19.90M	4002.04	609.31*	46.30	---- Not Found ----		Decay, Abun.
			768.36	5.04	---- Not Found ----		
			934.06	3.21	---- Not Found ----		

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
BI-214	19.90M	4002.04	1120.29	15.10	1.000E+35	32.61	Decay, Abun.
			1238.11	5.94	----	Not Found	----
			1377.67	4.11	----	Not Found	----
			1764.49	15.80	----	Not Found	----
% Abundances Found =				15.81	(Abn. Limit = 48.48%)		

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	XErr	XEff	Flags
0	60.36	36	86	3.30	136.56	128	13	2.11E-02	53.9	1.63E+00	T
2	511.26	83	14	2.31	1022.23	1013	19	4.59E-02	17.3	4.88E+00	T
2	512.14	26	11	1.91	1024.00	1013	19	1.46E-02	50.2	4.87E+00	
0	558.75	66	33	1.78	1117.19	1111	13	3.64E-02	21.8	4.68E+00	T
0	1120.41	21	7	1.55	2240.30	2236	10	1.16E-02	32.6	2.90E+00	T

Flags: "T" = Tentatively associated

\*\*\*\*\*  
 \* Sample ID : EFT4D0531109 \*\*\*\*\*

Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	18.	477.59	1.3234E-07
F-18	0.	511.00	Half-Life too short
NA-22	4.	1274.54	6.9588E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
K-40	51.	1460.81	2.0117E-07
AR-41	0.	1293.64	Half-Life too short
SC-46	5.	889.25	9.5088E-09
CR-51	22.	320.08	2.5445E-07
MN-54	10.	834.83	8.4097E-09
CO-56	12.	1238.25	2.4008E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	62.	158.38	4.8064E-06
CO-57	36.	122.06	1.0627E-08
CO-58	15.	810.76	1.5073E-08
FE-59	16.	1099.22	4.5089E-08
CO-60	9.	1332.49	9.6977E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	11.	1115.52	2.1443E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	42.	136.00	1.8169E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	49.	513.99	2.5486E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	49.	513.99	1.9745E-08
RB-86	11.	1076.63	8.1010E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	3.	1836.01	1.1143E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	13.	1204.90	6.8079E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short



Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
Y-92	0.	934.46	Half-Life too short
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	14.	702.63	7.3876E-09
NB-95	11.	765.79	2.1135E-08
NB-95M	0.	235.69	Half-Life too short
ZR-95	18.	756.72	2.9055E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	23.	497.08	2.2633E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	23.	621.84	9.5112E-08
CD-109	37.	88.03	3.0772E-07
AG-110M	16.	937.48	3.3947E-08
SN-113	45.	391.69	2.0003E-08
SN-117M	62.	158.56	1.7120E-07
SB-122	0.	563.93	Half-Life too short
SB-124	25.	602.71	1.6484E-08
SB-125	30.	427.89	2.8242E-08
TE-125M	43.	109.28	6.7344E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	22.	57.60	2.9222E-05
XE-127	44.	202.84	3.2194E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	25.	695.88	8.0442E-07
XE-129M	47.	196.56	1.2390E-05
I-130	0.	536.09	Half-Life too short
BA-131	53.	123.80	8.3226E-07
I-131	24.	364.48	9.9139E-07
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	44.	163.93	9.7983E-06
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	28.	302.84	3.8710E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	19.	604.70	8.1977E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
XE-135M	0.	526.56	Half-Life too short
CS-136	9.	818.50	1.2769E-07
I-136	0.	1313.02	Half-Life too short
CS-137	17.	661.65	8.8013E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	40.	165.85	1.1764E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	13.	537.32	4.9282E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	45.	145.44	5.2623E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	39.	133.54	8.1036E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	34.	91.10	1.3791E-06
PM-148M	16.	550.27	1.8143E-08
EU-152	26.	344.27	2.6309E-08
EU-154	15.	1004.76	5.7529E-08
EU-155	38.	105.31	4.8081E-08
EU-156	17.	646.29	1.2947E-06
NF-161	21.	482.03	2.1488E-08
TA-162	15.	1221.42	5.7423E-08
W-167	0.	605.81	Half-Life too short
RE-168	0.	155.03	Half-Life too short
HG-203	47.	279.19	2.4717E-08
BI-207	19.	569.67	7.5530E-09
TL-208	0.	503.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	47.	186.21	2.3590E-07
AC-228	38.	4338.32	7.2776E-08
TH-228	35.	84.37	1.2327E-06
PA-234	0.	131.20	Half-Life too short
TH-234	35.	63.29	5.3592E-06
U-235	44.	143.76	7.4132E-08
NP-239	0.	106.13	Half-Life too short
AM-241	26.	59.54	1.6291E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT 4D 9909

Sample Location (Well Number): 4D

1. Representative sample collected. Date/Time 9/9/09 1 1525

Sample collected by: Brinn Jordan / [Signature] Date: 9/9/09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward / [Signature] Date: 9/21/09  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: John M. Moore / [Signature] Date: 9-22-09  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. [Signature] Date: 10-13-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT4D9909
2 . Date Sampled	09/09/2009
3 . Time Sampled	15:25
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	09/21/2009
2 . Time Sample Counted	14:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.7 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2763.5 cpm
Net Spike Count Rate (cpm)	2755.8 cpm
H3 Spike Activity (dpm on count date)	7189.1 dpm
Counter Efficiency	0.3833 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	6.9 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.20\text{E-}06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 9-27-09

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT 4D 9909

Sample Location (Well Number): 4D

1. Representative sample collected. Date/Time 9/9/09 1 1525

Sample collected by: Brian Tordella / [Signature] Date: 9/09/09  
Printed Name - / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward / [Signature] Date: 9/24/09  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Southward / [Signature] Date: 10/21/09  
Fermi 2 RP Printed Name Signature

Sample number: EFT4D9909

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".

(Note disposition of unidentified peaks in "Remarks")

Performed by: Southward, Southward Date: 10/21/09  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert Coburn Date: 10-22-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT4D9909

Sample End Time: 9-SEP-2009 15:25:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*Sattawat*  
\_\_\_\_\_  
SIGNATURE

REVIEWED BY:

*[Signature]*  
\_\_\_\_\_  
SIGNATURE / DATE

Sample ID : EFT4D9909

Acquisition date : 21-OCT-2009 09:16:17

## Fermi 2 Radiation Protection Gamma Spectroscopy Report

## \*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT4D9909  
 Sample collection start date: 9-SEP-2009 15:25:00.00  
 Sample collection end date : 9-SEP-2009 15:25:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : M2LL Operator: JNS

## \*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 21-OCT-2009 09:16:17.94  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:01.06 Percent dead time : 0.05 %

## \*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 3-JUN-2009 17:37:00.00  
 Kev/channel : 5.00043E-01 Zero offset: 7.64342E-02  
 Daily cal date : 21-OCT-2009 00:56:57.98

## \*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

## \*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	511.68	142	31	2.78	1023.10	1014	24	7.08E-02	13.3	
2	0	1460.53	41	17	3.30	2920.50	2913	14	2.27E-02	26.7	



Sample Title : EFT4D9909  
Decay Time = 41 17:51:17.94

Page : 1  
Acquisition Time = 21-OCT-2009 09:16:17.9

4

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	XErr	Fit	Nuclides
0	511.68	142	31	2.78	1023.10	1014	24	13.3		Ann.
0	1460.53	41	17	3.30	2920.50	2913	14	26.7		K-40

10-22-09

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	41	10.67*	2.502E+00	2.303E-07	2.303E-07	26.67

Flag: "\*" = Keyline

Summary of Nuclide Activity

Sample ID : EFT4D9909

Acquisition date : 21-OCT-2009 09:16:17

Total number of lines in spectrum 2  
 Number of unidentified lines 0  
 Number of lines tentatively identified by NID 2 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.303E-07	2.303E-07	0.614E-07	26.67	
Total Activity :			2.303E-07	2.303E-07			
Grand Total Activity :			2.303E-07	2.303E-07			

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Nuclide	Half-life	Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	547.90	511.00	*193.46	1.000E+35	13.25	Decay
% Abundances Found = 100.00							

Flag: "\*" = Keyline

Unidentified Energy Lines

Sample ID : EFT4D9909

Acquisition date : 21-OCT-2009 09:16:17

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	511.60	142	31	2.78	1023.10	1014	24	7.00E-02	13.3	4.00E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	22.	477.59	1.2100E-07
F-18	0.	511.00	Half-Life too short
NA-22	7.	1274.54	8.7548E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	7.	889.25	9.9277E-09
CR-51	27.	320.08	1.9759E-07
MN-54	14.	834.83	9.3569E-09
CO-56	11.	1238.25	2.1012E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	29.	158.38	7.2128E-07
CO-57	26.	122.06	8.0494E-09
CO-58	8.	810.76	1.0213E-08
FE-59	6.	1099.22	2.4096E-08
CO-60	9.	1332.49	9.8457E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	10.	1115.52	1.9622E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	31.	136.00	1.4727E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	52.	513.99	2.6182E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	52.	513.99	1.7511E-08
RB-86	9.	1076.63	4.4771E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RE-88	0.	1382.39	Half-Life too short
Y-88	2.	1836.01	8.3855E-09
KR-89	0.	220.90	Half-Life too short
RE-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RE-90	0.	831.69	Half-Life too short
RE-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	6.	1204.90	4.1482E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT4D9909

Acquisition date : 21-OCT-2009 09:16:17

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	21.	702.63	8.7264E-09
NB-95	11.	765.79	1.6331E-08
NB-95M	0.	235.69	Half-Life too short
ZR-95	14.	756.72	2.2237E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	27.	497.08	1.9109E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	17.	621.84	8.1747E-08
CD-109	17.	88.03	2.6961E-07
AG-110M	8.	937.48	2.4987E-08
SN-113	23.	391.69	1.3533E-08
SN-117M	29.	158.56	6.1093E-08
SB-122	0.	563.93	Half-Life too short
SB-124	23.	602.71	1.3651E-08
SB-125	23.	427.89	2.4710E-08
TE-125M	39.	109.28	5.5149E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	21.	57.60	2.6613E-05
XE-127	43.	202.84	2.4768E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	14.	695.88	5.2326E-07
XE-129M	44.	196.56	4.1738E-06
I-130	0.	536.09	Half-Life too short
BA-131	29.	123.80	2.8656E-07
I-131	27.	364.48	3.2384E-07
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	31.	163.93	3.7869E-06
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133 >	25.	302.84	3.6773E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	22.	81.00	8.6822E-06
XE-133M	0.	233.22	Half-Life too short
CS-134	26.	604.70	9.3060E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	00.	526.56	Half-Life too short

Sample ID : EFT4D9909

Acquisition date : 21-OCT-2009 09:16:17

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	0.	818.50	6.1449E-08
I-136	0.	1313.02	Half-Life too short
CS-137	10.	661.65	7.0717E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	41.	165.85	1.1179E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	16.	537.32	2.5910E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	27.	145.44	3.1235E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	26.	133.54	6.5755E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	28.	91.10	5.3791E-07
PM-148M	19.	550.27	1.5582E-08
EU-152	30.	344.27	2.7885E-08
EU-154	13.	1004.76	5.4526E-08
EU-155	35.	105.31	4.5789E-08
EU-156	10.	646.29	5.5951E-07
HF-181	19.	482.03	1.6487E-08
TA-182	14.	1221.42	5.2122E-08
W-187	0.	685.81	Half-Life too short
RE-188	80.	155.03	Half-Life too short
HG-203	33.	279.19	1.7321E-08
BI-207	26.	569.67	8.7435E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	46.	186.21	2.3502E-07
AC-228	29.	338.32	6.4124E-08
TH-228	29.	84.37	1.1243E-06
PA-234	0.	131.20	Half-Life too short
TH-234	22.	63.29	2.9669E-06
U-235	28.	143.76	5.9877E-08
NP-239	0.	106.13	Half-Life too short
AM-241	26.	59.54	1.6212E-07



**EFT-4D**

**2010**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EF1-52510-4D

Sample Location (Well Number): 4D

1. Representative sample collected. Date/Time 5/25/10 1510

Sample collected by: Southward, Southward Date: 6/23/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward, Southward Date: 6/23/10  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR"

Performed by: Donna M. Gordon Date: 6-25-10  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert Greg Kelly Date: 6-30-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EF1-52510-4D
2 . Date Sampled	05/25/2010
3 . Time Sampled	15:10
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	06/24/2010
2 . Time Sample Counted	13:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	6.7 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2671.8 cpm
Net Spike Count Rate (cpm)	2665.1 cpm
H3 Spike Activity (dpm on count date)	6889.0 dpm
Counter Efficiency	0.3869 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	8.3 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	1.6 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	1.9 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.11\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 6-25-10

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EF1-52510-4D

Sample Location (Well Number): 4D

1. Representative sample collected. Date/Time 5/25/10 1 1510

Sample collected by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Charles Pruffitt / Charles Pruffitt Date: 6-14-10  
Fermi 2 RP Printed Name Signature

Sample number: EF1-52510-4D

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Charles Proffitt / Charles Proffitt Date: 9-14-10  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gregory Date: 10-5-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1-52510-4D

Sample End Time: 25-MAY-2010 15:10:00.00

REMARKS

PERFORMED BY:

*Charles Proffitt*  
SIGNATURE

REVIEWED BY:

*[Signature]*  
SIGNATURE/DATE

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1-52510-4D  
Sample collection start date: 25-MAY-2010 15:10:00.00  
Sample collection end date : 25-MAY-2010 15:10:00.00  
Type of sample : 1 L Mari. Liquid  
Sample quantity : 1.00000E+03 cc  
Sample geometry : MELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 14-SEP-2010 09:10:56.27  
Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00  
Elapsed real time : 0 00:45:00.85 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 23-JUN-2010 12:28:00.00  
KeV/channel : 5.00041E-01 Zero offset: 8.46290E-02  
Daily cal date : 14-SEP-2010 06:21:27.75

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
Abundance limit : 75.00000 Library : dacmaster.nlb  
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

PK	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	66.15	61	112	0.61	132.13	126	11	2.27E-02	35.9	
2	0	352.93	91	72	1.82	705.64	698	17	3.30E-02	23.8	
3	0	510.94	206	92	2.45	1021.66	1012	17	7.63E-02	12.8	
4	0	558.73	95	62	1.35	1117.23	1110	15	3.53E-02	20.5	
5	0	609.49	96	55	1.74	1218.75	1213	13	3.56E-02	18.9	
6	0	1120.59	26	11	1.52	2240.94	2236	10	9.49E-03	32.2	
7	0	1461.25	63	14	1.50	2922.29	2917	14	2.33E-02	17.8	
8	0	1764.67	35	18	1.56	3529.17	3520	18	1.30E-02	33.1	

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Post-NID Peak Search Report

It	Energy	Area	Bkgrnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	66.15	61	112	0.61	132.13	126	11	35.9	— HWC	
0	352.93	91	72	1.82	705.64	698	17	23.8	— Pb-214	
0	510.94	206	92	2.45	1021.66	1012	17	12.8	— ANN.	
0	558.73	95	62	1.35	1117.23	1110	15	20.5	— HWC	
0	609.49	96	55	1.74	1218.75	1213	13	18.9	— Bi-214	
0	1120.59	26	11	1.52	2240.94	2236	10	32.2	— Bi-214	
0	1461.25	63	14	1.50	2922.29	2917	14	17.8		K-40
0	1764.67	35	18	1.56	3529.17	3520	18	33.1	— Bi-214	



Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	63	10.67*	2.501E+00	2.363E-07	2.363E-07	17.82

Flag: "\*" = Keyline

Total number of lines in spectrum 8  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 8 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.363E-07	2.363E-07	0.421E-07	17.82	
Total Activity :			2.363E-07	2.363E-07			
Grand Total Activity :			2.363E-07	2.363E-07			

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	1466.11	511.00*	193.46	1.000E+35	12.80	Decay
		% Abundances	Found = 100.00				
SC-46	83.83D	1.33	142.53	62.70	---- Not Found ----		Abun.
			889.25*	99.98	---- Not Found ----		
			1120.51	99.99	2.229E-08	32.23	
		% Abundances	Found = 38.07				
SE-75	119.78D	0.93	66.05	1.02	8.208E-06	35.91	Abun.
			96.73	3.41	---- Not Found ----		
			121.12	16.70	---- Not Found ----		
			136.00*	59.20	---- Not Found ----		
			198.60	1.45	---- Not Found ----		
			264.65	59.80	---- Not Found ----		
			279.53	25.20	---- Not Found ----		
			303.91	1.32	---- Not Found ----		
			400.65	11.40	---- Not Found ----		
		% Abundances	Found = 0.57				
AS-76	26.32H	101.88	559.10*	44.70	2.127E+23	20.52	Decay, Abun.
			563.23	1.17	---- Not Found ----		
			571.30	0.14	---- Not Found ----		
			657.03	6.10	---- Not Found ----		
			665.31	0.39	---- Not Found ----		
			740.12	0.12	---- Not Found ----		
			771.76	0.12	---- Not Found ----		
			867.63	0.12	---- Not Found ----		
			1129.87	0.14	---- Not Found ----		
			1212.72	1.63	---- Not Found ----		
			1216.02	3.84	---- Not Found ----		
			1228.52	1.39	---- Not Found ----		
			1439.13	0.33	---- Not Found ----		
			1453.60	0.13	---- Not Found ----		
			1787.67	0.33	---- Not Found ----		
		% Abundances	Found = 73.70				
RU-103	39.35D	2.84	497.00*	89.00	---- Not Found ----		Abun.
			610.33	5.60	2.719E-06	18.93	
		% Abundances	Found = 5.92				
XE-135	9.11H	294.35	249.79*	89.90	---- Not Found ----		Decay, Abun.
			608.19	2.89	1.000E+35	18.93	
		% Abundances	Found = 3.11				
CS-136	13.16D	8.49	66.91	12.50	1.262E-04	35.91	Abun.
			86.29	6.30	---- Not Found ----		
			153.22	7.46	---- Not Found ----		
			163.89	4.61	---- Not Found ----		
			176.55	13.56	---- Not Found ----		
			273.65	12.66	---- Not Found ----		
			340.57	48.50	---- Not Found ----		
			818.50*	99.70	---- Not Found ----		

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity 1-Sigma (uCi/cc)	%Error	Rejected by
CS-136	13.16D	8.49	1048.07	79.60	----	Not Found	----
			1235.34	19.70	----	Not Found	----
			% Abundances Found =		4.10		
TA-182	114.74D	0.97	67.75	42.30	2.036E-07	35.91	Abun.
			100.10	14.10	----	Not Found	----
			1189.05	16.30	----	Not Found	----
			1221.42*	27.10	----	Not Found	----
			1230.97	11.50	----	Not Found	----
% Abundances Found =		38.01					
BI-214	19.90M	8085.00	609.31*	46.30	1.000E+35	18.93	Decay
			768.36	5.04	----	Not Found	----
			934.06	3.21	----	Not Found	----
			1120.29	15.10	1.000E+35	32.23	
			1238.11	5.94	----	Not Found	----
			1377.67	4.11	----	Not Found	----
% Abundances Found =		80.84	(Abn. Limit = 40.48%)				
PB-214	26.80M	6003.41	87.30	4.67	----	Not Found	----
			241.98	7.49	----	Not Found	----
			295.21	19.20	----	Not Found	----
			351.92*	37.20	1.000E+35	23.79	
			785.91	1.10	----	Not Found	----
% Abundances Found =		53.40	(Abn. Limit = 37.20%)				

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	66.15	61	112	0.61	132.13	126	11	2.27E-02	35.9	1.40E+00	T
0	352.93	91	72	1.52	705.64	690	17	3.38E-02	23.8	5.69E+00	T
0	510.94	206	92	2.45	1021.66	1012	17	7.63E-02	12.8	4.88E+00	T
0	558.73	95	62	1.35	1117.23	1110	15	3.53E-02	20.5	4.69E+00	T
0	609.49	96	55	1.74	1218.75	1213	13	3.56E-02	18.9	4.52E+00	T
0	1120.59	26	11	1.52	2240.94	2236	10	9.49E-03	32.2	2.90E+00	T
0	1764.67	35	18	1.56	3529.17	3520	10	1.30E-02	33.1	2.26E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Rckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	27.	477.59	2.1805E-07
F-18	0.	511.00	Half-Life too short
NA-22	0.	1274.54	6.5421E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	18.	889.25	1.7257E-08
CR-51	42.	320.00	9.2701E-07
MN-54	21.	834.63	8.8252E-09
CO-56	26.	1238.25	3.8345E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	0.	158.30	Half-Life too short
CO-57	56.	122.06	1.0077E-08
CO-58	16.	810.76	1.7623E-08
FE-59	17.	1099.22	7.4493E-08
CO-60	13.	1332.49	7.6185E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	15.	1115.52	1.9209E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	65.	136.00	2.0572E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	77.	513.99	2.1207E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	77.	513.99	2.9734E-08
RB-86	20.	1076.63	5.6886E-06
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	10.	1836.01	1.6346E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	21.	1204.90	1.0697E-05
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EF1-52510-4D

Acquisition date : 14-SEP-2010 09:18:56

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	32.	702.63	7.0233E-09
NB-95	19.	765.79	5.4940E-08
NB-95M	0.	235.69	Half-Life too short
ZR-95	26.	756.72	4.2267E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	38.	497.08	5.1409E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	24.	621.84	7.1241E-08
CD-109	54.	88.03	3.3179E-07
AG-110M	19.	937.40	2.0782E-08
SN-113	42.	391.69	1.8010E-08
SN-117M	81.	158.56	2.2989E-06
SB-122	0.	563.93	Half-Life too short
SB-124	36.	602.71	2.5047E-08
SB-125	33.	427.89	2.0424E-08
TE-125M	74.	109.20	1.1340E-05
TE-127	0.	417.90	Half-Life too short
TE-127M	49.	57.60	4.0503E-05
XE-127	88.	202.84	8.6827E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	34.	695.88	2.1915E-06
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	59.	123.80	1.5975E-05
I-131	0.	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	68.	163.93	2.1669E-04
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	42.	302.84	3.1286E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	37.	604.70	7.8127E-09
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EF1-52510-4D

Acquisition date : 14-SEP-2010 08:18:56

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	19.	818.50	2.3159E-06
I-136	0.	1313.02	Half-Life too short
CS-137	22.	661.65	6.6975E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	60.	165.85	1.2617E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	24.	537.32	9.1833E-06
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	74.	145.44	1.4691E-07
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	59.	133.54	7.5214E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PM-148M	25.	550.27	3.8096E-08
EU-152	56.	344.27	2.4953E-08
EU-154	14.	1004.76	3.7057E-08
EU-155	52.	105.31	3.7696E-08
EU-156	20.	646.29	1.2345E-05
HF-181	36.	482.03	4.5793E-08
TA-182	20.	1221.42	6.1047E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	60.	279.19	4.5220E-08
BI-207	31.	569.67	6.3881E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	78.	186.21	2.0022E-07
AC-228	42.	338.32	5.1737E-08
TH-228	61.	84.37	1.1297E-06
PA-234	0.	131.20	Half-Life too short
TH-234	66.	63.29	2.4348E-05
U-235	55.	143.76	5.4862E-08
NP-239	0.	106.13	Half-Life too short
AM-241	49.	59.54	1.4464E-07



## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-102010-4/D

Sample Location (Well Number): 4 D

1. Representative sample collected. Date/Time 11-11-10 | 11:50

Sample collected by: C Proffitt | C Proffitt Date: 11-11-10  
Printed Name | Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: C Proffitt | [Signature] Date: \_\_\_\_\_  
Printed Name | Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: S. R. Dyer | [Signature] Date: 11-12-10  
Fermi 2 Chemistry Printed Name | Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. [Signature] | [Signature] Date: 11-15-10  
Fermi 2 Printed Name | Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EPT
2 . Date Sampled	EFF-102010-4/D
3 . Time Sampled	11/11/2010
4 . Sample Volume, (ml)	11:50 4 ml

**Instrument Count Data**

1 . Date Sample Counted	11/12/2010
2 . Time Sample Counted	15:50
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.1 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2556.5 cpm
Net Spike Count Rate (cpm)	2549.4 cpm
H3 Spike Activity (dpm on count date)	6740.5 dpm
Counter Efficiency	0.3782 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	6.8 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	1.9 cpm


**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.17\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician  Date 11-12-10

Reviewed By:  Date 11/15/10

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-102010-4/D

Sample Location (Well Number): 4/D

1. Representative sample collected. Date/Time 10/20/10 1 12:55

Sample collected by: Thomas Mow / [Signature] Date: 11/11/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: C Proffitt / [Signature] Date: 11-17-10  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: C Proffitt / [Signature] Date: 11-17-10  
Fermi 2 RP Printed Name Signature

Sample number: GFT-102010-4-D

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: C Proffitt / [Signature] Date: 11-17-10  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Heyde / [Signature] Date: 11-22-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT 10C010-4/E

Sample End Time: 20-NOV-2010 13:55:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*Charles Pappas*  
SIGNATURE

REVIEWED BY:

*[Signature]*  
SIGNATURE DATE

Form 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*  
 Sample ID Number: EFT-102010-4.D *Oct 9/11-2210*  
 Sample collection start date: 20-~~11~~<sup>09</sup>-2010 12:55:00.00  
 Sample collection end date : 20-~~11~~<sup>09</sup>-2010 12:55:00.00  
 Type of sample : 1 L Maril. Liquid  
 Sample quantity : 1.000000E+03 cc  
 Sample geometry : WELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*  
 Detector number : DET 4 Acquire date : 22-NOV-2010 09:57:43.52  
 Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00  
 Elapsed real time : 0 00:45:00.59 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*  
 Detector number : DET 4 Yearly-cal date : 23-JUN-2010 12:00:00.00  
 KeV/channel : 5.00110E-01 Zero offset: 1.54046E-01  
 Daily cal date : 22-NOV-2010 09:53:53.21

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*  
 Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*  
 Energy tolerance : 1.75000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

PK	It	Energy	Area	Bkgrd	FWHM	Channel	Left	Pw	Cts./Sec	%Err	Fit
1	0	100.72	32	08	1.36	397.16	393	10	1.19E-02	57.3	
2	0	511.26	157	60	2.62	1021.99	1012	17	5.80E-02	13.0	
3	0	559.19	22	30	1.07	1117.03	1112	14	8.26E-03	60.6	
4	0	612.20	79	44	10.53	1223.82	1214	26	2.93E-02	25.0	
5	0	1192.37	13	7	4.13	2303.02	2375	14	4.81E-03	51.3	
6	0	1461.22	66	19	2.28	2921.53	2913	19	2.44E-02	20.1	

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Multiplier
0	198.78	32	88	1.36	397.10	393	18	57.3	_____	High % Error.
0	511.23	157	80	2.62	1031.99	1012	17	13.8	_____	ANN. Peak
0	559.17	22	38	1.07	1117.93	1112	14	68.6	_____	High % Error.
3	612.20	79	44	10.53	1223.82	1214	26	25.9	_____	High FWHM
0	1192.37	12	7	4.13	2383.92	2375	14	51.3	_____	High % Error.
3	1461.22	66	19	2.25	2921.53	2913	19	20.1	_____	K-40

*J* 11-22-10

Radionuclide Type: natural

Radionuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/sec	Decay Corr uCi/sec	1-Sigma %Error
K-40	1462.81	66	10.67*	2.501E+00	2.476E-07	2.476E-07	20.00

Flags "X" = Keyline



Total number of lines in spectrum 6  
Number of unidentified lines 1  
Number of lines tentatively identified by MID 5 93.33%

Nuclide Type : natural

Nuclide	HLife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma XError	Flags
K-40	1.00E+05Y	1.00	2.476E-07	2.476E-07	0.497E-07	20.00	
Total Activity :			2.476E-07	2.476E-07			
Grand Total Activity :			2.476E-07	2.476E-07			

Flags: "K" = Keyline not found  
"E" = Manually edited

"B" = Manually accepted  
"R" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1 Sigma MError	Rejected by
F-18	109.74H	24.83	511.00*	100.46	4.948E-01	13.84	Decay
% Abundances Found =			100.00				
3E-75	119.78D	0.02	66.05	1.02	----	Not Found	Abun.
			96.73	3.41	----	Not Found	
			121.12	16.70	----	Not Found	
			130.00*	59.20	----	Not Found	
			190.60	1.45	3.401E-07	57.26	
			204.05	59.50	----	Not Found	
			270.53	25.20	----	Not Found	
			303.91	1.02	----	Not Found	
			400.65	11.40	----	Not Found	
% Abundances Found =			0.01				
38-76	26.32H	1.73	550.10*	44.70	3.527E-05	60.50	Abun.
			563.23	1.17	----	Not Found	
			571.30	0.14	----	Not Found	
			657.03	6.10	----	Not Found	
			665.31	0.39	----	Not Found	
			740.12	0.12	----	Not Found	
			771.76	0.12	----	Not Found	
			867.63	0.12	----	Not Found	
			1129.07	0.14	----	Not Found	
			1212.72	1.63	----	Not Found	
			1216.02	3.54	----	Not Found	
			1228.52	1.39	----	Not Found	
			1439.13	0.33	----	Not Found	
			1453.00	0.13	----	Not Found	
			1787.67	0.33	----	Not Found	
% Abundances Found =			73.70				
3M-140M	41.30D	0.95	290.11	12.56	----	Not Found	Abun.
			414.07	10.66	----	Not Found	
			432.78	5.35	----	Not Found	
			501.26	6.75	----	Not Found	
			550.27*	94.90	----	Not Found	
			599.74	12.54	----	Not Found	
			611.26	5.40	3.302E-07	25.90	
			629.37	89.00	----	Not Found	
			725.70	32.80	----	Not Found	
			915.33	17.17	----	Not Found	
			1013.01	20.30	----	Not Found	
% Abundances Found =			1.74				

Flags: "\*" = Keyline

It	Energy	Area	Elignd	FWHM	Channel	Left	Pw	Cts/Sec	XErf	XEFF	Flags
0	109.74	32	28	1.32	397.16	393	10	1.19E-02	57.2	6.62E+00	T
0	511.26	157	68	2.62	1021.79	1012	17	5.20E-02	13.9	4.88E+00	T
0	559.19	22	30	1.07	1117.93	1112	14	0.25E-03	60.6	4.50E+00	T
0	612.20	79	44	10.53	1223.92	1214	26	2.93E-02	25.9	4.51E+00	T
0	1122.37	13	7	1.13	2352.02	2375	14	4.01E-03	51.3	2.91E+00	

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Detected Sum	Energy (keV)	MDA (uCi/cc)
BE-7	32.	477.59	5.6592E-08
F-18	0.	511.00	Half-Life too short
Na-22	8.	1274.54	5.8939E-09
Na-24	10.	1368.53	5.5200E-08
NO-27	0.	1014.44	Half-Life too short
OL-20	3.	1642.42	Half-Life too short
OR-41	0.	1293.64	Half-Life too short
SC-40	17.	889.25	6.7193E-09
CR-51	20.	320.00	5.0876E-08
MN-54	10.	834.03	4.9665E-09
CO-56	20.	1238.25	1.3887E-08
NI-56	0.	1810.67	Half-Life too short
NI-58	55.	158.38	7.0230E-09
CO-57	32.	122.00	5.9477E-09
CO-58	12.	810.76	6.1574E-09
FE-59	12.	1090.20	1.1841E-08
CO-60	11.	1332.49	6.9827E-09
CU-64	10.	1345.98	2.5143E-05
NI-65	0.	1481.94	Half-Life too short
ZN-65	22.	1115.52	1.6311E-08
ZN-69M	31.	439.63	5.6892E-08
SC-75	52.	130.00	9.9333E-09
AS-76	40.	559.10	5.3886E-08
BR-82	11.	776.49	1.4193E-08
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	55.	513.99	1.7705E-08
KR-85M	0.	151.18	Half-Life too short
CR-85	55.	513.99	7.0500E-09
SD-86	12.	1076.62	7.6700E-08
KR-87	0.	402.52	Half-Life too short
CR-87M	0.	380.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RE-88	0.	1382.39	Half-Life too short
Y-88	5.	1936.81	6.0683E-09
KR-89	0.	220.90	Half-Life too short
RE-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RE-90	0.	931.09	Half-Life too short
RE-90M	0.	924.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
CR-91	9.	1024.30	4.7352E-09
Y-91	11.	1204.98	2.2283E-06
Y-91M	0.	555.60	Half-Life too short
CR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Radionuclide	Delayed Count	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-92	51.	266.90	1.8897E-06
HB-94	27.	782.63	6.5728E-09
HF-95	15.	765.70	5.6917E-09
NB-95M	43.	235.69	3.0032E-08
ZR-95	10.	753.72	1.1187E-08
NB-97	0.	657.90	Half-Life too short
FR-97	25.	743.30	4.3661E-08
HO-99	13.	730.58	5.3738E-08
TC-99E	61.	140.50	1.2789E-08
TC-101	0.	306.81	Half-Life too short
RU-103	31.	497.00	6.7466E-09
TC-104	0.	357.09	Half-Life too short
PH-105	38.	310.90	6.5374E-08
RU-105	0.	724.50	Half-Life too short
RU-106	21.	621.84	5.5301E-08
CD-109	34.	88.83	2.2920E-07
OG-110M	16.	937.40	1.9825E-08
SM-113	33.	391.69	8.3555E-09
SM-117M	54.	158.56	7.0679E-09
SB-122	21.	563.93	1.2570E-08
SB-124	28.	602.71	6.2534E-09
SB-125	28.	427.89	1.7545E-08
TE-125M	41.	109.28	2.3228E-06
TE-127	26.	417.90	1.4429E-05
TE-127M	21.	57.60	1.4561E-05
XE-127	44.	202.84	7.7820E-09
TE-129	0.	450.60	Half-Life too short
TE-129M	25.	695.88	1.9506E-07
XE-129M	50.	196.56	1.3159E-07
I-130	23.	536.89	6.7241E-08
BA-131	38.	123.80	2.0735E-08
I-131	30.	364.48	7.2667E-09
TE-131	0.	149.72	Half-Life too short
TE-131M	12.	773.87	3.7661E-08
XE-131M	68.	163.03	3.4337E-07
I-132	0.	667.67	Half-Life too short
TE-132	49.	228.18	9.3793E-09
BA-132	25.	302.84	2.3980E-08
BA-133M	48.	276.60	7.0228E-08
I-133	19.	529.87	2.5268E-08
TE-133M	0.	912.58	Half-Life too short
XE-133	34.	81.00	3.6378E-08
XE-133M	42.	233.22	9.1949E-08
CG-134	25.	604.70	5.8818E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	51.	268.24	1.0936E-07
I-135	11.	1260.41	2.6828E-06
XE-135	42.	249.79	1.0492E-07
XE-135M	0.	520.56	Half-Life too short

Sample ID : EFT-100010 (17)

Acquisition date : 22 NOV 2010 20:57:12

Radionuclide	Decayd Sec	Energy (keV)	MBA (uCi/cc)
CS-136	10.	818.50	0.6617E-09
I-136	0.	1313.02	Half-Life too short
CS-137	10.	661.65	6.0700E-09
XE-137	0.	455.40	Half-Life too short
CS-138	0.	1438.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
DA-139	0.	1420.50	Half-Life too short
CE-139	41.	165.85	0.0901E-00
CS-139	0.	1287.23	Half-Life too short
DA-140	27.	537.32	2.5012E-08
LA-140	4.	1596.49	1.1551E-08
BA-141	6.	190.22	Half-Life too short
CE-141	45.	145.44	1.1240E-08
LA-141	0.	1354.52	Half-Life too short
DA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	32.	293.26	2.9442E-08
CE-144	58.	107.54	5.0340E-08
PR-144	0.	1403.15	Half-Life too short
NE-147	41.	91.10	3.4730E-08
PM-148M	19.	550.27	5.3005E-09
EU-150	37.	344.27	2.0500E-08
EU-154	12.	1004.76	3.4042E-08
EU-155	49.	105.31	3.5000E-08
EU-156	16.	646.29	7.3502E-08
HF-161	30.	402.02	6.9021E-09
TA-162	17.	1221.42	2.9207E-08
W-167	11.	605.01	5.5137E-08
RE-180	46.	155.03	2.1946E-07
NO-203	49.	279.19	7.5033E-09
BI-207	33.	569.67	6.4503E-09
TL-230	0.	583.14	Half-Life too short
PD-212	57.	238.63	2.4902E-07
BI-214	0.	609.31	Half-Life too short
PE-214	0.	251.92	Half-Life too short
RA-224	48.	240.98	2.0109E-07
RA-226	63.	186.21	1.0123E-07
AC-228	43.	338.32	5.0343E-08
TH-228	42.	34.37	0.5034E-07
PA-234	30.	131.00	3.3016E-06
TH-234	45.	63.29	0.0430E-07
U-235	55.	143.76	0.4570E-08
NF-239	40.	106.13	5.4051E-08
AM-241	31.	59.54	1.1016E-07

**EFT-4D**

**2011**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-66114D

Sample Location (Well Number): 4D

1. Representative sample collected. Date/Time 6-9-11 110:35

Sample collected by: C. Proffitt / [Signature] Date: 6-9-11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: C. Proffitt / [Signature] Date: 6-9-11  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Russ Burton / [Signature] Date: 6-10-11  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert Gay / [Signature] Date: 6-13-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks ~~NA~~ 6-13-11



Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-6711 4D
2 . Date Sampled	06/09/2011
3 . Time Sampled	10:35
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**


1 . Date Sample Counted	06/10/2011
2 . Time Sample Counted	10:59
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	5.7 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2407.6 cpm
Net Spike Count Rate (cpm)	2401.9 cpm
H3 Spike Activity (dpm on count date)	6525.4 dpm
Counter Efficiency	0.3681 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	6.1 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.4 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	1.7 cpm

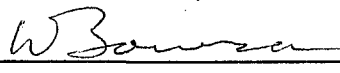
**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.08\text{E}-06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician  Date 6-10-11

Reviewed By:  Date 6-13-11

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-661-4D

Sample Location (Well Number): 4D

1. Representative sample collected. Date/Time 6-6-11 | 09:30

Sample collected by: Thomas Mow | Tomson Date: 6-6-11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: C Proffitt | Shaffer Date: 6-9-11  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: C Proffitt | Shaffer Date: 6-13-11  
Fermi 2 RP Printed Name Signature

Sample number: EFT-66114D

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".

(Note disposition of unidentified peaks in "Remarks")

Performed by: C. Proffitt 1 C. Proffitt Date: 6-13-11  
Fermi 2 RP Printed Name Signature 6-9-11  
6-13-11

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Ayers Robert C. Ayers Date: 6-17-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ W 6/17/11  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT  
GAMMA SPECTROSCOPY ANALYSIS REPORT  
HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-6611-4D

Sample End Time: 6-JUN-2011 09:30:00.00

REMARKS: *Natural*

PERFORMED BY:

*Charles Proffitt*  
SIGNATURE

REVIEWED BY:

*[Signature]*  
SIGNATURE DATE

Sample ID : EFT-6611-4D

Acquisition date : 14-JUN-2011 09:27:31

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-6611-4D
Sample collection start date: 6-JUN-2011 09:30:00.00
Sample collection end date : 6-JUN-2011 09:30:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : MELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 14-JUN-2011 09:27:31.89
Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00
Elapsed real time : 0 00:45:00.62 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 23-JUN-2010 12:28:00.00
Kev/channel : 5.00056E-01 Zero offset: 1.07166E-01
Daily cal date : 14-JUN-2011 08:35:44.28

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Table with 11 columns: Pk, It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. It contains 6 rows of peak data.

9

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	XErr	Fit	Nuclides
0	352.57	26	58	1.00	704.72	700	11	58.9		<i>Pb-214</i>
0	511.01	213	27	3.34	1021.61	1012	18	8.9		<i>Ann. Peak</i>
0	550.90	41	33	0.67	1117.40	1112	14	33.2		<i>cd-n-gamma</i>
0	803.22	21	3	3.95	1606.10	1599	12	27.7		<i>Pb-n-n'-gamma</i>
3	1459.77	41	0	3.40	2919.56	2912	20	20.6	0.83E-01	<i>K-40</i>
3	1461.52	56	0	2.95	2923.05	2912	20	16.4		<i>K-40</i>

*f-6-15-11*

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	56	10.67*	2.501E+00	2.103E-07	2.103E-07	16.44

Flag: "\*" = Keyline

Total number of lines in spectrum 6  
Number of unidentified lines 1  
Number of lines tentatively identified by NID 5 83.33%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.103E-07	2.103E-07	0.346E-07	16.44	
Total Activity :			2.103E-07	2.103E-07			
Grand Total Activity :			2.103E-07	2.103E-07			

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit



Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	105.16	511.00*	193.46	1.019E+24	8.93	Decay
				% Abundances Found =	100.00		
AS-76	26.32H	7.31	559.10*	44.70	3.096E-06	33.21	Abun.
				563.23	1.17	---- Not Found ----	
				571.30	0.14	---- Not Found ----	
				657.03	6.10	---- Not Found ----	
				665.31	0.39	---- Not Found ----	
				740.12	0.12	---- Not Found ----	
				771.76	0.12	---- Not Found ----	
				867.63	0.12	---- Not Found ----	
				1129.87	0.14	---- Not Found ----	
				1212.72	1.63	---- Not Found ----	
				1216.02	3.84	---- Not Found ----	
				1228.52	1.39	---- Not Found ----	
				1439.13	0.33	---- Not Found ----	
				1453.60	0.13	---- Not Found ----	
				1787.67	0.33	---- Not Found ----	
				% Abundances Found =	73.70		
BR-84	31.80M	362.89	604.80	1.80	---- Not Found ----	----	Decay, Abun.
				736.50	1.31	---- Not Found ----	
				802.20	6.10	1.000E+35	27.66
				881.50*	42.00	---- Not Found ----	
				1015.90	6.20	---- Not Found ----	
				1213.30	2.60	---- Not Found ----	
				1463.80	2.00	---- Not Found ----	
				1741.20	1.60	---- Not Found ----	
				1877.50	1.14	---- Not Found ----	
				1897.30	14.90	---- Not Found ----	
				2029.60	2.10	---- Not Found ----	
				% Abundances Found =	7.46		
BR-85	2.87M	4025.13	802.41*	2.56	1.000E+35	27.66	Decay, Abun.
				924.63	1.63	---- Not Found ----	
				% Abundances Found =	61.10		
CS-134	2.06Y	0.01	127.42	12.90	---- Not Found ----	----	Abun.
				475.35	1.46	---- Not Found ----	
				563.23	8.38	---- Not Found ----	
				569.32	15.43	---- Not Found ----	
				604.70*	97.60	---- Not Found ----	
				795.85	85.40	---- Not Found ----	
				801.93	8.73	6.629E-08	27.66
				1038.57	1.00	---- Not Found ----	
				1167.94	1.80	---- Not Found ----	
				1365.15	3.04	---- Not Found ----	
				% Abundances Found =	3.70		
FB-214	26.80M	430.60	87.30	4.67	---- Not Found ----	----	Decay
				241.98	7.49	---- Not Found ----	
				295.21	19.20	---- Not Found ----	

Sample ID : EFT-6611-4D

Acquisition date : 14-JUN-2011 09:27:31

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
PB-214	26.80M	430.60	351.92*	37.20	1.000E+35	58.88	Decay
			785.91	1.10	----	Not Found	----
% Abundances Found =				53.40	(Abn. Limit = 37.20%)		

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	352.57	26	58	1.00	704.72	700	11	9.65E-03	58.9	5.70E+00	T
0	511.01	213	27	3.34	1021.61	1012	18	7.89E-02	8.9	4.88E+00	T
0	558.90	41	33	0.67	1117.40	1112	14	1.51E-02	33.2	4.68E+00	T
0	803.22	21	3	3.95	1606.10	1599	12	7.69E-03	27.7	3.62E+00	T
3	1459.77	41	0	3.40	2919.56	2912	20	1.52E-02	20.6	2.50E+00	

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	30.	477.59	5.9283E-08
F-18	0.	511.00	Half-Life too short
NA-22	11.	1274.54	6.7607E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	18.	889.25	7.2951E-09
CR-51	33.	320.00	6.2051E-08
MN-54	26.	834.83	7.6534E-09
CO-56	16.	1238.25	1.2514E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	45.	158.38	1.2701E-08
CO-57	44.	122.06	6.9295E-09
CO-58	15.	810.76	6.3023E-09
FE-59	17.	1099.22	1.4882E-08
CO-60	19.	1332.49	8.7427E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	16.	1115.52	1.4733E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	40.	136.00	9.0586E-09
AS-76	51.	559.10	2.7261E-06
BR-82	13.	776.49	2.7211E-07
BR-83	0.	529.64	Half-Life too short
BR-84	0.	801.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	62.	513.99	1.8040E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	62.	513.99	8.8780E-09
RB-86	15.	1076.63	1.0898E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	5.	1836.01	6.2623E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	7.	1204.90	1.9823E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1303.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT-6611-4D

Acquisition date : 14-JUN-2011 09:27:31

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NR-94	28.	702.63	6.5922E-09
NR-95	14.	765.79	6.2501E-09
NR-95M	54.	235.69	1.0899E-07
ZR-95	20.	756.72	1.2214E-08
NR-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	17.	739.58	3.3032E-07
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	23.	497.08	6.5211E-09
TC-104	0.	357.99	Half-Life too short
RH-105	31.	318.90	1.0972E-06
RU-105	0.	724.50	Half-Life too short
RU-106	26.	621.84	6.0738E-08
CD-109	52.	88.03	2.7932E-07
AG-110M	16.	937.48	2.0329E-08
SN-113	38.	391.69	9.2650E-09
SN-117M	46.	158.56	8.9414E-09
SB-122	24.	563.93	6.0969E-08
SB-124	31.	602.71	7.0245E-09
SB-125	34.	427.89	1.9231E-08
TE-125M	40.	109.28	2.4714E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	37.	57.60	1.0464E-05
XE-127	44.	202.84	8.7624E-09
TE-129	0.	459.60	Half-Life too short
TE-129M	27.	695.88	2.3116E-07
XE-129M	57.	196.56	2.2629E-07
I-130	0.	536.09	Half-Life too short
BA-131	34.	123.80	2.0087E-08
I-131	41.	364.48	1.4213E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	14.	773.67	1.1998E-06
XE-131M	46.	163.93	4.1754E-07
I-132	0.	667.69	Half-Life too short
TE-132	39.	228.16	3.1267E-08
BA-133	44.	302.84	3.1453E-08
BA-133M	42.	276.09	9.1012E-07
I-133	27.	529.07	3.9364E-06
TE-133M	0.	912.50	Half-Life too short
XE-133	41.	81.00	8.0870E-08
XE-133M	50.	233.22	6.9089E-07
CS-134	25.	604.70	5.9521E-09
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	46.	268.24	3.5675E-06
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT-6611-4D

Acquisition date : 14-JUN-2011 09:27:31

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	18.	818.50	9.6897E-09
I-136	0.	1313.02	Half-Life too short
CS-137	16.	661.65	5.7611E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.06	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	45.	165.05	6.5508E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	20.	537.32	3.0760E-08
LA-140	2.	1596.49	1.1231E-07
BA-141	0.	190.22	Half-Life too short
CE-141	46.	145.44	1.2946E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	51.	293.26	7.9539E-07
CE-144	56.	133.54	5.6832E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	46.	91.10	5.3708E-08
PM-148M	24.	550.27	6.5427E-09
EU-152	39.	344.27	2.0983E-08
EU-154	12.	1004.76	3.4315E-08
EU-155	47.	105.31	3.4468E-08
EU-156	22.	646.29	1.1218E-07
HF-181	20.	482.03	6.4265E-09
TA-182	14.	1221.42	2.7998E-08
W-187	20.	685.81	5.1428E-06
RE-188	0.	155.03	Half-Life too short
AU-199	45.	158.38	8.0937E-08
HG-203	48.	279.19	8.2151E-09
BI-207	24.	569.67	5.6360E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	60.	240.98	7.2274E-07
RA-226	39.	186.21	1.4432E-07
AC-228	43.	338.32	5.0490E-08
TH-228	40.	84.37	8.3708E-07
PA-234	0.	131.20	Half-Life too short
TH-234	40.	63.29	9.7736E-07
U-235	53.	143.76	5.3813E-08
NP-239	49.	106.13	3.3503E-07
AM-241	30.	59.54	1.1513E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-101211-4D

Sample Location (Well Number): EFT-4/D

1. Representative sample collected. Date/Time 10/12/11 1 09:30

Sample collected by: Thomas Mow / [Signature] Date: 10/25/11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Thomas Mow / [Signature] Date: 10/25/11  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Tom M. Moxon / [Signature] Date: 11-1-11  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert [Signature] / [Signature] Date: 11-5-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks 12/14

Tritium Activity Calculation

**Sample Information**

1. Sample Location	EFT-4/D
2. Date Sampled	10/12/2011
3. Time Sampled	09:30
4. Sample Volume, (ml)	4 ml

**Instrument Count Data**

1. Date Sample Counted	10/30/2011
2. Time Sample Counted	13:30
3. Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.5 cpm
4. Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2548.6 cpm
Net Spike Count Rate (cpm)	2541.1 cpm
H3 Spike Activity (dpm on count date)	6383.7 dpm
Counter Efficiency	0.3981 cpm/dpm
5. Sample Info:	
Sample Gross Count Rate (cpm)	8.2 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.7 cpm
6. Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.14\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician \_\_\_\_\_

Date 11-1-11

Reviewed \_\_\_\_\_

Date NOV 01 2011



## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-101211-4D

Sample Location (Well Number): EFT-41D

1. Representative sample collected. Date/Time 10/12/11 1 09:30

Sample collected by: Thomas Mow / [Signature] Date: 10/25/11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Thomas Mow / [Signature] Date: 10/25/11  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function.

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 2/

Performed by: C Proffitt / [Signature] Date: 11-2-11  
Fermi 2 RP Printed Name Signature

Sample number: EFT101211-4D

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Proffitt | [Signature] Date: 11-2-11  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Roberta Bleggs | [Signature] Date: 11-3-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT101211-4D

Sample End Time: 12-OCT-2011 09:30:00.00

REMARKS

*Report Relocated To tapes*

PERFORMED BY:

*Charles Prappas*  
SIGNATURE

REVIEWED BY:

*[Signature]*  
SIGNATURE/DATE

Sample ID : EFT101211-4D

Acquisition date : 2-NOV-2011 15:02:32

\*\*\*\*\*

Fermi-2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT101211-4D
Sample collection start date: 12-OCT-2011 09:30:00.00
Sample collection end date : 12-OCT-2011 09:30:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : PELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 2-NOV-2011 15:02:32.53
Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00
Elapsed real time : 0 00:45:00.62 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 14-JUN-2011 14:50:56.41
Kev/channel : 5.00053E-01 Zero offset: -5.47137E-01
Daily cal date : 2-NOV-2011 08:42:06.40

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

Table with 11 columns: Pk, It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. It contains 3 rows of peak data.

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	511.04	189	47	2.53	1023.00	1013	23	11.9		
0	610.12	33	30	0.99	1221.22	1216	14	42.0		
0	1461.41	64	9	2.49	2923.71	2914	18	16.6		

*Ann. Peak  
Bi-214*

K-40

*f-11-3-11*

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.01	64	10.67*	2.353E+00	2.552E-07	2.552E-07	16.65

Flag: "\*" = Keyline

Sample ID : EFT101211-4D

Acquisition date : 2-NOV-2011 15:02:32

Total number of lines in spectrum	3	
Number of unidentified lines	0	
Number of lines tentatively identified by NID	3	100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	2.552E-07	2.552E-07	0.425E-07	16.65	
Total Activity :			2.552E-07	2.552E-07			

Grand Total Activity :	2.552E-07	2.552E-07
------------------------	-----------	-----------

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Sample ID : EFT101211-4D

Acquisition date : 2-NOV-2011 15:02:32

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
F-18	109.74M	278.80	511.00*	193.46	1.000E+35	11.85	Decay
% Abundances Found =			100.00				
RU-103	39.35D	0.54	497.08*	89.00	---- Not Found ----	----	Abun.
% Abundances Found =			5.92	610.33	5.60	2.049E-07	42.84
PM-148M	41.30D	0.51	298.11	12.56	---- Not Found ----	----	Abun.
% Abundances Found =			1.74	414.07	18.66	---- Not Found ----	
				432.78	5.35	---- Not Found ----	
				501.26	6.75	---- Not Found ----	
				550.27*	94.90	---- Not Found ----	
				599.74	12.54	---- Not Found ----	
				611.26	5.48	2.057E-07	42.84
				629.97	89.00	---- Not Found ----	
				725.70	32.80	---- Not Found ----	
				915.33	17.17	---- Not Found ----	
				1013.81	20.30	---- Not Found ----	
BI-214	19.90M	1537.44	609.31*	46.30	1.000E+35	42.84	Decay
% Abundances Found =			48.48	768.36	5.04	---- Not Found ----	
				934.06	3.21	---- Not Found ----	
				1120.29	15.10	---- Not Found ----	
				1238.11	5.94	---- Not Found ----	
				1377.67	4.11	---- Not Found ----	
				1764.49	15.80	---- Not Found ----	
% Abundances Found =			48.48	(Abn. Limit = 48.48%)			

Flag: "\*" = Keyline



It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	XErr	XEff	Flags
0	511.04	189	47	2.53	1023.00	1013	23	6.99E-02	11.9	4.59E+00	T
0	610.12	33	38	0.99	1221.22	1216	14	1.24E-02	42.8	4.25E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	22.	477.59	6.5769E-08
F-18	0.	511.00	Half-Life too short
NA-22	20.	1274.54	9.4941E-09
NA-24	0.	1368.53	Half-Life too short
NO-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	14.	889.25	7.7059E-09
CR-51	39.	320.00	9.8213E-08
MN-54	31.	834.83	9.0961E-09
CO-56	14.	1238.25	1.4054E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	47.	158.38	6.1690E-08
CO-57	50.	122.06	0.0676E-09
CO-58	16.	810.76	7.7120E-09
FE-59	12.	1099.22	1.6680E-08
CO-60	14.	1332.49	8.1977E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	19.	1115.52	1.7631E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	35.	136.00	9.7283E-09
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	57.	513.99	1.9281E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	57.	513.99	1.0442E-08
RB-86	13.	1076.63	1.7271E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	4.	1836.01	6.6210E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	8.	1204.90	2.6446E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT101211-4D

Acquisition date : 2-NOV-2011 15:02:32

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	29.	702.63	7.1137E-09
NB-95	18.	765.79	9.6765E-09
NB-95M	46.	235.69	1.3375E-06
ZR-95	17.	756.72	1.3647E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MD-99	12.	739.58	8.5326E-06
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	23.	497.08	8.8904E-09
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	17.	621.84	5.4500E-08
CD-109	35.	88.03	2.4709E-07
AG-110M	10.	937.48	1.7730E-08
SN-113	32.	391.69	9.8755E-09
SN-117M	49.	158.56	1.8088E-08
SB-122	18.	563.93	1.7137E-06
SB-124	27.	602.71	8.2230E-09
SB-125	34.	427.89	2.0666E-08
TE-125M	38.	109.28	3.0140E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	26.	57.60	1.9716E-05
XE-127	58.	202.84	1.3274E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	26.	695.88	3.1571E-07
XE-129M	57.	196.56	6.5611E-07
I-130	0.	536.09	Half-Life too short
BA-131	44.	123.00	7.2959E-08
I-131	35.	364.48	4.3800E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	42.	163.93	9.0937E-07
I-132	0.	667.69	Half-Life too short
TE-132	45.	228.16	5.8099E-07
BA-133	38.	302.84	3.0646E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	28.	81.00	4.4957E-07
XE-133M	50.	233.22	4.7413E-05
CS-134	30.	604.70	6.8972E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT101211-4D

Acquisition date : 2-NOV-2011 15:02:32

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	16.	818.50	1.9515E-08
I-136	0.	1313.02	Half-Life too short
CS-137	10.	661.65	4.9766E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	43.	165.85	7.1796E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	29.	537.32	7.7773E-08
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	62.	145.44	2.0712E-09
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	34.	133.54	4.9657E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	37.	91.10	1.1635E-07
PM-148M	21.	550.27	8.1230E-09
EU-152	37.	344.27	2.1594E-08
EU-154	20.	1004.76	4.5083E-08
EU-155	40.	105.31	3.4193E-08
EU-156	26.	646.29	2.3557E-07
HF-181	24.	482.03	9.3312E-09
TA-182	16.	1221.42	3.4290E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
AU-199	47.	158.38	1.6119E-06
HG-203	41.	279.19	9.7910E-09
BI-207	24.	569.67	5.9660E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	69.	240.98	1.0149E-05
RA-226	55.	106.21	1.7666E-07
AC-228	33.	338.32	4.7651E-08
TH-228	43.	84.37	9.0920E-07
PA-234	0.	131.20	Half-Life too short
TH-234	30.	63.29	1.3410E-06
U-235	49.	143.76	5.5082E-08
HP-239	40.	106.13	1.5040E-05
AM-241	28.	59.54	1.2411E-07

**GEL LAB RESULTS**

**EFT-4D 2009**

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Company : Detroit Edison - Fermi 1  
 Address : PO Box 44440  
 Detroit, Michigan 48244

Report Date: February 17, 2010

Contact: Mr. Tom Mow  
 Project: **Fermi 1 - PO# 4700246055**

Client Sample ID: EF1-4/D  
 Sample ID: 245517009  
 Matrix: Ground Water  
 Collect Date: 29-DEC-09 10:20  
 Receive Date: 25-JAN-10  
 Collector: Client

Project: ROIT00116  
 Client ID: ROIT001

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
<b>Rad Gas Flow Proportional Counting</b>											
<i>GFPC, Gross A/B, liquid "As Received"</i>											
Alpha	U	2.28	+/-2.49	3.92	5.00	pCi/L		DXF3 02/11/10	1932	945896	1
Beta		5.07	+/-2.03	2.71	5.00	pCi/L					

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	EPA 900.0	

**Certificate of Analysis**

Company : Detroit Edison - Fermi 1  
 Address : PO Box 44440

Report Date: December 30, 2010

Contact: Detroit, Michigan 48244  
 Mr. Tom Mow  
 Project: Fermi 1 - PO# 4700246055

Client Sample ID: EFT-102010-4/D  
 Sample ID: 268144013  
 Matrix: Water  
 Collect Date: 20-OCT-10 12:55  
 Receive Date: 06-DEC-10  
 Collector: Client

Project: ROIT00116  
 Client ID: ROIT001

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
<b>Rad Gas Flow Proportional Counting</b>											
<i>GFPC, Gross A/B, liquid "As Received"</i>											
Alpha		6.35	+/-1.76	2.08	5.00	pCi/L		VXC2 12/27/10 1941	1059089		1
Beta		7.69	+/-1.75	2.63	5.00	pCi/L					

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	EPA 900.0/SW846 9310	

**EFT-5S**

**2006**



## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-55060806

Sample Location (Well Number): EFT-55

1. Representative sample collected. Date/Time 06/08/06 / 1447

Sample collected by: Jay Slebocka-Tilk / Seanhard P. [Signature] Date: 06/08/06  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Freiling / Cheryl A. [Signature] Date: 08/02/06  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Russ Burgess [Signature] Date: 8-3-06  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KO Linosoy / [Signature] Date: 8-21-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-5S	
2 . Date Sampled	06/08/2006	
3 . Time Sampled	14:42	
4 . Sample Volume, (ml)	4	ml

**Instrument Count Data**

1 . Date Sample Counted	08/03/2006	
2 . Time Sample Counted	10:00	
3 . Background Inf.:		
Minutes Counted	10	min.
Background Count Rate (cpm)	7.2	cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)		
Gross Spike Count Rate (cpm)	3598.6	cpm
Net Spike Count Rate (cpm)	3591.4	cpm
H3 Spike Activity (dpm on count date)	8580.4	dpm
Counter Efficiency	0.4186	cpm/dpm
5 . Sample Info:		
Sample Gross Count Rate (cpm)	9.0	cpm
Sample Count Time (min.)	10.0	min.
Net Sample Count Rate (cpm)	1.8	cpm
6 . Critical Level:		
Critical Level Count Rate (cpm)	2.0	cpm

**Minimum Detectable Activity**

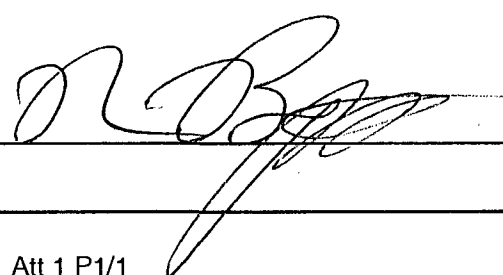
$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.07\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician



Date

8-3-06

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-55060806

Sample Location (Well Number): EFT-55

1. Representative sample collected. Date/Time 06/08/06 1 1442

Sample collected by: Jay Slaback / [Signature] Date: 06/08/06  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Freiling / Cheryl A. Satiz Date: 08/02/06  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Aberc / [Signature] Date: 8-5-06  
Fermi 2 RP Printed Name Signature

Sample number: EFT-53060806

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Abere Anderson Date: 8-5-06  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: KD Lindsay | KD Lindsay Date: 2-21-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-55060806 EF1

Sample End Time: 8-JUN-2006 14:42:00.00

REMARKS

PERFORMED BY:

*Andrew Yere*

SIGNATURE

REVIEWED BY:

*K. G. G. G.*

2-21-08

SIGNATURE/DATE

Sample ID : EFT-58060006 EF1

Acquisition date : 5-AUG-2006 10:46:02

## Fermi 2 Radiation Protection Gamma Spectroscopy Report

## \*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-58060006 EF1  
 Sample collection start date: 8-JUN-2006 14:42:00.00  
 Sample collection end date : 8-JUN-2006 14:42:00.00  
 Type of sample : 1 L Marin. Liquid  
 Sample quantity : 1.000000E+03 cc  
 Sample geometry : M2LL Operator: AKG

## \*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 5-AUG-2006 10:46:02.27  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:01.07 Percent dead time : 0.05 %

## \*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 26-APR-2000 11:50:00.00  
 Kev/channel : 5.00143E-01 Zero offset: -2.30456E-03  
 Daily cal date : 5-AUG-2006 00:20:12.42

## \*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

## \*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

PK	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Er	Fit
1	3	511.08	92	41	2.51	1022.10	1013	19	5.11E-02	20.2	1.72E+00
2	3	511.99	21	31	1.09	1024.00	1013	19	1.19E-02	73.4	
3	0	559.62	67	20	2.00	1119.30	1112	17	3.72E-02	23.1	
4	0	610.85	33	54	0.67	1221.79	1211	21	2.93E-02	38.4	
5	0	1461.07	91	3	2.27	2923.02	2917	13	5.04E-02	11.3	

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
3	511.08	90	41	2.51	1023.19	1013	19	20.2	1.72E+00	<i>Annihilation</i>
5	511.99	21	31	1.89	1024.00	1013	19	73.6		<i>H<sub>2</sub>O</i>
6	559.62	67	20	2.00	1119.30	1112	17	23.1		<i>&lt; 1 FWHM</i>
8	610.95	53	54	0.67	1221.79	1211	21	30.4		<i>K-40</i>
8	1461.07	91	3	2.27	2923.02	2917	13	11.3		

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	91	10.67*	2.300E+00	5.520E-07	5.520E-07	11.20

Flag: "0" = Keyline



Total number of lines in spectrum 5  
Number of unidentified lines 1  
Number of lines tentatively identified by NID 4 80.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	5.520E-07	5.520E-07	0.623E-07	11.28	
Total Activity :			5.520E-07	5.520E-07			

Grand Total Activity : 5.520E-07 5.520E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"P" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	759.06	511.00*	193.46	1.000E+35	20.17	Decay
% Abundances			Found = 100.00				
AS-76	26.32H	52.75	559.10*	44.70	3.949E+05	23.10	Decay, Abun.
% Abundances			Found = 73.70				
			563.23	1.17	---	Not Found	---
			571.30	0.14	---	Not Found	---
			657.03	6.10	---	Not Found	---
			665.31	0.39	---	Not Found	---
			740.12	0.12	---	Not Found	---
			771.76	0.12	---	Not Found	---
			867.63	0.12	---	Not Found	---
			1129.87	0.14	---	Not Found	---
			1212.72	1.63	---	Not Found	---
			1216.02	3.84	---	Not Found	---
			1228.52	1.39	---	Not Found	---
			1439.13	0.33	---	Not Found	---
			1453.60	0.13	---	Not Found	---
			1787.67	0.33	---	Not Found	---
% Abundances			Found = 73.70				
Y-92	3.54H	392.18	448.50	2.30	---	Not Found	Decay, Abun.
% Abundances			Found = 9.74				
			561.10	2.40	1.000E+35	23.10	
			844.30	1.25	---	Not Found	---
			934.46*	13.90	---	Not Found	---
			1405.40	4.80	---	Not Found	---
% Abundances			Found = 9.74				
RU-103	39.35D	1.47	497.08*	89.00	---	Not Found	Abun.
% Abundances			Found = 5.92				
			610.33	3.60	9.416E-07	38.42	
PM-148M	41.30D	1.40	288.11	12.56	---	Not Found	Abun.
% Abundances			Found = 1.74				
			414.07	18.66	---	Not Found	---
			432.78	5.35	---	Not Found	---
			501.86	6.75	---	Not Found	---
			550.27*	24.90	---	Not Found	---
			599.74	12.54	---	Not Found	---
			611.26	5.48	9.170E-07	38.42	
			629.97	89.00	---	Not Found	---
			725.70	32.90	---	Not Found	---
			915.33	17.17	---	Not Found	---
			1013.81	20.30	---	Not Found	---
% Abundances			Found = 1.74				
BI-214	19.90M	4185.88	609.31*	46.30	1.000E+35	38.42	Decay
% Abundances			Found = 48.48 (Abn. Limit = 48.48%)				
			768.36	5.04	---	Not Found	---
			934.06	3.21	---	Not Found	---
			1120.29	15.10	---	Not Found	---
			1238.11	5.94	---	Not Found	---
			1377.67	4.11	---	Not Found	---
			1764.49	15.00	---	Not Found	---

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
3	511.00	92	41	2.51	1022.10	1013	19	5.11E-02	20.2	4.40E+00	T
3	511.99	21	31	1.89	1024.00	1013	19	1.19E-02	73.6	4.40E+00	
9	559.62	67	23	2.00	1119.30	1112	17	3.72E-02	23.1	4.31E+00	T
0	610.85	53	54	0.67	1221.79	1211	21	2.93E-02	30.4	4.16E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	35.	477.59	1.9994E-07
F-18	0.	511.00	Half-Life too short
NA-22	16.	1274.54	1.0841E-08
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	20.	809.25	1.9156E-08
CR-51	40.	320.08	3.0975E-07
MN-54	17.	834.83	1.1744E-08
CO-56	16.	1238.25	3.1477E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	54.	158.38	6.5327E-06
CO-57	39.	122.06	1.2315E-08
CO-58	10.	810.76	1.4030E-08
FE-59	12.	1099.22	4.4398E-08
CO-60	17.	1332.49	1.3824E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	10.	1115.52	2.2521E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	49.	136.00	2.1795E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.58	Half-Life too short
BR-85	0.	802.41	Half-Life too short
RR-85	60.	513.99	3.0598E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	60.	513.99	2.4348E-08
RB-86	8.	1876.77	8.0232E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	398.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	7.	1836.01	1.6099E-08
RP-89	0.	220.90	Half-Life too short
RP-89	0.	1031.88	Half-Life too short
RP-89	0.	1118.60	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RE-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	10.	1204.90	6.7812E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT-58060006 EF1

Acquisition date : 5-AUG-2006 10:46:02

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	12.	702.63	7.5458E-09
NB-95	19.	765.79	3.1588E-08
NB-95M	0.	235.69	Half-Life too short
ZR-95	17.	756.72	3.1642E-08
NE-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MD-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	25.	497.00	2.6713E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	29.	621.84	1.1492E-07
CD-109	43.	88.03	4.6561E-07
AG-110M	15.	937.48	3.6877E-08
SN-113	35.	391.69	1.9717E-08
SN-117M	56.	158.56	2.0212E-07
SB-122	0.	563.93	Half-Life too short
SD-124	23.	602.71	1.7715E-08
SB-125	24.	427.89	2.7997E-08
TE-125M	41.	109.28	7.5594E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	24.	57.60	2.9757E-05
XE-127	54.	202.84	4.0971E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	22.	695.88	9.5398E-07
XE-129M	57.	190.50	1.0047E-05
I-130	0.	536.09	Half-Life too short
BA-131	53.	123.00	1.0662E-06
I-131	35.	364.48	1.5513E-06
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	55.	103.93	1.3697E-05
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	49.	302.84	5.5578E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	30.	604.70	1.0983E-08
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT-55060006 EF1

Acquisition date : 5-AUG-2006 10:46:02

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	18.	818.50	2.1760E-07
I-136	0.	1313.02	Half-Life too short
CS-137	9.	661.65	7.4327E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.58	Half-Life too short
CE-139	52.	165.85	1.4655E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	20.	537.32	7.4414E-07
LA-140	0.	1596.49	Half-Life too short
BO-141	0.	190.22	Half-Life too short
CE-141	44.	145.44	6.0204E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	39.	133.54	8.9715E-08
FR-144	0.	1489.15	Half-Life too short
HD-147	34.	91.10	1.8110E-06
PM-148M	20.	550.27	2.2834E-08
EU-150	44.	344.27	3.6607E-08
EU-154	13.	1004.76	5.7763E-08
EU-156	17.	646.29	1.5091E-06
HF-181	27.	482.03	2.7335E-08
TA-182	10.	1221.42	5.3631E-08
W-187	0.	605.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HO-203	50.	279.19	2.9509E-08
BI-207	18.	569.67	8.0381E-09
TL-208	0.	583.14	Half-Life too short
PE-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PE-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	68.	106.21	3.0667E-07
AC-228	41.	338.32	8.2979E-08
TI-228	44.	84.37	1.5331E-06
PA-234	0.	131.20	Half-Life too short
TH-234	41.	63.29	6.5733E-06
U-235	48.	143.76	8.4033E-08
NP-239	0.	106.13	Half-Life too short
AM-241	23.	59.54	1.5500E-07

### FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-55060806

Sample Location (Well Number): EFT-55

1. Representative sample collected. Date/Time 06/08/06 / 1442

Sample collected by: Jay Sleback / Tony Maria Slalack Date: 06/08/06  
Printed Name / Signature Collection Date: 06/08/06  
signed 02/01/07

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample ≥ 50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Freiling / Cheryl A. Kelly Date: 08/02/06  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Russ Boyer Date: 2-5-7  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: William V. Lyman Date: 2/15/07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks No tritium detected. William V. Lyman 48651 2/15/07



**Sample Information**

1 . Sample Location	EFT-5S060806
2 . Date Sampled	06/08/2006
3 . Time Sampled	14:42
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	02/02/2007
2 . Time Sample Counted	10:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.4 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3388.1 cpm
Net Spike Count Rate (cpm)	3380.7 cpm
H3 Spike Activity (dpm on count date)	8340.7 dpm
Counter Efficiency	0.4053 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	7.8 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.4 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.12\text{E-06 uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 dpm/uCi x Sample Volume}} < \text{MDA}$$

Technician  Date 2-5-07

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-55060806

Sample Location (Well Number): EFT-55

1. Representative sample collected. Date/Time 06/08/06 1 1442

Sample collected by: Jay Slabick / Jerry Maud Slabick Date: 06/08/06  
Printed Name / Signature <sup>Collection</sup>  
Signed 02/01/07

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Friling / Cheryl A Friling Date: 08/02/06  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: RD Lindsay / RD Lindsay Date: 7-17-07  
Fermi 2 RP Printed Name Signature

Sample number: EF1-55060806

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard Date: 7-2-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation/Protection Supervision or delegate.

Performed by: K.D. Linosoy Date: 8-21-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1 EFT-55060006

Sample End Time: 6-JUN-2006 14:42:00.00

REMARKS

PERFORMED BY:

SIGNATURE

REVIEWED BY:

SIGNATURE/DATE

Sample ID : EF1 EFT-58060006

Acquisition date : 2-JUL-2007 10:55:43

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-58060006  
 Sample collection start date: 6-JUN-2006 14:42:00.00  
 Sample collection end date : 6-JUN-2006 14:42:00.00  
 Type of sample : WELL EFT-58  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : WELL Operator: CMH

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 2-JUL-2007 10:55:43.34  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:01.15 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 \ Yearly cal date : 20-JUN-2007 12:16:46.16  
 KeV/channel : 4.99646E-01 Zero offset: 5.21199E-02  
 Daily cal date : 2-JUL-2007 10:33:40.58

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	352.30	45	30	3.66	705.13	697	15	2.50E-02	30.4	PO-214
2	5	510.77	80	22	2.36	1022.13	1017	15	4.46E-02	17.6	2.12E+00
3	5	512.64	41	22	2.13	1025.00	1017	15	2.29E-02	30.5	annihilation
4	0	550.78	67	13	1.92	1110.21	1114	11	3.72E-02	16.2	H2C
5	0	1461.30	68	7	1.25	2924.31	2917	13	3.70E-02	14.4	K-40

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	352.30	45	30	3.66	705.13	697	15	30.4		
5	510.77	00	22	2.36	1022.13	1017	15	17.6	2.12E+00	
5	512.64	41	22	2.13	1025.00	1017	15	30.5		SR-85 KR-85
0	558.70	67	13	1.92	1110.21	1114	11	16.2		
0	1461.30	60	7	1.25	2924.31	2917	13	14.4		K-40

Sample ID : EF1 EFT-58060006

Acquisition date : 2-JUL-2007 10:55:43

## Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	68	10.67*	2.501E+00	3.829E-07	3.829E-07	14.41

## Nuclide Type: fission gas

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
KR-85	513.99	41	0.43*	4.872E+00	2.955E-06	3.167E-06	38.53

## Nuclide Type: activation

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
SR-85	513.99	41	99.27*	4.872E+00	1.200E-08	8.353E-07	38.53

Flag: "\*" = Keyline

Total number of lines in spectrum 5  
 Number of unidentified lines 0  
 Number of lines tentatively identified by MID 5 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error Flags
K-40	1.00E+05Y	1.00	3.829E-07	3.829E-07	0.552E-07	14.41
Total Activity :			3.829E-07	3.829E-07		

Nuclide Type : fission gas

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error Flags
KR-85	10.72Y	1.07	2.955E-06	3.167E-06	1.220E-06	39.53
Total Activity :			2.955E-06	3.167E-06		

Nuclide Type : activation

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error Flags
SR-85	64.94D	65.3	1.280E-08	8.353E-07	3.219E-07	39.53
Total Activity :			1.280E-08	8.353E-07		

Grand Total Activity : 3.351E-06 4.385E-06

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit



Sample ID : EFL EFT-550500006

Acquisition date : 2-JUL-2007 10:55:43

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
F-18	109.74M	5120.75	511.00*	100.00	1.000E+35	17.55	Decay
% Abundances Found = 100.00							
AS-76	26.32H	356.40	559.10*	44.70	1.000E+35	16.22	Decay, Abun.
			563.23	1.17	----	Not Found	----
			571.30	0.14	----	Not Found	----
			657.03	6.10	----	Not Found	----
			665.31	0.39	----	Not Found	----
			740.12	0.12	----	Not Found	----
			771.76	0.12	----	Not Found	----
			867.63	0.12	----	Not Found	----
			1129.07	0.14	----	Not Found	----
			1212.72	1.63	----	Not Found	----
			1216.02	3.84	----	Not Found	----
			1228.52	1.39	----	Not Found	----
			1439.13	0.33	----	Not Found	----
			1453.60	0.13	----	Not Found	----
			1787.67	0.33	----	Not Found	----
% Abundances Found = 73.70							
PE-214	26.00M	21001.07	87.30	4.67	----	Not Found	Decay
			241.90	7.49	----	Not Found	----
			295.21	19.20	----	Not Found	----
			351.92*	37.20	1.000E+35	30.43	
			705.91	1.10	----	Not Found	----
% Abundances Found = 53.40 (Abn. Limit = 37.20%)							

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	352.38	45	30	3.66	705.13	697	15	2.50E-02	30.4	5.70E+00	T
5	510.77	80	22	2.36	1022.13	1017	15	4.46E-02	17.6	4.80E+00	T
0	558.78	67	13	1.92	1118.21	1114	11	3.72E-02	16.2	4.60E+00	T

Flags: "T" = Tentatively associated

\* Sample ID : EF1 EFT-58060006 \*

Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	17.	477.59	9.8743E-06
F-18	0.	511.00	Half-Life too short
NA-22	7.	1274.54	1.1425E-08
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	0.	889.25	1.0341E-07
CR-51	0.	320.00	Half-Life too short
MN-54	14.	834.93	2.0714E-08
CO-56	14.	1238.25	5.0886E-07
MN-56	0.	1010.69	Half-Life too short
NI-56	0.	158.30	Half-Life too short
CO-57	42.	122.06	2.7145E-08
CO-58	15.	810.76	3.9451E-07
FE-59	5.	1099.22	5.3325E-06
CO-60	9.	1332.49	1.1150E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	2.	1115.52	3.1010E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	46.	136.00	1.3257E-07
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85M	0.	151.10	Half-Life too short
RB-86	0.	1076.63	Half-Life too short
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	380.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	6.	1836.01	1.2247E-07
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	3.	1204.90	1.0976E-04
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short

Sample ID : EF1 EFT-59060006

Acquisition date : 2-JUL-2007 10:55:43

Nuclide	Eckgnd Sum	Energy (keV)	MDA (uCi/cc)
NB-94	10.	702.63	8.1747E-09
NB-95	0.	765.79	Half-Life too short
NB-95M	0.	235.69	Half-Life too short
ZR-95	15.	756.72	1.0240E-06
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.50	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	22.	497.09	8.1712E-06
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	19.	621.84	1.6427E-07
CD-109	28.	98.03	5.6465E-07
AG-110M	7.	937.48	6.3125E-08
SN-113	18.	391.69	9.8409E-08
SN-117M	0.	150.56	Half-Life too short
SB-122	0.	563.93	Half-Life too short
SB-124	18.	602.71	6.8754E-07
SB-125	20.	427.89	2.9840E-08
TE-125M	44.	109.28	3.7775E-04
TE-127	0.	417.90	Half-Life too short
TE-127M	28.	57.60	2.7791E-04
XE-127	0.	202.84	Half-Life too short
TE-129	0.	459.60	Half-Life too short
TE-129M	0.	695.88	Half-Life too short
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	0.	123.00	Half-Life too short
I-131	0.	364.40	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	0.	163.93	Half-Life too short
I-132	0.	667.69	Half-Life too short
TE-132	0.	220.16	Half-Life too short
BA-133	32.	302.84	4.3737E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	25.	604.70	1.2561E-08
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short
CS-136	0.	818.50	Half-Life too short
I-136	0.	1313.02	Half-Life too short

Sample ID : EF1 EFT-55060006

Acquisition date : 2-JUL-2007 10:55:43

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-137	9.	661.65	7.0719E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.06	Half-Life too short
XE-138	0.	250.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	41.	165.05	6.4720E-08
CS-139	0.	1203.23	Half-Life too short
BA-140	0.	537.32	Half-Life too short
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	0.	145.44	Half-Life too short
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	49.	133.54	2.0416E-07
PR-144	0.	1409.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PM-140M	17.	550.27	5.1223E-06
EU-152	34.	344.27	3.1041E-08
EU-154	15.	1004.76	6.1741E-08
EU-156	0.	646.29	Half-Life too short
HF-181	13.	402.03	4.2514E-06
TA-182	7.	1221.42	3.1030E-07
W-187	0.	605.01	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	30.	279.19	2.9467E-06
BI-207	19.	569.67	7.6037E-09
TL-208	0.	503.14	Half-Life too short
PB-212	0.	230.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.90	Half-Life too short
RA-226	54.	106.21	2.5207E-07
AC-228	26.	330.32	6.0366E-08
TH-228	35.	84.37	1.7345E-06
PA-234	0.	131.20	Half-Life too short
TH-234	0.	63.29	Half-Life too short
U-235	44.	143.76	7.4362E-08
NP-239	0.	106.13	Half-Life too short
AM-241	42.	59.54	2.0227E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-55 121306

Sample Location (Well Number): EFT-55

1. Representative sample collected. Date/Time 12/13/06 1 1511

Sample collected by: J. Slaback / Jay Main Slaback Date: 02/01/07  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 2/2/07  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: D. Howard / Amithwan Date: APR 20 2007  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KD LINDSEY / KD Lindsey Date: 11-14-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-5S121306
2 . Date Sampled	12/13/2006
3 . Time Sampled	15:11
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	04/19/2007
2 . Time Sample Counted	17:17
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.7 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3407.6 cpm
Net Spike Count Rate (cpm)	3399.9 cpm
H3 Spike Activity (dpm on count date)	8243.8 dpm
Counter Efficiency	0.4124 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	7.0 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.12\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 uCi/ml x Sample Volume}} < \text{MDA}$$

Technician

*Am / Jwarril*

APR 20 2007  
Date

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-55 121306

Sample Location (Well Number): EFT-55

1. Representative sample collected. Date/Time 12/13/06 1 1511

Sample collected by: J. Slaback / Jay Marie Slaback Date: 02/01/07  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 2/2/07  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: KD LINDSEY / KD Lindsey Date: 2.8.07  
Fermi 2 RP Printed Name Signature



Sample number: EFT-55 121306

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard [Signature] Date: 7-16-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System.  
If so, verify the critical levels and LLDs and count sample in accordance  
with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: [Signature] [Signature] Date: 8-8-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DETOIT EDISON FERMI-2 POWER PLANT

16-JUL-2007 10:47:31.63

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

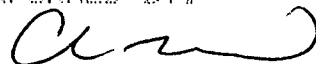
HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1 EFT-59121306

Sample End Time: 13-DEC-2006 15:11:00.00

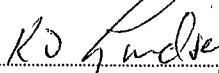
REMARKS

PERFORMED BY:



SIGNATURE

REVIEWED BY:



8-8-07

SIGNATURE/DATE

Sample ID : EF1 EFT-55121306

Acquisition date : 16-JUL-2007 10:17:29

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-55121306
Sample collection start date: 13-DEC-2006 15:11:00.00
Sample collection end date : 13-DEC-2006 15:11:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.000000E+03 CC
Sample geometry : N2LL Operator: CFM

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 16-JUL-2007 10:17:29.96
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:00.90 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16
Kev/channel : 4.99738E-01 Zero offset: -1.95000E-01
Daily cal date : 16-JUL-2007 00:37:10.01

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Table with 11 columns: Pk It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. Contains 5 rows of peak data with handwritten annotations like 'RA-227', 'annihilation', 'H2O', 'Bi-214', 'K-40'.

Sample Title : EF1 EFT-58121306  
Decay Time = 214 19:06:29.96

Page : 1  
Acquisition Time = 16-JUL-2007 10:17:29.9

6

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	XErr	Fit	Nuclides
0	66.00	64	83	1.59	132.63	125	15	34.1		
0	511.33	136	69	2.14	1023.56	1013	23	18.0		
0	559.32	48	41	1.91	1119.59	1110	15	32.4		
0	609.20	33	19	1.65	1219.41	1212	11	30.9		
0	1460.49	59	3	2.39	2922.72	2914	15	14.8		K-40

Nuclide Line Activity Report  
Sample ID : EF1 EFT-SS121306

Page : 2  
Acquisition date : 16-JUL-2007 10:17:29

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/CC	Decay Corr uCi/CC	1-Sigma %Error
K-40	1460.51	59	10.67*	2.502E+00	3.311E-07	3.311E-07	14.82

Flag: "\*" = Keyline

Summary of Nuclide Activity  
Sample ID : EF1 EFT-5S121306

Page : 3  
Acquisition date : 16-JUL-2007 10:17:29

Total number of lines in spectrum 5  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 5 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/CC	Decay Corr uCi/CC	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	3.311E-07	3.311E-07	0.491E-07	14.82	
Total Activity :			3.311E-07	3.311E-07			

Grand Total Activity : 3.311E-07 3.311E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"G" = Nuclide specific abn. limit

Rejected Report  
 Sample ID : EF1 EFT-58121306

Page : 4  
 Acquisition date : 16-JUL-2007 10:17:29

Nuclide	Half-life	Ratio	Energy	%Abund	Activity (uCi/CC)	1-Sigma %Error	Rejected by
F-18	109.74M	2818.68	511.00*	193.46	1.000E+35	19.04	Decay
				% Abundances Found =	100.00		
SE-75	119.78D	1.79	66.05	1.02	2.339E-05	34.05	Abun.
				96.73	3.41	----	Not Found
				121.12	16.70	----	Not Found
				136.00*	59.20	----	Not Found
				198.60	1.45	----	Not Found
				264.65	59.00	----	Not Found
				279.53	25.20	----	Not Found
				303.91	1.32	----	Not Found
				400.65	11.40	----	Not Found
				% Abundances Found =	0.57		
AS-76	26.32H	195.07	559.10*	44.70	1.000E+35	32.42	Decay, Abun.
				563.23	1.17	----	Not Found
				571.30	0.14	----	Not Found
				657.03	6.10	----	Not Found
				665.31	0.39	----	Not Found
				740.12	0.12	----	Not Found
				771.76	0.12	----	Not Found
				867.63	0.12	----	Not Found
				1129.07	0.14	----	Not Found
				1212.72	1.63	----	Not Found
				1216.02	3.04	----	Not Found
				? 1228.52	1.39	----	Not Found
				1439.13	0.33	----	Not Found
				1453.60	0.13	----	Not Found
				1787.67	0.33	----	Not Found
				% Abundances Found =	73.70		
Y-92	3.54H	1456.32	448.50	2.30	----	----	Decay, Abun.
				561.10	2.40	1.000E+35	32.42
				844.30	1.25	----	Not Found
				934.46*	13.90	----	Not Found
				1405.40	4.80	----	Not Found
				% Abundances Found =	9.74		
RU-103	39.35D	5.46	497.00*	89.00	----	----	Abun.
				610.33	5.60	8.639E-06	30.94
				% Abundances Found =	5.92		
XE-135	9.11H	565.90	249.79*	89.90	----	----	Decay, Abun.
				600.19	2.89	1.000E+35	30.94
				% Abundances Found =	3.11		
CS-136	13.16D	16.32	66.91	12.50	4.513E-02	34.05	Decay, Abun.
				86.29	6.30	----	Not Found
				153.22	7.46	----	Not Found
				163.09	4.61	----	Not Found
				176.55	13.56	----	Not Found
				273.65	12.66	----	Not Found

Rejected Report (continued)  
 Sample ID : EF1 EFT-5S121306

Page : 5  
 Acquisition date : 16-JUL-2007 10:17:20

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/CC)	%Error	
CS-136	13.16D	16.32	340.57	48.50	----	Not Found	Decay, Abun.
			818.50*	29.70	----	Not Found	
			1048.07	79.60	----	Not Found	
			1235.34	19.70	----	Not Found	
			% Abundances Found =			4.10	
TA-182	114.74D	1.87	67.75	42.30	5.956E-07	34.85	Abun.
			100.10	14.10	----	Not Found	
			1109.05	16.30	----	Not Found	
			1221.42*	27.10	----	Not Found	
			1230.97	11.50	----	Not Found	
% Abundances Found =			38.01				
BI-214	19.90M	15543.79	609.31*	46.30	1.000E+35	30.94	Decay
			768.36	5.04	----	Not Found	
			934.06	3.21	----	Not Found	
			1120.29	15.10	----	Not Found	
			1230.11	5.94	----	Not Found	
			1377.67	4.11	----	Not Found	
1764.49	15.90	----	Not Found				
% Abundances Found =			48.48	(Abn. Limit = 48.48%)			

Flag: "\*" = Keyline



Unidentified Energy Lines  
Sample ID : EF1 EFT-55121306

Page : 6  
Acquisition date : 16-JUL-2007 10:17:29

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	66.08	84	83	1.59	132.63	125	15	3.54E-02	34.1	1.39E+00	T
0	511.33	136	69	2.14	1023.56	1013	23	7.56E-02	10.0	4.80E+00	T
0	550.32	40	41	1.91	1119.59	1110	15	2.60E-02	32.4	4.60E+00	T
0	609.20	33	19	1.65	1219.41	1212	11	1.84E-02	30.9	4.52E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
BE-7	22.	477.59	1.1324E-06
F-18	0.	511.00	Half-Life too short
NA-22	9.	1274.54	1.1072E-08
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-39	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	11.	889.25	4.8136E-08
CR-51	26.	320.08	1.4735E-05
MN-54	11.	834.83	1.2781E-08
CO-56	4.	1238.25	6.4588E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	0.	158.38	Half-Life too short
CO-57	36.	122.06	1.6148E-08
CO-58	5.	810.76	4.4921E-08
FE-59	7.	1099.22	3.9366E-07
CO-60	9.	1332.49	1.0052E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.04	Half-Life too short
ZN-65	9.	1115.52	3.0934E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	40.	136.00	4.5019E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	43.	513.99	2.4661E-06
KR-85M	0.	151.18	Half-Life too short
SR-95	43.	513.99	1.0219E-07
RB-86	0.	1076.63	Half-Life too short
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	1.	1036.01	2.0339E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.80	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	12.	1204.90	4.3101E-05
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page : 2

Sample ID : EF1 EFT-5S121306

Acquisition date : 16-JUL-2007 10:17:29

Nuclide	Backgrd Sum	Energy (keV)	MDA (uCi/CC)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
HB-94	23.	702.63	9.0756E-09
NB-95	13.	765.79	5.3299E-07
NB-95M	0.	235.69	Half-Life too short
ZR-95	18.	756.72	1.6382E-07
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	17.	497.08	3.2837E-07
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	15.	621.04	1.0578E-07
CD-109	35.	88.03	4.7099E-07
AG-110M	13.	937.48	4.8802E-08
SN-113	21.	391.69	3.6907E-08
SN-117M	0.	158.56	Half-Life too short
SB-122	0.	563.93	Half-Life too short
SB-124	23.	602.71	1.0020E-07
SB-125	20.	427.89	2.6200E-08
TE-125M	27.	109.28	3.6827E-05
TE-127	0.	417.90	Half-Life too short
TE-127M	28.	57.60	9.0194E-05
XE-127	32.	202.04	5.8382E-07
TE-129	0.	459.60	Half-Life too short
TE-129M	15.	695.88	1.8791E-05
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	0.	123.00	Half-Life too short
I-131	0.	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	0.	163.93	Half-Life too short
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	31.	302.84	4.1734E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	21.	604.70	9.8302E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page : 3

Sample ID : EF1 EFT-5S121306

Acquisition date : 16-JUL-2007 10:17:29

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/CC)
CS-136	0.	818.50	Half-Life too short
I-136	0.	1313.02	Half-Life too short
CS-137	10.	661.65	7.2689E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.06	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	34.	165.05	2.4620E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	0.	537.32	Half-Life too short
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	35.	145.44	1.4061E-06
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	45.	133.54	1.2822E-07
PR-144	0.	1489.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PM-148M	20.	550.27	2.8848E-07
EU-152	28.	344.27	2.7854E-08
EU-154	14.	1004.76	5.7576E-08
EU-156	0.	646.29	Half-Life too short
HF-181	16.	482.03	2.5786E-07
TA-182	11.	1221.42	1.3542E-07
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	39.	279.19	2.4247E-07
BI-207	15.	569.67	6.9026E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	54.	186.21	2.5349E-07
AC-228	36.	338.32	7.4895E-08
TH-228	33.	84.37	1.4840E-06
PA-234	0.	131.20	Half-Life too short
TH-234	43.	63.29	5.7839E-04
U-235	53.	143.76	0.0210E-08
NP-239	0.	106.13	Half-Life too short
AM-241	19.	59.54	1.4157E-07

**EFT-5S**

**2007**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-557307

Sample Location (Well Number): EFT-55

1. Representative sample collected. Date/Time 7/3/07 1 1728

Sample collected by: Jay Maise Slback / Jay Maise Slback Date: 12/10/2007  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 12/10/07  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: R. Buzzetti / R. Buzzetti Date: 12-14-07  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: RD Lindsey / RD Lindsey Date: 2-26-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location 5S  
 2 . Date Sampled 07/03/2007  
 3 . Time Sampled 17:28  
 4 . Sample Volume, (ml) 4 ml

**Instrument Count Data**

1 . Date Sample Counted 12/14/2007  
 2 . Time Sample Counted 08:00  
 3 . Background Inf.:  
     Minutes Counted 10 min.  
     Background Count Rate (cpm) 8.2 cpm  
 4 . Efficiency Inf.: (Daily Spike Source ID # 111)  
     Gross Spike Count Rate (cpm) 3189.3 cpm  
     Net Spike Count Rate (cpm) 3181.1 cpm  
     H3 Spike Activity (dpm on count date) 7944.9 dpm  
     Counter Efficiency 0.4004 cpm/dpm  
 5 . Sample Info:  
     Sample Gross Count Rate (cpm) 9.2 cpm  
     Sample Count Time (min.) 10.0 min.  
     Net Sample Count Rate (cpm) 1.0 cpm  
 6 . Critical Level:  
     Critical Level Count Rate (cpm) 2.1 cpm

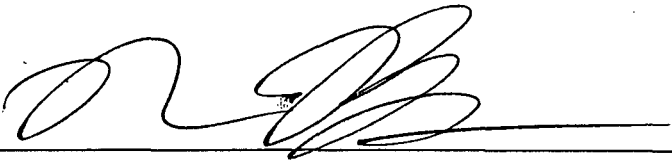
**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}{\text{Efficiency} \times 2.22\text{E6 dpm/uCi} \times \text{Sample Volume}} = 1.19\text{E-06 uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E6 uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician \_\_\_\_\_



Date

12/14/07

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-557307

Sample Location (Well Number): EFT-55

1. Representative sample collected. Date/Time 07/03/2007 / 1728

Sample collected by: J. Slaback / Jay Marie Slaback Date: 07/16/2007  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jemif Southward Date: 08/08/07  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: K. LINDSEY / K. Lindsey Date: 8.8.07  
Fermi 2 RP Printed Name / Signature



Sample number: EFT-557307

- 4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard Date: 7-19-07  
 Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

- 5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: K. Purdsey Date: 8-8-07  
 Fermi 2 Printed Name Signature  
 Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

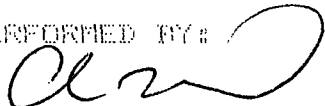
GAMMA SPECTROSCOPY ANALYSIS REPORT


HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1 EFT-557307

Sample End Time: 3-JUL-2007 17:39:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:   
SIGNATURE

REVIEWED BY:  8-8-07  
SIGNATURE/DATE

Sample ID : EF1 EFT-557307

Acquisition date : 19-JUL-2007 10:22:47

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-557307  
 Sample collection start date: 3-JUL-2007 17:25:00.00  
 Sample collection end date : 3-JUL-2007 17:29:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : M2LL Operator: CMH

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 19-JUL-2007 10:22:47.78  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:00.91 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16  
 Kev/channel : 4.99741E-01 Zero offset: -1.77476E-01  
 Daily cal date : 19-JUL-2007 08:20:24.04

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m2ll Efficiencies at : Peak energy

Pk	It	Energy	Area	Ekgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	511.64	147	26	2.20	1024.14	1014	21	8.17E-02	12.0	annihilation
2	0	558.56	84	15	1.80	1110.03	1113	12	4.64E-02	14.4	HWC
3	0	609.44	53	10	1.37	1219.85	1213	14	2.96E-02	21.5	Bi-214
4	0	1461.01	82	4	1.21	2923.74	2915	17	4.54E-02	12.5	K-40
5	0	1764.51	21	0	0.70	3531.00	3524	12	1.17E-02	21.0	Bi-214

Sample Title : EF1 EFT-557307

Page : 1

Decay Time = 15 16:54:47.78

Acquisition Time = 19-JUL-2007 10:22:47.7

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Post-MID Peak Search Report

It	Energy	Area	Bgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	511.64	147	26	2.20	1024.14	1014	21	12.0		
0	553.56	84	15	1.00	1118.03	1113	12	14.4		
0	609.44	53	10	1.37	1219.85	1213	14	21.5		
0	1461.01	82	4	1.21	2923.74	2915	17	12.5		K-40
0	1764.51	21	0	0.70	3531.00	3524	12	21.8		

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	82	10.67*	2.501E+00	4.599E-07	4.599E-07	12.48

Flag: "\*" = Keyline

Summary of Nuclide Activity  
Sample ID : CF1 EFT-557307

Page : 3  
Acquisition date : 19-JUL-2007 10:22:47

Total number of lines in spectrum 5  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 5 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma Error	Flags
K-40	1.00E+05Y	1.00	4.599E-07	4.599E-07	0.574E-07	12.45	
Total Activity :			4.599E-07	4.599E-07			

Grand Total Activity : 4.599E-07 4.599E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Sample ID : EF1 EFT-507307

Acquisition date : 19-JUL-2007 10:23:47

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	206.21	511.00*	193.46	1.000E+35	11.99	Decay
% Abundances Found = 100.00							
AS-76	26.32H	14.33	559.10*	44.70	1.234E-03	14.36	Decay, Abun.
			563.23	1.17	---	Not Found	---
			571.30	0.14	---	Not Found	---
			557.03	6.10	---	Not Found	---
			665.31	0.39	---	Not Found	---
			740.12	0.12	---	Not Found	---
			771.76	0.12	---	Not Found	---
			807.63	0.12	---	Not Found	---
			1129.07	0.14	---	Not Found	---
			1212.72	1.63	---	Not Found	---
			1216.02	3.04	---	Not Found	---
			1228.52	1.39	---	Not Found	---
			1439.13	0.33	---	Not Found	---
			1453.60	0.13	---	Not Found	---
			1707.67	0.33	---	Not Found	---
% Abundances Found = 73.70							
RU-103	39.35D	0.40	497.08*	89.00	---	Not Found	---
			610.33	5.60	4.177E-07	21.55	Abun.
% Abundances Found = 5.92							
XE-135	9.11H	41.40	249.79*	89.90	---	Not Found	---
			600.19	2.99	1.702E+06	21.55	Decay, Abun.
% Abundances Found = 3.11							
PM-140M	41.30D	0.38	200.11	12.56	---	Not Found	---
			414.07	10.66	---	Not Found	---
			432.70	5.35	---	Not Found	---
			501.26	6.75	---	Not Found	---
			550.27*	94.90	---	Not Found	---
			599.74	12.54	---	Not Found	---
			611.26	5.48	4.213E-07	21.55	Abun.
			629.97	89.00	---	Not Found	---
			725.70	32.00	---	Not Found	---
			915.33	17.17	---	Not Found	---
			1013.01	20.30	---	Not Found	---
% Abundances Found = 1.74							
BI-214	19.90M	1137.10	609.31*	46.30	1.000E+35	21.55	Decay
			760.36	5.04	---	Not Found	---
			934.06	3.21	---	Not Found	---
			1120.29	15.10	---	Not Found	---
			1230.11	5.94	---	Not Found	---
			1377.67	4.11	---	Not Found	---
			1764.49	15.00	1.000E+35	21.02	Decay
% Abundances Found = 65.03 (Abn. Limit = 40.40%)							

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EPI EYT-537397

Page : 5  
Acquisition date : 19 JUL 2007 10:02:47

It	Energy	Area	Blind	FWHM	Channel	Left	Pa	Cts/Sec	WErr	WEff	Flags
0	511.64	147	26	2.20	1024.14	1014	21	0.17E-02	12.0	4.80E+00	T
0	550.56	84	15	1.80	1115.03	1113	12	4.64E-02	14.4	6.69E+00	T
0	609.44	53	18	1.37	1219.85	1213	14	2.96E-02	21.5	4.52E+00	T
0	1764.51	21	0	0.70	3531.00	3524	12	1.17E-02	21.8	2.26E+00	T

Flags: "T" = Tentatively associated



Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	25.	477.59	9.1973E-08
F-18	0.	511.00	Half-Life too short
NA-22	10.	1274.54	9.7962E-07
NA-24	0.	1360.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-36	0.	1042.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	6.	889.25	7.4560E-09
CR-51	32.	320.00	1.1002E-07
MN-54	12.	834.03	8.3415E-09
CO-56	16.	1238.25	1.9942E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	44.	158.30	4.5549E-08
CO-57	46.	122.06	1.0799E-08
CO-58	10.	010.76	8.5597E-09
FE-59	10.	1099.22	2.0457E-08
CO-60	8.	1332.49	9.1024E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1401.04	Half-Life too short
ZN-65	12.	1115.52	2.0314E-08
ZN-60M	0.	430.63	Half-Life too short
SE-75	37.	136.00	1.3644E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	801.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	49.	513.99	2.5330E-06
KR-85M	0.	151.10	Half-Life too short
SR-85	49.	513.99	1.2943E-08
RB-86	11.	1076.63	1.9892E-07
KR-87	0.	402.50	Half-Life too short
SR-87M	0.	300.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1302.39	Half-Life too short
Y-88	4.	1036.01	9.0900E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.00	Half-Life too short
KR-90	0.	1110.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	9.	1204.70	3.6006E-06
Y-91M	0.	555.60	Half-Life too short
CR-92	0.	1003.74	Half-Life too short
Y-92	0.	934.40	Half-Life too short

Sample ID : E1 EFT-507007

Acquisition date : 19 JUL-2007 10:22:47

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
GR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NE-94	14.	700.63	7.3636E-09
NE-95	10.	765.79	9.4160E-09
NE-95M	40.	235.69	6.6455E-07
ZR-95	0.	756.72	1.3284E-08
NE-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
NO-99	12.	739.50	2.9624E-06
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	22.	497.00	1.1074E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	16.	621.04	7.5295E-08
CD-109	39.	80.00	3.7327E-07
AG-110M	14.	937.40	2.9220E-08
SN-113	10.	391.69	1.0461E-08
SN-117M	44.	150.56	1.9393E-08
SB-122	17.	563.93	5.6050E-07
SB-124	30.	602.71	1.1477E-08
SD-125	23.	427.09	2.4244E-08
TE-125M	37.	109.20	3.9232E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	23.	57.60	2.3310E-05
XE-127	39.	202.04	1.4450E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	19.	695.00	3.4979E-07
XE-129M	50.	196.56	5.7965E-07
I-130	0.	536.09	Half-Life too short
BA-131	35.	123.00	6.7261E-08
I-131	14.	364.40	2.5417E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	44.	163.93	9.5649E-07
I-132	0.	667.69	Half-Life too short
TE-132	49.	220.16	2.6749E-07
BA-133	31.	302.04	4.0271E-08
BA-133M	43.	276.09	3.6936E-05
I-133	0.	529.07	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE+133M	305.	0.0000	3.156200E-005
CS-134	22.	604.70	0.3060E-09
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	260.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EF1 EFT-537307

Acquisition date : 19-JUL-2007 19:22:47

Nuclide	Backgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	9.	818.50	1.5938E-08
I-136	0.	1313.02	Half-Life too short
CS-137	15.	661.65	8.3949E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	38.	165.85	9.4488E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	21.	537.32	7.1309E-08
LA-140	4.	1596.49	5.2471E-06
BA-141	0.	190.22	Half-Life too short
CE-141	44.	145.44	2.2254E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	45.	132.54	7.8446E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	53.	91.10	1.3084E-07
PM-148M	17.	550.27	9.4625E-09
EU-152	27.	344.27	2.6342E-08
EU-154	8.	1804.76	4.2511E-08
EU-156	11.	646.29	1.8118E-07
HF-181	18.	482.03	1.0482E-08
TA-182	8.	1221.42	3.4538E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	39.	279.19	1.2531E-08
BI-207	16.	569.67	7.1175E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	44.	248.98	4.0981E-06
RA-226	48.	186.21	2.3035E-07
AC-228	25.	338.32	5.8945E-08
TH-228	35.	84.37	1.1846E-06
PA-234	0.	131.20	Half-Life too short
TH-234	29.	63.29	1.5901E-06
U-235	59.	143.76	8.4578E-08
NP-239	49.	106.13	4.8617E-06
AM-241	27.	59.54	1.6398E-07

**EFT-5S**

**2008**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-55 41708

Sample Location (Well Number): EFT-55

1. Representative sample collected. Date/Time 4/17/08 1030

Sample collected by: Joy Marie Slaback / Joy Marie Slaback Date: 04/21/2008  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 4/21/08  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: R. ss Bingen / [Signature] Date: 4-22-08  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KD Lindsay / KD Lindsay Date: 4-24-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-5S41708
2 . Date Sampled	04/17/2008
3 . Time Sampled	10:30
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	04/21/2008
2 . Time Sample Counted	21:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.8 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3020.9 cpm
Net Spike Count Rate (cpm)	3013.1 cpm
H3 Spike Activity (dpm on count date)	7788.2 dpm
Counter Efficiency	0.3869 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	8.1 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.3 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.20\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 uCi/ml x Sample Volume}} < \text{MDA}$$

Technician  Date 4-22-08

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-55 41708

Sample Location (Well Number): EFT-55

1. Representative sample collected. Date/Time 4/17/08 1 1030

Sample collected by: Joy Marie Slaback / Amy Marie Slaback Date: 04/21/2008  
Printed Name Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 4/21/08  
Printed Name Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: J. Southward / J. Southward Date: 4/22/08  
Fermi 2 RP Printed Name Signature

Sample number: EFT-SS41708

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: J. Southward | J. Southward | Date: 4/22/08  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: KD LINDSEY | [Signature] | Date: 4.24.08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



DETROIT EDISON FERMI-2 POWER PLANT

22-APR-2008 10:09:40.42

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-5541700

Sample End Time: 17-APR-2008 10:37:00.00

REMARKS

PERFORMED BY:

*J. Saito*  
SIGNATURE

REVIEWED BY:

*B. Rudy* 4-24-08  
SIGNATURE/DATE

Sample ID : EFT 5341700

Acquisition date : 22-APR 2008 09:55:44

Gamma 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-5341700
Sample collection start date: 17-APR-2008 10:30:00.00
Sample collection end date : 17-APR 2008 15:30:00.00
Type of sample : 1 L Marin. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : MOLL Operator: JHS

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 22-APR-2008 09:55:44.51
Presel live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:00.97 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:10:46.16
KeV/channel : 5.00190E 01 Zero offset: -1.47005E-01
Daily cal date : 22-APR-2008 06:30:50.32

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.lib
Efficiency file : EFTD4\_m211 Efficiencies at 5 Peak energy

Table with 11 columns: Pl, It, Energy, Area, Dk/gnd, FWHM, Channel, Left, Pw, Cts/Sec, XEFF, Flt. It contains 4 rows of peak data.

Sample Title : EST-5841708  
Decay Time = 4 23:27:44.84

Page # 1  
Acquisition Time = 22 APR 2008 09:59:41.0

Post-NID Peak Search Report

Id	Energy	Area	Bgnd	FWHM	Channel	Left	Pw	%Err	File	Naclide
0	198.47	35	44	4.95	397.89	394	8	21.2		<u>4.24-02</u> AL-129M
0	510.79	150	35	3.00	1021.46	1012	10	11.0		Am-241
0	559.92	43	51	3.33	1119.69	1109	24	45.7		Hu-210
0	1450.60	53	7	1.62	2909.24	2911	16	18.8		K-40

Nuclide Line Activity Report  
Sample ID : EFT-SS41708

Page : 2  
Acquisition date : 22 APR 2000 09:59:14

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.61	53	10.67*	2.582E+00	2.995E-07	2.995E-07	16.01

Nuclide Type: activation

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
XE-135M	136.56	35	4.74*	6.593E+00	1.782E-07	2.511E-07	36.02

Flag: "a" = Ke/line

Summary of Nuclide Activity

Sample ID : EFT-3341700

Acquisition date : 22-APR-2003 09:51:41

Total number of lines in spectrum 4  
 Number of unidentified lines 0  
 Number of lines tentatively identified by NED 4 100.00%

Nuclide Type : natural

Nuclide	HLife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma SErrors	Flags
K-40	1.00E+05Y	1.00	2.995E-07	2.995E-07	0.549E-07	19.01	
Total Activity :			2.995E-07	2.995E-07			

Nuclide Type : activation

Nuclide	HLife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma SErrors	Flags
XE-129M	0.090	1.48	1.702E-07	2.511E-07	0.084E-07	30.02	
Total Activity :			1.702E-07	2.511E-07			

Grand Total Activity : 4.697E-07 5.506E-07

Flags "K" = Keyline not found  
 "E" = Manually edited

"P" = Manually accepted  
 "A" = Nuclide specific atm. limit

Rejected Report  
 Sample ID : CFT-5641702

Page : 4  
 Acquisition date : 22-APR-2008 09:59:44

Radionuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/g)	1 Sigma %Error	Rejected by	
F-18	109.74M	65.47	511.00*	100.00	1.203E+12	11.93	Decay	
				% Abundances Found = 100.00				
SE-75	119.78D	0.04	66.05	1.00	---	Not Found	---	Abun.
			91.73	3.41	---	Not Found	---	
			121.12	16.70	---	Not Found	---	
			136.00*	59.20	---	Not Found	---	
			198.60	1.45	5.726E-07	36.02		
			264.65	59.00	---	Not Found	---	
			279.53	25.20	---	Not Found	---	
			300.91	1.32	---	Not Found	---	
450.65	11.40	---	Not Found	---				
				% Abundances Found = 0.01				
AS-76	26.32H	4.55	559.10*	44.70	7.181E-07	45.75	Abun.	
			563.23	1.17	---	Not Found		---
			571.30	0.14	---	Not Found		---
			657.03	6.10	---	Not Found		---
			665.31	0.30	---	Not Found		---
			740.12	0.12	---	Not Found		---
			771.76	0.12	---	Not Found		---
			807.63	0.12	---	Not Found		---
			1129.07	0.14	---	Not Found		---
			1212.72	1.63	---	Not Found		---
			1216.02	3.94	---	Not Found		---
			1280.50	1.30	---	Not Found		---
			1439.13	0.33	---	Not Found		---
1453.00	0.13	---	Not Found	---				
1707.67	0.33	---	Not Found	---				
				% Abundances Found = 73.70				
Y-92	3.54H	33.83	440.50	2.30	---	Not Found	Decay, Abun.	
			561.10	2.40	0.606E+03	45.75		
			844.30	1.25	---	Not Found		---
			934.16*	13.90	---	Not Found		---
1400.40	4.00	---	Not Found	---				
				% Abundances Found = 9.74				

Flag: "X" = Keyline

Unidentified Energy Lines  
Sample ID : CFT 5041700

Page : 5  
Acquisition date : 02 APR 2000 09:59:44

IS	Energy	Area	Skpd	FWHM	Channel	Left	Pe	Cts/Sec	SErr	NEff	Flags
0	510.79	150	35	3.00	1021.40	1012	10	8.70E-02	11.9	1.00E+00	T
0	550.92	43	51	2.53	1119.69	1109	24	2.37E-02	45.7	4.60E+00	T

Flags "T" = tentatively associated

Sample ID : EFT-EC41700

Minimum Detectable Activity Report

Huclide	Bgknd Sum	Energy (keV)	MDA (uCi/cc)
DE-7	38.	477.59	8.5928E-08
F-19	0.	511.00	Half-Life too short
NA-22	8.	1274.54	8.8509E-09
NA-24	11.	1366.53	2.8949E-08
MO-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.54	Half-Life too short
SC-46	12.	889.25	9.1120E-09
CR-51	24.	320.00	7.4657E-08
MN-54	14.	834.83	8.8353E-09
CO-56	14.	1238.25	1.7309E-08
MN-56	0.	1010.69	Half-Life too short
NI-56	26.)	150.38	1.2317E-08
CO-57	46.	122.06	1.6542E-08
CO-58	10.	810.76	7.6421E-09
FE-59	10.	1099.82	1.7133E-08
CO-60	8.	1332.49	9.6687E-09
CU-64	6.	1346.98	1.8221E-08
HI-65	0.	1481.84	Half-Life too short
ZN-65	13.	1115.52	2.0100E-08
ZN-60M	17.	430.63	2.7845E-08
GE-75	27.	130.00	1.1145E-08
AG-70	59.	559.18	6.4440E-07
BR-82	13.	776.49	9.8277E-08
BR-83	0.	529.64	Half-Life too short
BR-84	0.	681.50	Half-Life too short
BR-85	0.	982.41	Half-Life too short
KR-85	49.	513.99	2.6319E-06
KR-85M	0.	151.18	Half-Life too short
CR-85	49.	513.99	1.1550E-08
RE-86	0.	1076.63	1.1620E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	308.48	Half-Life too short
KR-88	0.	190.32	Half-Life too short
R3-90	0.	1302.39	Half-Life too short
Y-92	5.	1836.01	9.2611E-09
KR-93	0.	220.90	Half-Life too short
RB-93	0.	1031.88	Half-Life too short
KR-98	0.	1118.69	Half-Life too short
RD-98	5.	831.69	Half-Life too short
RD-98M	0.	824.23	Half-Life too short
Y-98M	0.	202.51	Half-Life too short
CR-91	0.	1024.38	Half-Life too short
Y-91	7.	1204.98	2.0918E-08
Y-91M	0.	555.68	Half-Life too short



Minimum Detectable Activity Report (continued)

Sample ID : EFT-5041708

Acquisition date : 22-APR-2008 09:59:14

Nuclide	Dkg/d Sum	Energy (keV)	MDA (uCi/cc)
SR-90	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	13.	702.63	7.1995E-09
NB-95	16.	763.79	9.2486E-09
NB-95M	40.	235.69	7.0642E-08
ZR-95	15.	756.72	1.5313E-08
NB-97	0.	657.96	Half-Life too short
ZR-97	0.	743.36	0.6133E-07
MO-99	19.	739.50	2.4440E-07
TC-99M	0.	140.56	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	23.	497.00	9.2918E-09
TC-104	0.	357.99	Half-Life too short
RH-105	31.	310.90	3.9650E-07
RU-105	0.	724.50	Half-Life too short
RU-106	22.	621.04	0.4690E-08
CD-109	31.	60.03	3.3025E-07
AO-110M	7.	907.40	2.1316E-08
SN-113	34.	391.09	1.2058E-08
SN-117M	34.	150.56	9.9094E-09
SN-122	16.	563.93	3.5411E-08
SN-124	16.	602.71	7.7176E-09
SB-125	17.	427.09	2.1300E-08
YE-125M	45.	109.20	3.7955E-06
TE-127	0.	417.00	Half-Life too short
TE-127M	24.	57.60	2.2107E-05
XE-127	42.	202.04	1.2100E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	17.	695.00	2.6331E-07
I-130	19.	538.09	6.0731E-06
BA-131	46.	123.00	4.0421E-08
I-131	32.	364.40	1.4540E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	11.	773.67	3.0311E-07
XE-131M	56.	163.93	5.7336E-07
I-132	0.	657.69	Half-Life too short
TE-132	20.	220.16	2.0360E-08
BA-133	32.	302.04	4.0369E-08
BA-133M	34.	276.09	3.3820E-07
I-133	22.	509.07	4.8244E-07
TC-133M	0.	912.50	Half-Life too short
XE-133	35.	01.00	2.2954E-08
XE-133M	40.	233.22	3.8006E-07
CO-134	22.	604.70	2.4115E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	37.	260.24	2.3776E-07
I-135	0.	1200.41	Half-Life too short
XE-135	0.	240.75	Half-Life too short
XE-135M	0.	236.56	Half-Life too short
CO-136	10.	0.00	0.000000

Minimum Detectable Activity Report (continued)

Sample ID : EFT-5041700

Acquisition date : 22-APR-2000 09:59:44

Nuclide	Background Sum	Energy (keV)	MDA (uCi/cc)
T-136	0.	1313.92	Half-Life too short
CG-137	15.	601.65	0.5134E-00
XE-137	0.	455.49	Half-Life too short
CG-139	0.	1435.86	Half-Life too short
XE-139	0.	250.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	50.	165.03	1.0033E-00
CG-139	0.	1203.33	Half-Life too short
BA-140	15.	937.30	3.4250E-00
LA-140	7.	1505.49	7.7336E-00
PA-141	0.	190.22	Half-Life too short
CE-141	43.	145.44	1.7542E-00
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	355.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	26.	293.26	1.9074E-07
CE-144	42.	133.54	7.3873E-00
PR-144	0.	1409.15	Half-Life too short
ND-147	37.	91.10	0.0067E-00
PM-140M	17.	550.37	7.9392E-09
EU-152	42.	344.27	3.2433E-00
LU-154	9.	1004.76	4.5530E-00
EU-156	18.	646.29	1.3555E-07
HF-101	22.	402.03	9.5619E-09
TA-102	5.	1021.42	2.7190E-00
W-187	15.	605.91	0.3309E-07
RE-100	37.	155.00	6.2001E-06
HO-203	56.	279.19	1.2030E-00
BI-207	17.	509.07	7.2911E-00
TL-208	0.	583.14	Half-Life too short
PB-212	0.	230.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	39.	240.90	4.9513E-07
RA-226	50.	106.21	2.4430E-07
AC-228	34.	330.32	6.0145E-00
TH-228	20.	94.37	1.0076E-00
PA-231	0.	131.20	Half-Life too short
TI-234	40.	63.29	1.3400E-00
U-235	30.	143.76	6.2220E-00
NP-239	35.	106.13	1.7630E-07
AM-241	34.	59.54	1.9251E-07

**EFT-5S**

**2009**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-53031109

Sample Location (Well Number): EFT-53

1. Representative sample collected. Date/Time 3-11-09 / 13:20

Sample collected by: Chris Ellison / [Signature] Date: 3-11-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Proffit / [Signature] Date: 4-17-09  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: D. Howard / [Signature] Date: 4-22-09  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: R. Byers / [Signature] Date: 4-22-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT-5S031109
2 . Date Sampled	03/11/2009
3 . Time Sampled	13:20
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	04/21/2009	
2 . Time Sample Counted	10:20	
3 . Background Inf.:		
Minutes Counted	10	min.
Background Count Rate (cpm)	7.5	cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)		
Gross Spike Count Rate (cpm)	2991.0	cpm
Net Spike Count Rate (cpm)	2983.5	cpm
H3 Spike Activity (dpm on count date)	7361.1	dpm
Counter Efficiency	0.4053	cpm/dpm
5 . Sample Info:		
Sample Gross Count Rate (cpm)	7.8	cpm
Sample Count Time (min.)	10.0	min.
Net Sample Count Rate (cpm)	0.3	cpm
6 . Critical Level:		
Critical Level Count Rate (cpm)	2.0	cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.12\text{E}-06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician     *am Howard*    

Date     4-21-09

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-SS031109

Sample Location (Well Number): EFT-SS

1. Representative sample collected. Date/Time 3-11-09 / 13:20

Sample collected by: Chris Ellison / [Signature] Date: 3-11-09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: [Signature] / [Signature] Date: 4-17-09  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: [Signature] / [Signature] Date: 4-21-09  
Fermi 2 RP Printed Name Signature

Sample number: EFT - 55031109

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".

(Note disposition of unidentified peaks in "Remarks")

Performed by: Charles Proffitt | Charles Proffitt Date: 4-21-09 - Performed  
Fermi 2 RP Printed Name Signature 1-3-12 Signed.

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: K.D. LINDSEY | [Signature] Date: Performed 4-22-09  
Fermi 2 Printed Name Signature Signed 1-3-12  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DETOIT EDISON FERMI-2 POWER PLANT

21-APR-2009 16:14:19.93

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-55031109

Sample End Time: 11-MAR-2009 13:20:00.00

REMARKS

PERFORMED BY:

*Charles Ruppel*  
SIGNATURE

REVIEWED BY:

*R. H. Hulsey* 4.22.09  
SIGNATURE/DATE



Sample ID : EFT-55031109

Acquisition date : 21-APR-2009 15:44:17

```

*****
Fermi 2 Radiation Protection Gamma Spectroscopy Report
*****

```

```

***** Sample Parameters *****

```

```

Sample ID Number: EFT-55031109
Sample collection start date: 11-MAR-2009 13:20:00.00
Sample collection end date : 11-MAR-2009 13:20:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : PELL Operator: CLP

```

```

***** Acquisition Parameters *****

```

```

Detector number : DET 4 Acquire date : 21-APR-2009 15:44:17.69
Presew live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:00.06 Percent dead time : 0.05 %

```

```

***** Calibration Parameters *****

```

```

Detector number : DET 4 Yearly cal date : 20-JUN-2008 12:00:00.00
Key/channel : 4.99002E-01 Zero offset: 7.45979E-02
Daily cal date : 21-APR-2009 06:54:02.66

```

```

***** Peak Search Parameters *****

```

```

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

```

```

***** Nuclide Identification Parameters *****

```

```

Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4_m211 Efficiencies at : Peak energy

```

```

*****

```

PK	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	XErr	Fit
1	1	510.27	48	34	2.05	1020.63	1013	27	2.67E-02	31.1	1.14E+00
2	1	511.65	47	29	1.99	1023.37	1013	27	2.62E-02	32.3	
3	0	1460.96	51	0	1.63	2922.25	2913	15	2.01E-02	10.4	

```


```

Sample Title : EFT-55031109  
Decay Time = 41 02:24:17.69

Page : 1  
Acquisition Time = 21-APR-2009 15:44:17.6

9

Post-NID Peak Search Report

Id	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
1	510.27	48	34	2.05	1020.63	1013	27	31.1	1.14E+00	<i>7 Ann. Peak</i>
1	511.65	47	29	1.99	1023.37	1013	27	32.3		
0	1460.90	51	8	1.63	2922.25	2913	15	10.4		K-40

Nuclide Line Activity Report  
Sample ID : EFT-56051109

Page # 2  
Acquisition date : 21-APR-2009 15:44:17

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.01	51	10.67*	2.561E+00	2.841E-07	2.841E-07	10.30

Flag: "\*" = Keyline

Summary of Nuclide Activity

Sample ID : EFT-58031109

Acquisition date : 21-APR-2009 15:44:17

Total number of lines in spectrum 3  
 Number of unidentified lines 1  
 Number of lines tentatively identified by NID 2 66.67%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma Error	Flags
K-40	1.00E+05Y	1.00	2.841E-07	2.841E-07	0.522E-07	18.30	
Total Activity :			2.841E-07	2.841E-07			

Grand Total Activity : 2.841E-07 2.841E-07

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Rejected Report

Page : 4

Sample ID : EFT-55831109

Acquisition date : 21-APR-2009 15:44:17

Nuclide	Half-life	Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	539.45	511.00	*193.46	1.000E+35	32.32	Decay

% Abundances Found = 100.00

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EFT-55031109

Page : 5  
Acquisition date : 21-APR-2009 15:40:17

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
1	510.27	48	34	2.05	1020.63	1013	27	2.67E-02	31.1	4.00E+00	
1	511.65	47	29	1.99	1023.37	1013	27	2.62E-02	32.3	4.00E+00	T

Flags: "T" = Tentatively associated

\* Detroit Edison Fermi 2 MDA Report, Generated 21-APR-2009 16:14:23.82 \*  
 \* Sample ID : EFT-55031109 \*

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	24.	477.59	1.2559E-07
F-18	0.	511.00	Half-Life too short
NA-22	6.	1274.54	7.9452E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	<	1293.64	Half-Life too short
SC-46	16.	889.25	1.3800E-08
CR-51	31.	320.00	2.0565E-07
MN-54	16.	834.03	1.0110E-08
CU-56	7.	1230.25	1.7019E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	31.	150.30	6.9005E-07
CO-57	36.	122.06	1.0346E-08
CO-58	16.	810.76	1.3506E-08
FE-59	9.	1099.22	2.9266E-08
CO-60	9.	1332.49	9.5254E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.04	Half-Life too short
ZN-65	11.	1115.52	2.0525E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	41.	136.00	1.6549E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	801.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	35.	513.99	2.1701E-06
KR-85M	0.	151.10	Half-Life too short
SR-85	35.	513.99	1.4402E-08
RB-86	9.	1076.63	4.2427E-07
KR-87	0.	402.50	Half-Life too short
SR-87M	0.	300.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	4.	1936.01	0 1.0732E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.00	Half-Life too short
KR-90	0.	1110.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	924.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	9.	1204.90	4.9449E-06

SR-92	0.	1313.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Minimum Detectable Activity Report (continued)

Sample ID : EFT-55031109

Acquisition date : 21 APR 2009 15:44:17

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NE-94	10.	702.63	6.4335E-09
NE-95	9.	765.79	1.4501E-08
NE-95M	0.	235.69	Half-Life too short
ZR-95	11.	756.72	2.0104E-08
NE-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.50	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	15.	497.08	1.4657E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	10.	621.04	0.3406E-08
CD-109	33.	80.03	3.6019E-07
AG-110M	13.	937.40	2.9059E-08
SN-113	25.	391.69	1.3909E-08
SN-117M	33.	150.56	6.2500E-08
SB-122	0.	563.93	Half-Life too short
SB-124	24.	602.71	1.3065E-08
SB-125	21.	427.09	2.3724E-08
TE-125M	37.	109.20	5.3110E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	24.	57.60	2.7070E-05
XE-127	20.	202.04	1.9944E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	14.	695.00	5.0076E-07
XE-129M	42.	196.56	3.0605E-06
I-130	0.	536.09	Half-Life too short
BA-131	32.	123.00	2.0531E-07
I-131	29.	364.40	3.1317E-07
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	20.	163.93	3.4712E-06
I-132	0.	667.69	Half-Life too short
TE-132	0.	220.16	Half-Life too short
BA-133	26.	302.04	3.7111E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.07	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	20.	01.00	0.0044E-06
XE-133M	0.	233.22	Half-Life too short
CS-134	24.	604.70	9.0036E-09
I-134	0.	004.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	200.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short



## Minimum Detectable Activity Report (continued)

Page : 3

Sample ID : EFT-53031109

Acquisition date : 21-APR-2009 15:44:17


Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	0.	818.50	5.8315E-08
I-136	0.	1313.02	Half-Life too short
CS-137	23.	661.65	1.0150E-08
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	31.	165.85	9.7755E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	19.	537.32	2.6904E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	42.	145.44	3.7602E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	39.	133.54	7.8301E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	21.	91.10	4.5579E-07
PM-148M	12.	550.27	1.2671E-08
EU-152	19.	344.27	2.3033E-08
EU-154	3.	1004.76	3.0844E-08
EU-155	31.	105.31	4.3600E-08
EU-156	13.	646.29	6.1295E-07
NF-181	11.	482.03	1.2734E-08
TA-182	9.	1221.42	4.2062E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HC-203	36.	279.19	1.7730E-08
BI-207	10.	569.67	7.5008E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	4 0.	240.90	Half-Life too short
RA-226	30.	156.21	1.9289E-07
AC-228	23.	338.32	5.7521E-08
TH-228	30.	84.37	1.1424E-06
PA-234	0.	131.20	Half-Life too short
TH-234	34.	63.29	3.5420E-06
U-235	51.	143.76	7.9370E-08
NP-239	0.	106.13	Half-Life too short
AM-241	30.	59.54	1.7356E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT 55 9909

Sample Location (Well Number): 55

1. Representative sample collected. Date/Time 9/9/09 1 11/0

Sample collected by: Brian Tardine /  Date: 9/2/09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

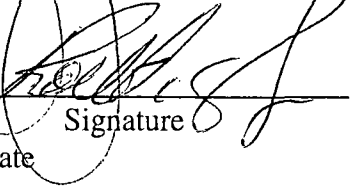
2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 9/21/09  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: John A. G... .. /  Date: 9-21-09  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert G. ... .. /  Date: 10-13-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT5S9909
2 . Date Sampled	09/09/2009
3 . Time Sampled	11:10
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

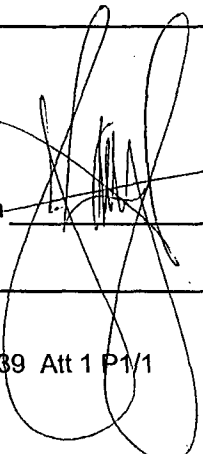
1 . Date Sample Counted	09/21/2009
2 . Time Sample Counted	14:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.7 cpm
4 . Efficiency Inf.: (Daily Spike Source ID #111)	
Gross Spike Count Rate (cpm)	2763.5 cpm
Net Spike Count Rate (cpm)	2755.8 cpm
H3 Spike Activity (dpm on count date)	7189.1 dpm
Counter Efficiency	0.3833 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	7.0 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.20\text{E}-06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 9-21-09

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT 55 9 909

Sample Location (Well Number): 55

1. Representative sample collected. Date/Time 9/9/09 1 0400 1110  
9/9/09

Sample collected by: Brian Jordan / [Signature] Date: 9/9/09  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward / [Signature] Date: 9/24/09  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Southward / [Signature] Date: 10/12/09  
Fermi 2 RP Printed Name Signature

Sample number: EFT 559909

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".

(Note disposition of unidentified peaks in "Remarks")

Performed by: Southward, S. Southward Date: 10/27/09  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert King Date: 10-29-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT5S9909

Sample End Time: 9-SEP-2009 11:10:00.00

REMARKS

PERFORMED BY:

*Southwood*

SIGNATURE

REVIEWED BY:

*Polite*

SIGNATURE / DATE

Sample ID : EFT589909

Acquisition date : 22-OCT-2009 14:51:35

## Fermi 2 Radiation Protection Gamma Spectroscopy Report

## \*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT589909  
 Sample collection start date: 9-SEP-2009 11:10:00.00  
 Sample collection end date : 9-SEP-2009 11:10:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : NELL Operator: JNS

## \*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 22-OCT-2009 14:51:35.73  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:00.96 Percent dead time : 0.05 %

## \*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 3-JUN-2009 17:37:00.00  
 Kev/channel : 5.00117E-01 Zero offset: 6.04069E-02  
 Daily cal date : 22-OCT-2009 13:44:49.65

## \*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

## \*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	5	510.83	80	25	2.07	1021.30	1014	16	4.46E-02	10.4	4.29E+00
2	5	512.68	43	29	1.92	1025.00	1014	16	2.39E-02	30.0	

Sample Title : EFT589909  
Decay Time = 43 03:41:35.73

Page : 1  
Acquisition Time = 22-OCT-2009 14:51:35.7

3

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
5	510.03	80	25	2.07	1021.30	1014	16	10.4	4.29E+00	
5	512.68	43	29	1.92	1025.00	1014	16	30.9		SR-85 KR-85

> ANN



Nuclide Type: fission gas

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
KR-05	513.99	43	0.43*	4.872E+00	3.078E-06	3.102E-06	30.82

ø

Nuclide Type: activation

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
SR-05	513.99	43	99.27*	4.872E+00	1.333E-08	2.115E-08	30.82

Flags "\*" = Keyline

Summary of Nuclide Activity

Sample ID : EFT539909

Acquisition date : 22-OCT-2009 14:51:35

Total number of lines in spectrum 2  
 Number of unidentified lines 0  
 Number of lines tentatively identified by NID 2 100.00%

Nuclide Type : fission gas

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
KR-05	10.72Y	1.01	3.070E-06	3.102E-06	0.956E-06	30.82	
Total Activity :			3.070E-06	3.102E-06			

Nuclide Type : activation

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
SR-05	64.84D	1.59	1.333E-00	2.115E-00	0.652E-00	30.82	0
0							
Total Activity :			1.333E-00	2.115E-00			

Grand Total Activity : 3.091E-06 3.123E-06

Flags: "K" = Keyline not found  
 "E" = Manually edited

"M" = Manually accepted  
 "A" = Nuclide specific abn. limit

Rejected Report  
Sample ID : EFT5S9909

Page : 4  
Acquisition date : 22-OCT-2009 14:51:35

Nuclide	Half-life	Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	566.40	511.00	*193.46	1.000E+35	18.44	Decay

% Abundances Found = 100.00

Flag: "\*" = Keyline

Unidentified Energy Lines

Sample ID : EFT589909

Acquisition date : 22-OCT-2009 14:51:35

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
5	510.83	80	25	2.07	1021.30	1014	16	4.46E-02	18.4	4.88E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	32.	477.59	1.4499E-07
F-18	0.	511.00	Half-Life too short
NA-22	8.	1274.54	9.2133E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	642.42	Half-Life too short
K-40	49.	1460.81	1.9902E-07
AR-41	0.	1293.64	Half-Life too short
SC-46	15.	889.25	1.3587E-08
CR-51	22.	320.08	1.8702E-07
MN-54	13.	834.83	9.2001E-09
CO-56	16.	1238.25	2.5268E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	37.	158.38	9.4967E-07
CO-57	27.	122.06	9.1298E-09
CO-58	10.	810.76	1.1151E-08
FE-59	14.	1099.22	3.5795E-08
CO-60	3.	1332.49	6.1753E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	14.	1115.52	2.2966E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	32.	136.00	1.5061E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85M	0.	151.18	Half-Life too short
RB-86	17.	1076.63	6.2825E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	6.	1836.01	1.2992E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	5.	1204.90	3.9998E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short
SR-93	0.	590.28	Half-Life too short

Sample ID : EFT5S9909

Acquisition date : 22-OCT-2009 14:51:35

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
Y-93	0.	266.90	Half-Life too short
NB-94	13.	702.63	7.1758E-09
NB-95	16.	765.79	1.9784E-08
NB-95M	0.	235.69	Half-Life too short
ZR-95	10.	756.72	1.9419E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	14.	497.08	1.4803E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	15.	621.84	7.5851E-08
CD-109	31.	88.03	3.4889E-07
AG-110M	11.	937.48	2.7949E-08
SN-113	26.	391.69	1.4416E-08
SN-117M	36.	158.56	7.1971E-08
SB-122	0.	563.93	Half-Life too short
SB-124	20.	602.71	1.2948E-08
SB-125	19.	427.89	2.2984E-08
TE-125M	33.	109.28	5.2000E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	22.	57.60	2.7013E-05
XE-127	28.	202.84	2.0936E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	14.	695.88	5.4269E-07
XE-129M	45.	196.56	4.6937E-06
I-130	0.	536.09	Half-Life too short
BA-131	31.	123.80	3.1922E-07
I-131	15.	364.48	2.8109E-07
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	29.	163.93	3.9746E-06
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	27.	302.84	3.8145E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.588	Half-Life too short
XE-133	32.	81.00	1.2491E-05
KE-133M	0.	233.22	Half-Life too short
CS-134	26.	604.70	9.3531E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
KE-135	0.	249.79	Half-Life too short
KE-135M	0.	526.56	Half-Life too short
CS-136	13.	918.50	8.0107E-08

Sample ID : EFT5S9909

Acquisition date : 22-OCT-2009 14:51:35

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
I-136	0.	1313.02	Half-Life too short
CS-137	13.	661.65	7.8685E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	35.	165.85	1.0483E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	18.	537.32	2.9582E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	33.	145.44	3.5104E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	33.	133.54	7.2763E-08
FR-144	?	1489.15	Half-Life too short
ND-147	33.	91.10	6.3869E-07
FM-148M	12.	550.27	1.3192E-08
EU-152	21.	344.27	2.3704E-08
EU-154	7.	1004.76	4.0730E-08
EU-155	26.	105.31	4.0235E-08
EU-156	10.	646.29	7.6686E-07
HF-181	14.	482.03	1.4807E-08
TA-182	12.	1221.42	4.9273E-08
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	27.	279.19	01.5932E-08
BI-207	19.	569.67	7.6396E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life?too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	45.	186.21	2.3104E-07
AC-228	39.	338.32	7.2980E-08
TH-228	36.	84.37	1.2449E-06
PA-234	0.	131.20	Half-Life too short
TH-234	22.	63.29	3.0907E-06
U-235	32.	143.76	6.4199E-08
NP-239	0.	106.13	Half-Life too short
AM-241	26.	59.54	1.6208E-07

**EFT-5S**

**2010**



## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EF1-52410-55

Sample Location (Well Number): 55

1. Representative sample collected. Date/Time 5/24/10 1 1540

Sample collected by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Jam M. Forcum / [Signature] Date: 6-25-10  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert Craig / [Signature] Date: 6-30-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EF1-52410-5S
2 . Date Sampled	05/24/2010
3 . Time Sampled	15:40
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	06/24/2010	
2 . Time Sample Counted	14:10	
3 . Background Inf.:		
Minutes Counted	10	min.
Background Count Rate (cpm)	6.7	cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)		
Gross Spike Count Rate (cpm)	2671.8	cpm
Net Spike Count Rate (cpm)	2665.1	cpm
H3 Spike Activity (dpm on count date)	6889.0	dpm
Counter Efficiency	0.3869	cpm/dpm
5 . Sample Info:		
Sample Gross Count Rate (cpm)	6.7	cpm
Sample Count Time (min.)	10.0	min.
Net Sample Count Rate (cpm)	0.0	cpm
6 . Critical Level:		
Critical Level Count Rate (cpm)	1.9	cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.11\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician 

Date 5-26-10

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EF1-52410-5S

Sample Location (Well Number): 5S

1. Representative sample collected. Date/Time 5/24/10 1 1540

Sample collected by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: Southward / Southward Date: 6/23/10  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: Charles Proffitt / Charles Proffitt Date: 9-13-10  
Fermi 2 RP. Printed Name / Signature

Sample number: EF1-52410-55

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Charles Proffitt / Charles Druffert Date: 9-13-10  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate:

Performed by: Robert C. Gray SR Date: 10-5-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1-52410-5S

Sample End Time: 24-MAY-2010 15:40:00.00

REMARKS

PERFORMED BY:

*Charles Ruffin*

SIGNATURE

REVIEWED BY:

*[Signature]*

SIGNATURE/DATE

Sample ID : EF1-52410-55

Acquisition date : 13-SEP-2010 12:07:17

```

*****
Fermi 2 Radiation Protection Gamma Spectroscopy Report

```

```

***** Sample Parameters *****

```

```

Sample ID Number: EF1-52410-55
Sample collection start date: 24-MAY-2010 15:40:00.00
Sample collection end date : 24-MAY-2010 15:40:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : M2LL Operator: CLP

```

```

***** Acquisition Parameters *****

```

```

Detector number : DET 4 Acquire date : 13-SEP-2010 12:07:17.00
Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00
Elapsed real time : 0 00:45:00.88 Percent dead time : 0.03 %

```

```

***** Calibration Parameters *****

```

```

Detector number : DET 4 Yearly cal date : 23-JUN-2010 12:28:00.00
Kev/channel : 5.00035E-01 Zero offset: 1.90339E-01
Daily cal date : 13-SEP-2010 10:15:31.59

```

```

***** Peak Search Parameters *****

```

```

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

```

```

***** Nuclide Identification Parameters *****

```

```

Energy tolerance : 1.75000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4_m2ll Efficiencies at : Peak energy

```

```

*****

```

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	XErr	Fit
1	0	139.54	70	111	1.25	270.67	273	13	2.50E-02	33.4	
2	0	352.11	49	51	0.94	703.79	700	9	1.82E-02	29.6	
3	0	511.53	239	69	2.65	1022.61	1015	22	0.06E-02	10.0	
4	0	558.46	89	45	1.14	1116.48	1109	14	3.20E-02	19.3	
5	0	609.96	65	77	1.71	1219.46	1211	19	2.39E-02	34.7	
6	0	1460.96	93	0	2.44	2921.42	2913	10	3.44E-02	12.0	

Sample Title : EF1-52410-55  
Decay Time = 111 20:27:17.00

Page : 1  
Acquisition Time = 13-SEP-2010 12:07:17.0

Post-MID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	139.54	70	111	1.25	278.67	273	13	33.4	— HWC	
0	352.11	49	51	0.94	703.79	700	9	29.6	— LOFWHM	
0	511.53	239	69	2.65	1022.61	1015	22	10.0	— ANN,	
0	558.46	89	45	1.14	1116.48	1109	14	19.3	— HWC	
0	609.96	65	77	1.71	1219.46	1211	19	34.7	— Bi-214	
0	1460.96	93	0	2.44	2921.42	2913	18	12.8		K-40

Nuclide Line Activity Report  
Sample ID : EF1-52410-55

Page : 2  
Acquisition date : 13-SEP-2010 12:07:17

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	93	10.67*	2.501E+00	3.485E-07	3.485E-07	12.80

Flag: "\*" = Keyline



Summary of Nuclide Activity  
Sample ID : EF1-52410-5S

Page : 3  
Acquisition date : 13-SEP-2010 12:07:17

Total number of lines in spectrum 6  
Number of unidentified lines 0  
Number of lines tentatively identified by MID 6 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	3.485E-07	3.485E-07	0.446E-07	12.80	
Total Activity :			3.485E-07	3.485E-07			

Grand Total Activity : 3.485E-07 3.485E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	1467.92	511.00*	193.46	1.000E+35	10.83	Decay
% Abundances Found = 100.00							
AS-76	26.32H	102.01	559.10*	44.70	2.156E+23	19.34	Decay, Abun.
			563.23	1.17	----	Not Found	----
			571.30	0.14	----	Not Found	----
			657.03	6.10	----	Not Found	----
			665.31	0.39	----	Not Found	----
			740.12	0.12	----	Not Found	----
			771.76	0.12	----	Not Found	----
			867.63	0.12	----	Not Found	----
			1129.87	0.14	----	Not Found	----
			1212.72	1.63	----	Not Found	----
			1216.02	3.84	----	Not Found	----
			1228.52	1.39	----	Not Found	----
			1439.13	0.33	----	Not Found	----
			1453.60	0.13	----	Not Found	----
			1787.67	0.33	----	Not Found	----
% Abundances Found = 73.70							
MO-99	66.02H	40.67	140.51	3.80	5.007E+05	33.42	Decay, Abun.
			181.06	6.20	----	Not Found	----
			366.43	1.37	----	Not Found	----
			739.58*	12.80	----	Not Found	----
			778.00	4.50	----	Not Found	----
% Abundances Found = 13.25							
TC-99M	6.02H	445.99	140.50*	89.07	1.000E+35	33.42	Decay
% Abundances Found = 100.00							
RU-103	39.35D	2.84	497.08*	89.00	----	Not Found	Abun.
			610.33	5.60	1.835E-06	34.70	
% Abundances Found = 5.92							
CS-138	32.20M	5002.79	138.10	1.49	1.000E+35	33.42	Decay, Abun.
			227.76	1.51	----	Not Found	----
			408.98	4.66	----	Not Found	----
			462.79	30.70	----	Not Found	----
			546.94	10.80	----	Not Found	----
			871.80	5.11	----	Not Found	----
			1009.78	29.80	----	Not Found	----
			1147.22	1.24	----	Not Found	----
			1343.59	1.14	----	Not Found	----
			1435.06*	76.30	----	Not Found	----
% Abundances Found = 0.92							
PM-148M	41.30D	2.71	288.11	12.56	----	Not Found	Abun.
			414.07	18.66	----	Not Found	----
			432.78	5.35	----	Not Found	----
			501.26	6.75	----	Not Found	----
			550.27*	94.90	----	Not Found	----
			599.74	12.54	----	Not Found	----

Sample ID : EF1-52410-5S

Acquisition date : 13-SEP-2010 12:07:17

Nuclide	Half-life	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
		Ratio				(uCi/cc)	%Error	
PM-148M	41.30D	2.71		611.26	5.48	1.709E-06	34.70	Abun.
				629.97	89.00	----	Not Found	----
				725.70	32.80	----	Not Found	----
				915.33	17.17	----	Not Found	----
				1013.81	20.30	----	Not Found	----
% Abundances Found =					1.74			
BI-214	19.90M	8094.96		609.31*	46.30	1.000E+35	34.70	Decay
				768.36	5.04	----	Not Found	----
				934.06	3.21	----	Not Found	----
				1120.29	15.10	----	Not Found	----
				1238.11	5.94	----	Not Found	----
				1377.67	4.11	----	Not Found	----
	1764.49	15.80	----	Not Found	----			
% Abundances Found =					48.48	(Abn. Limit =	48.48%)	
PE-214	26.80M	6010.81		87.30	4.67	----	Not Found	Decay
				241.98	7.49	----	Not Found	----
				295.21	19.20	----	Not Found	----
				351.92*	37.20	1.000E+35	29.63	
				785.91	1.10	----	Not Found	----
% Abundances Found =					53.40	(Abn. Limit =	37.20%)	

Flag: "\*" = Keyline

## Unidentified Energy Lines

Page : 6

Sample ID : EF1-52410-5S

Acquisition date : 13-SEP-2010 12:07:17

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	139.54	70	111	1.25	278.67	273	13	2.50E-02	33.4	6.39E+00	T
0	352.11	49	51	0.94	703.79	700	9	1.82E-02	29.6	5.70E+00	T
0	511.53	239	69	2.65	1022.61	1015	22	8.86E-02	10.8	4.88E+00	T
0	558.46	89	45	1.14	1116.48	1109	14	3.28E-02	19.3	4.69E+00	T
0	609.96	65	77	1.71	1219.46	1211	19	2.39E-02	34.7	4.52E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	31.	477.59	2.3313E-07
F-18	0.	511.00	Half-Life too short
NA-22	7.	1274.54	6.0230E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	17.	889.25	1.6981E-08
CR-51	60.	320.08	1.0948E-06
MN-54	17.	834.83	7.9580E-09
CO-56	18.	1238.25	3.2632E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	0.	158.38	Half-Life too short
CO-57	69.	122.06	1.1105E-08
CO-58	15.	810.76	1.7531E-08
FE-59	16.	1099.22	7.3402E-08
CO-60	24.	1332.49	1.0043E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	16.	1115.52	1.9958E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	55.	136.00	1.9129E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	89.	513.99	2.2680E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	89.	513.99	3.1847E-08
RB-86	14.	1076.63	4.8920E-06
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	7.	1836.01	1.4177E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.00	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	13.	1204.90	8.8092E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page : 2

Sample ID : EF1-52410-53

Acquisition date : 13-SEP-2010 12:07:17

Nuclide	Backgd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	22.	702.63	5.9896E-09
NB-95	14.	765.79	4.9049E-08
NB-95M	0.	235.69	Half-Life too short
ZR-95	10.	756.72	3.5563E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.50	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	41.	497.00	5.3226E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	23.	621.04	7.0575E-08
CD-109	60.	88.03	3.5009E-07
AG-110M	16.	937.48	2.6674E-08
SN-113	31.	391.69	1.5674E-08
SN-117M	60.	158.56	2.0155E-06
SB-122	0.	563.93	Half-Life too short
SB-124	25.	602.71	2.1212E-08
SB-125	46.	427.09	2.3745E-08
TE-125M	59.	109.20	1.0237E-05
TE-127	0.	417.90	Half-Life too short
TE-127M	41.	57.60	3.7336E-05
XE-127	40.	202.04	6.5700E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	20.	695.00	2.0175E-06
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	60.	123.00	1.7293E-05
I-131	0.	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	73.	163.93	2.2546E-04
I-132	0.	667.69	Half-Life too short
TE-132	0.	220.16	Half-Life too short
BA-133	50.	302.04	3.3870E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.07	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	26.	604.70	6.6475E-09
I-134	0.	004.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	260.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EF1-52410-59

Acquisition date : 13-SEP-2010 12:07:17

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	21.	818.50	2.4701E-06
I-136	0.	1313.02	Half-Life too short
CS-137	20.	661.65	7.4144E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	70.	165.05	1.3593E-08
CS-139	0.	1203.23	Half-Life too short
BA-140	26.	537.32	9.5462E-06
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	69.	145.44	1.4311E-07
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	60.	133.54	8.0163E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PM-148M	30.	550.27	4.1075E-08
EU-152	30.	344.27	1.8801E-08
EU-154	19.	1004.76	4.2730E-08
EU-155	40.	105.31	3.6349E-08
EU-156	17.	646.29	1.1433E-05
HF-181	33.	482.03	4.4096E-08
TA-182	10.	1221.42	4.5740E-08
W-187	0.	685.01	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	60.	279.19	4.5290E-08
BI-207	30.	569.67	6.9224E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
RA-226	74.	186.21	1.9534E-07
AC-228	52.	338.32	5.7196E-08
TH-228	47.	84.37	1.0024E-06
PA-234	0.	131.20	Half-Life too short
TH-234	55.	63.29	2.2432E-05
U-235	65.	143.76	5.9182E-08
NP-239	0.	106.13	Half-Life too short
AM-241	52.	59.54	1.4764E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-102710-55

Sample Location (Well Number): 55

1. Representative sample collected. Date/Time 11-11-10 11:45

Sample collected by: Proffitt / [Signature] Date: 11-11-10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Proffitt / [Signature] Date: 11-11-10  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: P. D. Dyea / [Signature] Date: 11-12-10  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray JR / [Signature] Date: 11-15-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_



Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EPT EPT-102710-5S
2 . Date Sampled	11/11/2010
3 . Time Sampled	11:45
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

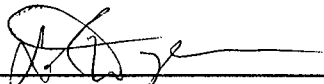
1 . Date Sample Counted	11/11/2010
2 . Time Sample Counted	22:08
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.2 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2546.6 cpm
Net Spike Count Rate (cpm)	2539.4 cpm
H3 Spike Activity (dpm on count date)	6741.6 dpm
Counter Efficiency	0.3767 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	7.0 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.0 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

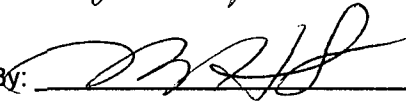
**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.18\text{E-}06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician  Date 11-12-10

Reviewed By:  Date 11/15/10

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-102710-5b

Sample Location (Well Number): 5/S

1. Representative sample collected. Date/Time 10/27/10 1 15:50

Sample collected by: Thomas Now 1 Tom Date: 11/4/10  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: C Proffitt 1 J Proffitt Date: 11-30-10  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: C Proffitt 1 J Proffitt Date: 11-30-10  
Fermi 2 RP Printed Name Signature

Sample number: EPT-102710-5/5

- 4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: C. Proffo 1. C. Proffo Date: 11-30-10  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

- 5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Heggen [Signature] Date: 12-27-10  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-102710-5/3

Sample End Time: 11-NOV-2010 11:45:09.00

REMARKS

PERFORMED BY:

*Charles Pappas*  
SIGNATURE

REVIEWED BY:

*[Signature]*  
SIGNATURE/DATE

Sample ID : EFT 102710-S-3

Acquisition date : 9-DEC-2010 15:22:12

Fernald 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number : EFT 102710-S-3
Sample collection start date : 11-NOV-2010 11:45:00.00
Sample collection end date : 11-NOV-2010 11:45:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.000000E+03 cc
Sample geometry : MELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 9-DEC-2010 15:22:10.85
Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00
Elapsed real time : 0 00:45:00.57 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 23-JUN-2010 12:28:00.00
Kev/channel : 5.00192E-01 Zero offset: 9.56468E-02
Daily cal date : 9-DEC-2010 10:08:55.12

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000
Abundance limit : 25.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

Table with 11 columns: Pk, It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. Contains 4 rows of peak data.

Sample Title : EFT 102710-S/O  
Decay Time : 00 00:27:10.05

Page : 1  
Acquisition Time : 9-DEC 2010 10:22:10.00

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	352.57	47	44	1.36	704.69	698	12	32.0	—————	Pb-214
0	511.46	141	58	2.34	1022.36	1015	16	14.8	—————	Ann Peak.
0	609.48	55	28	1.35	1218.33	1213	11	23.4	—————	Bi-214
0	1461.18	03	4	2.06	2921.82	2912	19	12.7		K-40

*f 12-27-10*  
*S*

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	83	10.67*	2.501E+00	3.090E-07	3.090E-07	12.67

Flags "R" = Rayline

Total number of lines in spectrum : 4  
Number of unidentified lines : 0  
Number of lines tentatively identified by NID : 4 100.00%

Nuclide Type : natural

Nuclide	HLife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma XError	Flags
K-40	1.00E+05Y	1.00	3.098E-07	3.098E-07	0.393E-07	12.67	
Total Activity :			3.098E-07	3.098E-07			

Grand Total Activity : 3.098E-07 3.098E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit



Sample ID : EFT-122710-5/3

Acquisition date : 9-DEC-2010 15:22:10

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	360.60	511.00*	100.00	1.000E+35	14.91	Decay
		% Abundances	Found =	100.00			
RU-103	39.35D	0.72	497.00*	89.00	---	Not Found	---
		% Abundances	Found =	5.92	3.460E-07	23.45	Abun.
XE-135	9.11H	74.20	249.79*	89.96	---	Not Found	---
		% Abundances	Found =	3.11	8.900E+15	23.45	Decay, Abun.
BI-214	19.90M	2038.18	609.31*	46.30	1.000E+35	23.45	Decay
			768.36	5.04	---	Not Found	---
			934.06	3.21	---	Not Found	---
			1120.29	15.10	---	Not Found	---
			1238.11	5.94	---	Not Found	---
			1377.67	4.11	---	Not Found	---
			1764.49	15.80	---	Not Found	---
		% Abundances	Found =	48.46		(Abn. Limit = 40.48%)	
PB-214	26.80M	1513.43	87.30	4.67	---	Not Found	---
			241.98	7.49	---	Not Found	---
			295.21	19.20	---	Not Found	---
			351.92*	37.20	1.000E+35	31.07	
			765.91	1.10	---	Not Found	---
		% Abundances	Found =	53.40		(Abn. Limit = 37.20%)	

Flag: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EFT-102710-5.0

Page : 5  
Acquisition date : 9-DEC-2010 15:02:10

IL	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	352.57	47	44	1.30	704.60	600	12	1.74E-02	32.0	5.70E+00	T
0	511.46	141	53	2.34	1022.36	1015	16	5.24E-02	14.0	4.88E+00	T
0	609.48	53	28	1.35	1210.33	1210	11	1.98E-02	23.4	4.52E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Eckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	21.	477.59	6.6022E-08
F-18	0.	511.00	Half-Life too short
NA-22	13.	1274.54	7.2582E-09
NA-24	0.	1328.50	Half-Life too short
NO-27	0.	1914.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	17.	895.25	8.4623E-07
CR-51	40.	320.88	1.1180E-07
MN-54	26.	834.83	8.0537E-09
CO-56	29.	1238.25	1.9310E-08
MN-56	0.	1816.69	Half-Life too short
NI-58	45.	158.38	1.2679E-07
CO-57	52.	122.06	7.8845E-09
CO-58	15.	810.76	7.6365E-09
FE-59	14.	1099.22	1.8899E-08
CO-60	10.	1332.49	6.7473E-09
CU-64	0.	1345.00	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	15.	1115.52	1.5320E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	37.	136.00	9.8834E-09
AS-76	0.	559.18	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	801.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	56.	513.99	1.7996E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	56.	513.99	1.0402E-08
RB-86	29.	1070.63	2.5677E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	283.40	Half-Life too short
KR-88	0.	190.32	Half-Life too short
RB-88	0.	1392.39	Half-Life too short
Y-88	7.	1836.01	8.2222E-09
KR-89	0.	220.90	Half-Life too short
RE-89	0.	1031.98	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RD-90	0.	831.69	Half-Life too short
RD-90M	0.	824.23	Half-Life too short
Y-90M	6.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	14.	1204.90	3.3057E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	3.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Nuclide	Backgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	17.	702.63	5.3483E-09
NB-95	17.	765.79	1.0175E-08
NB-95M	38.	235.69	4.4191E-06
ZR-95	19.	756.72	1.4759E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	148.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	25.	497.08	9.7549E-09
TC-104	0.	357.99	Half-Life too short
FM-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	26.	621.84	6.3069E-08
CD-109	37.	88.03	2.4600E-07
NO-110M	15.	957.48	2.0372E-08
SM-113	29.	391.69	9.2019E-09
SM-117M	46.	158.56	2.5024E-06
SB-122	0.	563.93	Half-Life too short
SB-124	27.	602.71	8.3756E-09
SB-125	33.	427.89	1.9297E-08
TE-125M	44.	109.28	3.2994E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	38.	57.60	2.1044E-05
XE-127	48.	202.84	1.3394E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	24.	695.88	3.3305E-07
XE-129M	49.	196.56	1.0073E-06
I-130	0.	536.09	Half-Life too short
BA-131	54.	123.00	1.1329E-07
I-131	35.	364.48	7.5110E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	45.	163.93	1.3481E-06
I-132	0.	667.69	Half-Life too short
TE-132	50.	228.16	2.5474E-06
BA-133	31.	302.84	2.6892E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	312.58	Half-Life too short
XE-133	29.	81.00	1.0091E-06
XE-133M	0.	233.22	Half-Life too short
CS-134	34.	604.79	6.9004E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	368.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT-100710 5/3

Acquisition date : 9-DEC-2010 15:22:10

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	12.	818.50	2.3175E-08
I-136	3.	1313.02	Half-Life too short
CC-137	22.	661.65	6.6547E-09
XE-137	0.	455.49	Half-Life too short
CC-138	0.	1435.06	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.58	Half-Life too short
CE-139	44.	165.85	7.1647E-09
CC-139	0.	1283.23	Half-Life too short
BA-140	27.	537.32	1.0412E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	62.	145.44	2.2730E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	56.	133.54	5.9069E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	35.	91.18	1.0061E-07
PM-148M	29.	550.27	9.9365E-09
EU-152	30.	344.27	1.0552E-08
EU-154	10.	1004.76	4.0598E-08
EU-155	43.	105.31	3.3580E-08
EU-156	11.	646.29	2.0869E-07
HF-181	22.	482.03	9.4558E-09
TA-182	12.	1221.42	2.9948E-08
W-187	0.	685.01	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HS-200	43.	279.19	1.0602E-08
DI-207	30.	569.67	6.1898E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
DI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	64.	240.98	3.5113E-05
RA-226	65.	186.21	1.8388E-07
AC-228	41.	330.32	4.9999E-08
TH-228	41.	84.37	8.6854E-07
PA-234	0.	131.20	Half-Life too short
TH-234	30.	63.29	1.7133E-06
U-235	72.	143.76	6.2093E-08
NP-239	0.	106.13	Half-Life too short
AM-241	31.	59.54	1.1627E-07

**EFT-5S**

**2011**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT 6611 55

Sample Location (Well Number): 55

1. Representative sample collected. Date/Time 6-9-11 1 09:20

Sample collected by: C. Proffitt / [Signature] Date: 6-9-11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: C. Proffitt / [Signature] Date: 6-9-11  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: D. Burger / [Signature] Date: 6-10-11  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert Bey / [Signature] Date: 6-13-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks W/A 6-13-11

Tritium Activity Calculation

**Sample Information**

1 . Sample Location	EFT 6611 5S
2 . Date Sampled	06/09/2011
3 . Time Sampled	09:20
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

1 . Date Sample Counted	06/09/2011
2 . Time Sample Counted	14:55
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	5.8 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	2424.5 cpm
Net Spike Count Rate (cpm)	2418.7 cpm
H3 Spike Activity (dpm on count date)	6526.4 dpm
Counter Efficiency	0.3706 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	6.7 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.9 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	1.8 cpm

**Minimum Detectable Activity**

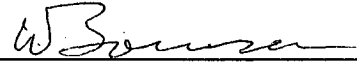
$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.08\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 uCi/ml x Sample Volume}} < \text{MDA}$$

Technician  Date 6-10-11

Reviewed By:  Date 6-13-11



## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-6611-55

Sample Location (Well Number): 55

1. Representative sample collected. Date/Time 6-6-11 11:30

Sample collected by: Thomas Mow / [Signature] Date: 6-7-11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: C. Proffitt / [Signature] Date: 6-8-11  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: C. Proffitt / [Signature] Date: 6.13.11  
Fermi 2 RP Printed Name Signature

Sample number: EFT-6611-55

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".

(Note disposition of unidentified peaks in "Remarks")

Performed by: Proffitt 1 [Signature] Date: 6-13-11  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Berg SR 1 [Signature] Date: 6-17-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

~~W. A. [Signature]~~

RADIATION PROTECTION DEPARTMENT  
GAMMA SPECTROSCOPY ANALYSIS REPORT  
HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT-6611-59

Sample End Time: 6-JUN-2011 11:30:00.00

REMARKS *Natural*

PERFORMED BY:

*Charles Propper*  
SIGNATURE

REVIEWED BY:

*[Signature]*  
SIGNATURE/DATE

Sample ID : EFT-6611-58

Acquisition date : 13-JUN-2011 15:44:06

\*\*\*\*\*

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT-6611-58  
 Sample collection start date: 6-JUN-2011 11:30:00.00  
 Sample collection end date : 6-JUN-2011 11:30:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc  
 Sample geometry : PELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 13-JUN-2011 15:44:06.81  
 Preset live time : 0 00:45:00.00 Elapsed live time : 0 00:45:00.00  
 Elapsed real time : 0 00:45:00.62 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 23-JUN-2010 12:28:00.00  
 Kev/channel : 5.00022E-01 Zero offset: 1.96812E-01  
 Daily cal date : 13-JUN-2011 08:58:17.00

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	511.75	202	40	2.25	1023.11	1015	20	7.49E-02	10.7	
2	0	559.39	71	25	4.45	1118.39	1108	25	2.63E-02	22.4	
3	0	1461.12	87	5	2.68	2922.08	2912	18	3.23E-02	12.2	

\*\*\*\*\*

1

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	511.75	202	40	2.25	1023.11	1015	20	10.7		<i>Ann. Peak</i>
0	559.39	71	25	4.45	1118.39	1108	25	22.4		<i>Cd-115</i>
0	1461.12	87	5	2.68	2922.08	2912	10	12.2		<i>K-40</i>

*Ann. Peak*  
*Cd-115*  
*K-40*  
*J. 6-13-11*

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	87	10.67*	2.501E+00	3.267E-07	3.267E-07	12.16

Flags: "\*" = Keyline

Summary of Nuclide Activity

Sample ID : EFT-6611-58

Acquisition date : 13-JUN-2011 15:44:06

Total number of lines in spectrum 3  
 Number of unidentified lines 0  
 Number of lines tentatively identified by NID 3 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	3.267E-07	3.267E-07	0.397E-07	12.16	
Total Activity :			3.267E-07	3.267E-07			

Grand Total Activity : 3.267E-07 3.267E-07

Flags: "K" = Keyline not found "M" = Manually accepted  
 "E" = Manually edited "A" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/cc)	1-Sigma %Error	Rejected by
F-18	109.74M	94.37	511.00*	193.46	5.489E+20	10.69	Decay
% Abundances Found =			100.00				
AS-76	26.32H	6.56	559.10*	44.70	3.200E-06	22.37	Abun.
			563.23	1.17	----	Not Found	----
			571.30	0.14	----	Not Found	----
			657.03	6.10	----	Not Found	----
			665.31	0.39	----	Not Found	----
			740.12	0.12	----	Not Found	----
			771.76	0.12	----	Not Found	----
			867.63	0.12	----	Not Found	----
			1129.87	0.14	----	Not Found	----
			1212.72	1.63	----	Not Found	----
			1216.02	3.04	----	Not Found	----
			1220.52	1.39	----	Not Found	----
			1439.13	0.33	----	Not Found	----
			1453.60	0.13	----	Not Found	----
			1787.67	0.33	----	Not Found	----
% Abundances Found =			73.70				
Y-92	3.54H	48.76	448.50	2.30	----	Not Found	----
			561.10	2.40	3.012E+08	22.37	Decay, Abun.
			844.30	1.25	----	Not Found	----
			934.46*	13.90	----	Not Found	----
			1405.40	4.00	----	Not Found	----
% Abundances Found =			9.74				

Flag: "\*" = Keyline



Unidentified Energy Lines  
Sample ID : EFT-6611-5S

Page : 5  
Acquisition date : 13-JUN-2011 15:44:06

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	511.75	202	40	2.25	1023.11	1015	20	7.49E-02	10.7	4.88E+00	T
0	559.39	71	25	4.45	1110.39	1100	25	2.63E-02	22.4	4.68E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	31.	477.59	5.9554E-08
F-18	0.	511.00	Half-Life too short
NA-22	9.	1274.54	6.1375E-09
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	9.	889.25	5.3506E-09
CR-51	43.	320.08	6.8160E-08
MN-54	23.	834.83	7.3225E-09
CO-56	17.	1238.25	1.2724E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	57.	158.38	1.3002E-08
CO-57	47.	122.06	7.1014E-09
CO-58	16.	810.76	6.4438E-09
FE-59	14.	1099.22	1.3438E-08
CO-60	12.	1332.49	7.1776E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	8.	1115.52	1.0982E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	54.	136.00	1.0324E-08
AS-76	55.	559.10	1.6689E-06
BR-82	19.	776.49	2.2154E-07
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	58.	513.99	1.8315E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	58.	513.99	8.5567E-09
RB-86	18.	1076.63	1.1371E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	3.	1836.01	5.2444E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	8.	1204.90	2.0245E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT-6611-55

Acquisition date : 13-JUN-2011 15:44:06

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	15.	702.63	4.9940E-09
NB-95	14.	765.79	6.2053E-09
NB-95M	43.	235.69	0.3343E-08
ZR-95	17.	756.72	1.1094E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	17.	739.58	2.6923E-07
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	27.	497.08	6.9475E-09
TC-104	0.	357.99	Half-Life too short
RH-105	49.	318.90	9.1146E-07
RU-105	0.	724.50	Half-Life too short
RU-106	22.	621.84	5.6931E-08
CD-109	34.	88.03	2.2921E-07
AG-110M	11.	937.48	1.6835E-08
SN-113	26.	391.69	7.7064E-09
SN-117M	57.	158.56	9.4727E-09
SB-122	17.	563.93	4.1762E-08
SB-124	27.	602.71	6.5500E-09
SB-125	41.	427.89	2.0939E-08
TE-125M	51.	109.20	2.7368E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	32.	57.60	1.7114E-05
XE-127	49.	202.84	9.0379E-09
TE-129	0.	459.60	Half-Life too short
TE-129M	21.	695.88	2.0140E-07
XE-129M	59.	196.56	2.1447E-07
I-130	0.	536.09	Half-Life too short
BA-131	46.	123.80	3.0753E-08
I-131	25.	364.48	1.0519E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	14.	773.67	7.5610E-07
XE-131M	45.	163.93	3.9406E-07
I-132	0.	667.69	Half-Life too short
TE-132	52.	228.16	2.9791E-08
BA-133	51.	302.84	3.3457E-08
BA-133M	49.	276.09	6.8585E-07
I-133	28.	529.87	2.0859E-06
TE-133M	0.	912.58	Half-Life too short
XE-133	46.	81.00	0.3813E-08
XE-133M	58.	233.22	5.6820E-07
CS-134	27.	604.70	6.1394E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	39.	268.24	2.0499E-06
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT-6611-58

Acquisition date : 13-JUN-2011 15:44:06

Nuclide	Bckgnd Sum	Energy (keV)	MDA ( $\mu\text{Ci}/\text{cc}$ )
CS-136	13.	818.50	8.1174E-09
I-136	0.	1313.02	Half-Life too short
CS-137	35.	661.65	8.1717E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	56.	165.85	7.2003E-09
CS-139	0.	1283.23	Half-Life too short
BA-140	29.	537.32	3.4205E-08
LA-140	9.	1596.49	1.4106E-07
BA-141	0.	190.22	Half-Life too short
CE-141	60.	145.44	1.4386E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	45.	293.26	4.9967E-07
CE-144	57.	133.54	5.7226E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	39.	91.10	4.7442E-08
PM-148M	18.	550.27	5.6749E-09
EU-152	35.	344.27	1.9837E-08
EU-154	11.	1004.76	3.2665E-08
EU-155	38.	105.31	3.1501E-08
EU-156	20.	646.29	1.0469E-07
HF-181	30.	482.03	7.6196E-09
TA-182	19.	1221.42	3.1911E-08
W-187	15.	685.81	2.5820E-06
RE-188	0.	155.03	Half-Life too short
AU-199	57.	158.38	7.5419E-08
HG-203	43.	279.19	7.7360E-09
BI-207	22.	569.67	5.4468E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	60.	240.98	6.1560E-07
RA-226	59.	186.21	1.7517E-07
AC-228	41.	338.32	4.9450E-08
TH-228	42.	84.37	8.5445E-07
PA-234	0.	131.20	Half-Life too short
TH-234	37.	63.29	9.1837E-07
U-235	57.	143.76	5.5525E-08
NP-239	40.	106.13	2.3847E-07
AM-241	29.	59.54	1.1372E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-101211-56

Sample Location (Well Number): EFT-5/S

1. Representative sample collected. Date/Time 10/12/11 1 15:20

Sample collected by: Thomas Mow / [Signature] Date: 10/25/11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Thomas Mow / [Signature] Date: 10/25/11  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Jaw M. Jovan / [Signature] Date: 11-1-11  
Fermi 2 Chemistry Printed Name / Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert C. Gray JR / [Signature] Date: 11-2-11  
Fermi 2 Printed Name / Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks N/A

Tritium Activity Calculation

**Sample Information**

1 . Sample Location EFT-5/S  
 2 . Date Sampled 10/12/2011  
 3 . Time Sampled 15:20  
 4 . Sample Volume, (ml) 4 ml

**Instrument Count Data**

1 . Date Sample Counted 10/30/2011  
 2 . Time Sample Counted 17:40  
 3 . Background Inf.:  
     Minutes Counted 10 min.  
     Background Count Rate (cpm) 7.5 cpm  
 4 . Efficiency Inf.: (Daily Spike Source ID # 111)  
     Gross Spike Count Rate (cpm) 2548.6 cpm  
     Net Spike Count Rate (cpm) 2541.1 cpm  
     H3 Spike Activity (dpm on count date) 6383.7 dpm  
     Counter Efficiency 0.3981 cpm/dpm  
 5 . Sample Info:  
     Sample Gross Count Rate (cpm) 7.7 cpm  
     Sample Count Time (min.) 10.0 min.  
     Net Sample Count Rate (cpm) 0.2 cpm  
 6 . Critical Level:  
     Critical Level Count Rate (cpm) 2.0 cpm

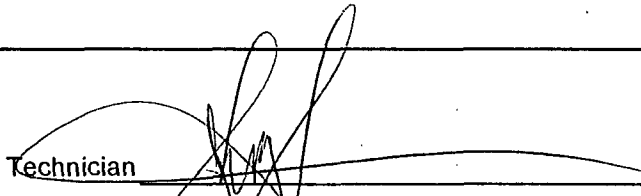

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.14\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 uCi/ml x Sample Volume}} < \text{MDA}$$

Technician   
 Reviewed 

Date 11-1-11

Date NOV 01 2011

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-101211-55

Sample Location (Well Number): EFT-5/S

1. Representative sample collected. Date/Time 10/12/11 1 15:20

Sample collected by: Thomas Mow / [Signature] Date: 10/25/11  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: Thomas Mow / [Signature] Date: 10/25/11  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: C. Proffitt / [Signature] Date: 11-1-11  
Fermi 2 RP Printed Name Signature

Sample number: EFT-101211-55

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: C. Proffitt | [Signature] Date: 11-1-11  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: Robert Carey, JR | [Signature] Date: 11-2-11  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
N/A  
\_\_\_\_\_  
\_\_\_\_\_



RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EFT101211-55

Sample End Time: 12-OCT-2011 15:20:00.00

REMARKS No Significant Related Isotopes

PERFORMED BY:

Charles Puffer  
SIGNATURE

REVIEWED BY:

[Signature]  
SIGNATURE/DATE

Sample ID : EFT101211-59

Acquisition date : 1-NOV-2011 13:07:23

\*\*\*\*\*

## Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EFT101211-59  
 Sample collection start date: 12-OCT-2011 15:20:00.00  
 Sample collection end date : 12-OCT-2011 15:20:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.00000E+03 cc ✓  
 Sample geometry : NELL Operator: CLP

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 ✓ Acquire date : 1-NOV-2011 13:07:23.94  
 Preset live time : 0 00:45:00.00 ✓ Elapsed live time : 0 00:45:00.00  
 Elapsed real time : 0 00:45:00.66 Percent dead time : 0.03 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 14-JUN-2011 14:50:56.41  
 Kev/channel : 5.00032E-01 Zero offset: -5.54949E-01  
 Daily cal date : 1-NOV-2011 07:48:09.27 ✓

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 1.75000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlb  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

Pk	It	Energy	Area	Bkgnd	FWHM	Chanel	Left	Pw	Cts/Sec	%Err	Fit
1	0	66.29	52	72	1.70	133.60	120	11	1.94E-02	34.2	
2	0	295.84	50	60	1.61	592.75	500	11	2.16E-02	29.0	
3	0	352.69	55	74	1.77	706.45	690	13	2.03E-02	35.1	
4	0	511.17	103	45	3.10	1023.39	1015	10	6.78E-02	11.3	
5	0	609.35	107	32	2.00	1219.74	1213	13	3.94E-02	14.7	
6	1	1459.73	49	13	3.11	2920.43	2910	19	1.81E-02	24.1	1.85E+00
7	1	1462.05	34	5	1.75	2925.00	2910	19	1.26E-02	25.4	

Post-MID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	66.29	52	72	1.70	133.68	128	11	34.2		Ge-76
0	295.84	58	60	1.61	592.75	588	11	29.0		Pb-214
0	352.69	55	74	1.77	706.45	698	13	35.1		Pb-214
0	511.17	183	45	3.10	1023.39	1015	18	11.3		Ann. Peak
0	609.35	107	32	2.00	1219.74	1213	13	14.7		Bi-214
1	1459.73	49	13	3.11	2920.43	2910	19	24.1	1.85E+00	K-40
1	1462.05	34	5	1.75	2925.00	2910	19	25.4		K-40

11-2-11

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected Decay Corr		1-Sigma
					uCi/cc	uCi/cc	%Error
K-40	1460.81	49	10.67*	2.354E+00	1.951E-07	1.951E-07	24.10

Flag: "\*" = Keyline

Sample ID : EFT101211-55

Acquisition date : 1-NOV-2011 13:07:23

Total number of lines in spectrum	7	
Number of unidentified lines	0	
Number of lines tentatively identified by NID	7	100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma XError	Flags
K-40	1.00E+05Y	1.00	1.951E-07	1.951E-07	0.470E-07	24.10	
Total Activity :			1.951E-07	1.951E-07			

Grand Total Activity :	1.951E-07	1.951E-07
------------------------	-----------	-----------

Flags: "K" = Keyline not found

"M" = Manually accepted

"E" = Manually edited

"A" = Nuclide specific abn. limit

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
F-18	109.74M	261.44	511.00*	193.46	1.000E+35	11.34	Decay
	% Abundances Found =			100.00			
SE-75	119.78D	0.17	66.05	1.02	4.297E-06	34.19	Abun.
			96.73	3.41	---	Not Found	---
			121.12	16.70	---	Not Found	---
			136.00*	59.20	---	Not Found	---
			198.60	1.45	---	Not Found	---
			264.65	59.80	---	Not Found	---
			279.53	25.20	---	Not Found	---
			303.91	1.32	---	Not Found	---
			400.65	11.40	---	Not Found	---
	% Abundances Found =			0.57			
BR-84	31.80M	902.20	604.80	1.80	---	Not Found	---
			736.50	1.31	---	Not Found	---
			802.20	6.10	---	Not Found	---
			881.50*	42.00	---	Not Found	---
			1015.90	6.20	---	Not Found	---
			1213.30	2.60	---	Not Found	---
			1463.80	2.00	1.000E+35	25.44	
			1741.20	1.60	---	Not Found	---
			1877.50	1.14	---	Not Found	---
			1897.30	14.90	---	Not Found	---
			2029.60	2.10	---	Not Found	---
	% Abundances Found =			2.45			
RU-103	39.35D	0.51	497.08*	89.00	---	Not Found	---
			610.33	5.60	6.364E-07	14.66	Abun.
	% Abundances Found =			5.92			
XE-135	9.11H	52.49	249.79*	89.90	---	Not Found	---
			608.19	2.89	5.483E+09	14.66	Decay, Abun.
	% Abundances Found =			3.11			
CS-136	13.16D	1.51	66.91	12.50	8.923E-07	34.19	Abun.
			86.29	6.30	---	Not Found	---
			153.22	7.46	---	Not Found	---
			163.89	4.61	---	Not Found	---
			176.55	13.56	---	Not Found	---
			273.65	12.66	---	Not Found	---
			340.57	48.50	---	Not Found	---
			818.50*	99.70	---	Not Found	---
			1048.07	79.60	---	Not Found	---
			1235.34	19.70	---	Not Found	---
	% Abundances Found =			4.10			
TA-182	114.74D	0.17	67.75	42.30	1.041E-07	34.19	Abun.
			100.10	14.10	---	Not Found	---
			1189.05	16.30	---	Not Found	---
			1221.42*	27.10	---	Not Found	---
			1230.97	11.50	---	Not Found	---
	% Abundances Found =			38.01			

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
BI-214	19.90M	1441.70	609.31*	46.30	1.000E+35	14.66	Decay
			769.36	5.04	----	Not Found	----
			934.06	3.21	----	Not Found	----
			1120.29	15.10	----	Not Found	----
			1238.11	5.94	----	Not Found	----
			1377.67	4.11	----	Not Found	----
			1764.49	15.80	----	Not Found	----
% Abundances Found =			48.48	(Abn. Limit = 48.48%)			
PB-214	26.80M	1070.52	87.30	4.67	----	Not Found	----
			241.98	7.49	----	Not Found	----
			295.21	19.20	1.000E+35	28.96	
			351.92*	37.20	1.000E+35	35.14	
			705.91	1.10	----	Not Found	----
% Abundances Found =			80.96	(Abn. Limit = 37.20%)			

Flag: "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	66.29	52	72	1.78	133.68	128	11	1.94E-02	34.2	1.34E+00	T
0	295.84	58	60	1.61	592.75	588	11	2.16E-02	29.0	5.82E+00	T
0	352.69	55	74	1.77	706.45	698	13	2.03E-02	35.1	5.38E+00	T
0	511.17	183	45	3.18	1023.39	1015	18	6.78E-02	11.3	4.59E+00	T
0	609.35	107	32	2.08	1219.74	1213	13	3.94E-02	14.7	4.25E+00	T
1	1462.05	34	5	1.75	2925.00	2910	19	1.26E-02	25.4	2.35E+00	T

Flags: "T" = Tentatively associated



Minimum Detectable Activity Report

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	32.	477.59	7.6120E-08
F-18	0.	511.00	Half-Life too short
NA-22	9.	1274.54	6.5583E-09
NA-24	0.	1368.53	Half-Life too short
NO-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	14.	889.25	7.6232E-09
CR-51	34.	320.00	9.8539E-08
MN-54	22.	834.83	7.7294E-09
CO-56	28.	1238.25	1.8686E-08
MN-56	0.	1810.69	Half-Life too short
NI-56	54.	158.38	5.6682E-08
CO-57	65.	122.06	9.1176E-09
CO-58	20.	810.76	8.4535E-09
FE-59	22.	1099.22	2.1499E-08
CO-60	17.	1332.49	8.9472E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	16.	1115.52	1.5961E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	51.	136.00	1.1443E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	69.	513.99	2.1126E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	69.	513.99	1.1283E-08
RB-86	12.	1076.63	1.6104E-07
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	8.	1836.01	8.8368E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1631.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	15.	1284.90	3.3320E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : EFT101211-55

Acquisition date : 1-NOV-2011 13:07:23

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	28.	702.63	7.0819E-09
NB-95	17.	765.79	9.0699E-09
NB-95M	62.	235.69	1.1951E-06
ZR-95	22.	756.72	1.5372E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	24.	739.58	8.2573E-06
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	28.	497.08	9.3562E-09
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	35.	621.84	7.5551E-08
CD-109	50.	88.03	2.9107E-07
AG-110M	16.	937.48	2.1843E-08
SN-113	43.	391.69	1.1239E-08
SN-117M	56.	150.56	1.8766E-08
SB-122	19.	563.93	1.2426E-06
SB-124	22.	602.71	7.4241E-09
SB-125	35.	427.89	2.1162E-08
TE-125M	45.	109.28	3.2009E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	25.	57.60	1.9174E-05
XE-127	52.	202.84	1.2309E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	20.	695.88	2.7321E-07
XE-129M	58.	196.56	5.9970E-07
I-130	0.	536.09	Half-Life too short
BA-131	43.	123.80	6.7123E-08
I-131	31.	364.48	3.6862E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	56.	163.93	9.5528E-07
I-132	0.	667.69	Half-Life too short
TE-132	55.	228.16	4.7966E-07
BA-133	30.	302.84	3.0872E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	41.	81.00	4.4523E-07
XE-133M	70.	233.22	3.6507E-05
CS-134	27.	604.70	6.5406E-09
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT101211-SS

Acquisition date : 1-NOV-2011 13:07:23

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	14.	810.50	1.6952E-08
I-136	0.	1313.02	Half-Life too short
CS-137	30.	661.65	8.0872E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.06	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	58.	165.05	8.1715E-09
CS-139	0.	1243.23	Half-Life too short
BA-140	38.	537.32	8.2756E-08
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	55.	145.44	1.9136E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	61.	133.54	6.4849E-08
PR-144	0.	1489.15	Half-Life too short
ND-147	43.	91.10	1.1451E-07
PM-148M	24.	550.27	8.4726E-09
EU-152	54.	344.27	2.5618E-08
EU-154	13.	1004.76	3.7448E-08
EU-155	40.	105.31	3.4097E-08
EU-156	16.	646.29	1.8018E-07
HF-181	31.	482.03	1.0132E-08
TA-182	10.	1221.42	2.7622E-08
W-187	0.	605.81	Half-Life too short
RE-188	0.	155.03	Half-Life too short
AU-199	54.	158.38	1.2856E-06
HG-203	37.	279.19	9.1088E-09
BI-207	24.	569.67	5.9939E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	67.	240.98	7.7331E-06
RA-226	55.	186.21	1.7610E-07
AC-228	53.	330.32	5.8987E-08
TH-228	35.	84.37	8.2386E-07
PA-234	0.	131.20	Half-Life too short
TH-234	31.	63.29	1.2980E-06
U-235	42.	143.76	5.0925E-08
NP-239	51.	106.13	1.1981E-05
AM-241	28.	59.54	1.2391E-07

**GEL LAB RESULTS**

**EFT-5S 2009**

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Company : Detroit Edison - Fermi 1  
 Address : PO Box 44440  
 Detroit, Michigan 48244

Report Date: February 17, 2010

Contact: Mr. Tom Mow  
 Project: **Fermi 1 - PO# 4700246055**

Client Sample ID:	EF1-5/S	Project:	ROIT00116
Sample ID:	245517011	Client ID:	ROIT001
Matrix:	Ground Water		
Collect Date:	29-DEC-09 12:25		
Receive Date:	25-JAN-10		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Pu, Liquid "As Received"</i>												
Plutonium-238	U	0.0361	+/-0.144	0.385	1.00	pCi/L		JXD2	02/09/10	0923	949025	1
Plutonium-239/240	U	-0.0167	+/-0.140	0.333	1.00	pCi/L						
Plutonium-244	U	0.139	+/-0.192	0.208	1.00	pCi/L						
<i>Alphaspec U, Liquid "As Received"</i>												
Pct Uranium-235		1.67				percent		MXE1	02/09/10	1349	947744	2
Uranium-233/234		3.62	+/-1.08	0.502	1.00	pCi/L						
Uranium-235/236		0.305	+/-0.345	0.305	1.00	pCi/L						
Uranium-238		2.80	+/-0.940	0.247	1.00	pCi/L						
<b>Rad Gas Flow Proportional Counting</b>												
<i>GFPC, Gross A/B, liquid "As Received"</i>												
Alpha	U	3.58	+/-2.90	4.13	5.00	pCi/L		DXF3	02/11/10	1942	945896	3
Beta		3.53	+/-2.05	2.97	5.00	pCi/L						
<i>GFPC, Ra228, Liquid "As Received"</i>												
Radium-228		1.51	+/-0.847	1.19	3.00	pCi/L		JXC5	02/01/10	0723	945895	4
<i>GFPC, Sr89&amp;Sr90, Liquid "As Received"</i>												
Strontium-89	U	-1.99	+/-0.507	1.98	2.00	pCi/L		JXR1	02/03/10	1029	946221	5
Strontium-90	U	1.77	+/-0.872	1.96	2.00	pCi/L						
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, liquid "As Received"</i>												
Radium-226		0.470	+/-0.277	0.380	1.00	pCi/L		KSD1	02/10/10	1440	948312	6

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Pu-11-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 900.0	
4	EPA 904.0/SW846 9320 Modified	
5	EPA 905.0 Modified	
6	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery %	Acceptable Limits
Plutonium-242 Tracer	Alphaspec Pu, Liquid "As Received"			80.4	(15%-125%)

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Company : Detroit Edison - Fermi 1  
Address : PO Box 44440  
Detroit, Michigan 48244

Contact: Mr. Tom Mow  
Project: **Fermi 1 - PO# 4700246055**

Report Date: February 17, 2010

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Client Sample ID: EF1-5/S      Project: ROIT00116  
Sample ID: 245517011      Client ID: ROIT001

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Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Uranium-232 Tracer	Alphaspec U, Liquid	"As Received"					93.9			(15%-125%)	
Barium-133 Tracer	GFPC, Ra228, Liquid	"As Received"					91.7			(15%-125%)	
Yttrium Carrier	GFPC, Sr89&Sr90, Liquid	"As Received"					104			(25%-125%)	
Strontium Carrier	GFPC, Sr89&Sr90, Liquid	"As Received"					91.9			(25%-125%)	

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

**Certificate of Analysis**

Company : Detroit Edison - Fermi 1  
 Address : PO Box 44440

Report Date: December 30, 2010

Contact: Detroit, Michigan 48244  
 Mr. Tom Mow  
 Project: Fermi 1 - PO# 4700246055

Client Sample ID:	EFT-102710-5/S	Project:	ROIT00116
Sample ID:	268144009	Client ID:	ROIT001
Matrix:	Water		
Collect Date:	27-OCT-10 15:50		
Receive Date:	06-DEC-10		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
<b>Rad Gas Flow Proportional Counting</b>											
<i>GFPC, Gross A/B, liquid "As Received"</i>											
Alpha	U	2.18	+/-2.12	3.45	5.00	pCi/L		VXC2 12/27/10	1948	1059089	1
Beta	U	0.318	+/-3.02	5.21	5.00	pCi/L					

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	EPA 900.0/SW846 9310	

**EFT-5D**

**2006**



## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-5D060806

Sample Location (Well Number): EFT-5D

1. Representative sample collected. Date/Time 06/08/06 / 1616

Sample collected by: Jon Slabach / Jon Slabach Date: 06/08/06  
Printed Name / Signature Collection  
Signed 02/01/07

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Frailing / Christel A. Wily Date: 08/02/06  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: K. Spaulding / K. Spaulding Date: 8-21-07  
Fermi 2 RP Printed Name Signature

Sample number: EFT-5D060806

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard [Signature] Date: 7-11-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: KD Lindsay | [Signature] Date: Signed 1-3-12  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

*Performed 8-27-07* *212* *1112*

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1 EFT-5D060006

Sample End Time: 8-JUN-2006 16:16:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:

*[Handwritten Signature]*

SIGNATURE

REVIEWED BY:

*[Handwritten Signature]* 8-21-07

SIGNATURE/DATE

Sample ID : CF1 EFT-50060006

Acquisition date : 11-JUL-2007 09:20:30

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-50060006
Sample collection start date: 8-JUN-2006 16:16:00.00
Sample collection end date : 8-JUN-2006 16:16:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 CC
Sample geometry : M2LL Operator: CMH

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 11-JUL-2007 09:20:30.47
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:00.92 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16
KeV/channel : 4.99666E-01 Zero offset: -9.01942E-02
Daily cal date : 11-JUL-2007 07:21:16.11

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFFD4\_m2ll Efficiencies at : Peak energy

Table with 11 columns: Pk, It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. Contains 3 rows of peak data with handwritten annotations like 'annihilation', 'HWC', and 'K-40'.

Sample Title : EF1 EFT-SD060806  
Decay Time = 397 17:04:38.47

Page : 1  
Acquisition Time = 11-JUL-2007 09:20:38.4

Post-NID Peak Search Report

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pe	XErr	Fit	Nuclides
0	511.52	130	57	2.01	1023.09	1014	21	17.1		
0	552.78	50	33	1.20	1110.46	1111	13	27.7		
0	1460.91	61	3	1.07	2923.77	2910	12	14.0		K-40

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected	Decay Corr	1-Sigma
					uCi/CC	uCi/CC	
K-40	1460.81	61	10.67*	2.501E+00	3.442E-07	3.442E-07	13.97

Flag: "\*" = Keyline

Summary of Nuclide Activity  
Sample ID : EF1 EFT-5D060906

Page : 3  
Acquisition date : 11-JUL-2007 09:20:30

Total number of lines in spectrum 3  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 3 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/CC	Decay Corr uCi/CC	Decay Corr 1-Sigma Error	1-Sigma XError	Flags
K-40	1.00E+05Y	1.00	3.442E-07	3.442E-07	0.481E-07	13.97	
Total Activity :			3.442E-07	3.442E-07			

Grand Total Activity : 3.442E-07 3.442E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/CC)	%Error	
F-18	109.74H	5210.00	511.00*	193.46	1.000E+35	17.06	Decay
% Abundances Found = 100.00							
AS-76	26.32H	362.66	559.10*	44.70	1.000E+35	27.67	Decay, Abun.
			563.23	1.17	----	Not Found	----
			571.30	0.14	----	Not Found	----
			657.03	6.10	----	Not Found	----
			665.31	0.39	----	Not Found	----
			740.12	0.12	----	Not Found	----
			771.76	0.12	----	Not Found	----
			867.63	0.12	----	Not Found	----
			1129.87	0.14	----	Not Found	----
			1212.72	1.63	----	Not Found	----
			1216.02	3.04	----	Not Found	----
			1220.52	1.39	----	Not Found	----
			1439.13	0.33	----	Not Found	----
			1453.60	0.13	----	Not Found	----
			1787.67	0.33	----	Not Found	----
% Abundances Found = 73.70							

Flag: "\*" = Keyline



Unidentified Energy Lines  
Sample ID : EF1 EFT-50060006

Page : 5  
Acquisition date : 11-JUL-2007 09:20:30

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	511.52	130	57	2.01	1033.99	1014	21	7.21E-02	17.1	4.00E+00	T
0	558.78	50	33	1.28	1119.40	1111	13	2.75E-02	27.7	4.68E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
BE-7	20.	477.59	1.3625E-05
F-19	0.	511.00	Half-Life too short
NA-22	7.	1274.54	1.1295E-08
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	10.	889.25	2.0985E-07
CR-51	0.	320.08	Half-Life too short
MN-54	19.	834.83	2.3704E-08
CO-56	16.	1238.25	5.7273E-07
MN-56	0.	1010.69	Half-Life too short
NI-56	0.	150.38	Half-Life too short
CO-57	35.	122.06	2.5413E-08
CO-58	12.	810.76	3.8068E-07
FE-59	10.	1099.22	7.4984E-08
CO-60	9.	1332.49	1.1046E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1481.84	Half-Life too short
ZN-65	13.	1115.52	6.2137E-08
ZN-69M	0.	438.63	Half-Life too short
SE-75	47.	136.00	1.3945E-07
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	881.50	Half-Life too short
BR-85	0.	882.41	Half-Life too short
KR-85	44.	513.99	2.5832E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	44.	513.99	7.3236E-07
RB-86.	0.	1076.63	Half-Life too short
KR-87	0.	402.58	Half-Life too short
SR-87M	0.	388.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	7.	1036.01	1.3779E-07
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.88	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	9.	1204.90	3.3872E-04
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1383.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

Sample ID : CF1 EFT-5D060806

Acquisition date : 11-JUL-2007 09:20:30

Nuclide	Bckgrd Sum	Energy (KeV)	MDA (uCi/CC)
SR-93	0.	590.28	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	17.	702.63	0.0045E-09
NB-95	0.	765.79	Half-Life too short
NB-95M	0.	235.69	Half-Life too short
ZR-95	13.	756.72	1.0143E-06
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.50	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.81	Half-Life too short
RU-103	0.	497.00	Half-Life too short
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	19.	621.04	1.6316E-07
CD-109	32.	80.03	5.9846E-07
AG-110M	11.	937.40	7.5360E-08
SN-113	21.	391.69	1.1127E-07
SN-117M	0.	158.56	Half-Life too short
SB-122	0.	563.93	Half-Life too short
SB-124	22.	602.71	0.0472E-07
SB-125	24.	427.09	3.2136E-08
TE-125M	53.	109.28	4.4654E-04
TE-127	0.	417.90	Half-Life too short
TE-127M	22.	57.60	2.5960E-04
XE-127	0.	202.84	Half-Life too short
TE-129	0.	459.60	Half-Life too short
TE-129M	0.	695.00	Half-Life too short
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	0.	123.80	Half-Life too short
I-131	0.	364.48	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	0.	163.93	Half-Life too short
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	43.	302.84	5.0112E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	25.	604.70	1.2594E-08
I-134	0.	804.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EF1 EFT-5D080006

Acquisition date : 11-JUL-2007 09:20:38

Nuclide	Bckgd Sum	Energy (keV)	MDA (uCi/CC)
CS-136	0.	818.58	Half-Life too short
I-136	0.	1313.82	Half-Life too short
CS-137	19.	661.65	9.5759E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	258.31	Half-Life too short
BA-139	0.	1428.58	Half-Life too short
CE-139	39.	165.85	6.5314E-08
CS-139	0.	1283.23	Half-Life too short
BA-140	0.	537.32	Half-Life too short
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	198.22	Half-Life too short
CE-141	0.	145.44	Half-Life too short
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	38.	133.54	1.8371E-07
PR-144	0.	1489.15	Half-Life too short
ND-147	0.	91.18	Half-Life too short
PM-148M	19.	558.27	6.8692E-06
EU-152	43.	344.27	3.4536E-08
EU-154	12.	1884.76	5.5342E-08
EU-156	0.	646.29	Half-Life too short
HF-181	21.	482.83	5.7947E-06
TA-182	7.	1221.42	3.3215E-07
W-187	0.	685.81	Half-Life too short
RE-188	0.	155.83	Half-Life too short
HG-203	31.	279.19	3.3153E-06
BI-207	28.	569.67	9.2299E-09
TL-208	0.	583.14	Half-Life too short
PE-212	0.	238.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PE-214	0.	351.92	Half-Life too short
RA-224	0.	248.98	Half-Life too short
RA-226	51.	186.21	2.4722E-07
AC-228	29.	338.32	7.1549E-08
TH-228	34.	84.37	1.7238E-06
PA-234	0.	131.20	Half-Life too short
TH-234	0.	63.29	Half-Life too short
U-235	43.	143.76	7.3161E-08
NP-239	0.	106.13	Half-Life too short
AM-241	29.	59.54	1.7889E-07

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-5D060806

Sample Location (Well Number): EFT-5D

1. Representative sample collected. Date/Time 06/08/06 / 1616

Sample collected by: Joy Slebeck / See J Slanham Date: 06/08/06  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq$  50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Freiling / Cheryl A. Lynn Date: 08/02/06  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Russ Bunger / [Signature] Date: 8-3-06  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: ROBINSON / [Signature] Date: 2-21-09  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1. Sample Location	EFT-5D	
2. Date Sampled	06/08/2006	
3. Time Sampled	16:16	
4. Sample Volume, (ml)	4	ml

**Instrument Count Data**

1. Date Sample Counted	08/03/2006	
2. Time Sample Counted	12:30	
3. Background Inf.:		
Minutes Counted	10	min.
Background Count Rate (cpm)	8.3	cpm
4. Efficiency Inf.: (Daily Spike Source ID # 111)		
Gross Spike Count Rate (cpm)	3619.6	cpm
Net Spike Count Rate (cpm)	3611.3	cpm
H3 Spike Activity (dpm on count date)	8580.4	dpm
Counter Efficiency	0.4209	cpm/dpm
5. Sample Info:		
Sample Gross Count Rate (cpm)	9.1	cpm
Sample Count Time (min.)	10.0	min.
Net Sample Count Rate (cpm)	0.8	cpm
6. Critical Level:		
Critical Level Count Rate (cpm)	2.1	cpm

**Minimum Detectable Activity**

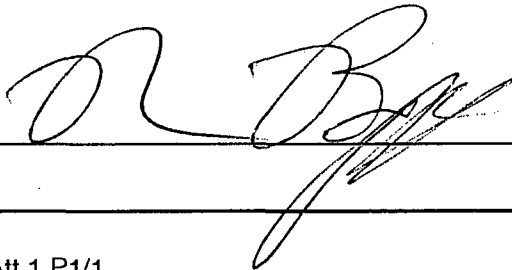
$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.14\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician



Date

8-3-06

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-5D060806

Sample Location (Well Number): EFT-5D

1. Representative sample collected. Date/Time 06/08/06 / 1616

Sample collected by: Jay Slabach / [Signature] Date: 06/08/06  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: Christopher Frutkin / [Signature] Date: 08/02/06  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: [Signature] / [Signature] Date: 8-5-06  
Fermi 2 RP Printed Name Signature

Sample number: EFT-5D060806

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Abere | [Signature] Date: 1-5-06  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: KD LINDSEY | [Signature] Date: 2-21-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

HIGH EFFICIENCY DETECTOR

Sample ID Num: FF-00000000-113

Sample End Time: 8-JUN-2006 16:16:00.00

REMARKS

PERFORMED BY:

*Andrew Gere*

SIGNATURE

REVIEWED BY:

*LO Lindsey*

2-21-08

SIGNATURE/DATE

Sample ID : EFT-5D060006 EF1

Acquisition date : 5-AUG-2006 14:04:15

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample ID Number: EFT-5D060006 EF1 \*\*\*\*\*

Sample collection start date: 8-JUN-2006 16:16:00.00
Sample collection end date : 8-JUN-2006 16:16:00.00
Type of sample : 1 L Marin. Liquid
Sample quantity : 1.000000E+03 cc
Sample geometry : P2LL Operator: AKG

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*
Detector number : DET 4 Acquire date : 5-AUG-2006 14:04:15.95
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:01.09 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*
Detector number : DET 4 Yearly cal date : 26-APR-2006 11:58:00.00
KeV/channel : 5.00143E-01 Zero offset: -2.30456E-03
Daily cal date : 5-AUG-2006 08:28:12.42

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*
Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*
Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.nlb
Efficiency file : EFF04\_m211 Efficiency at : Peak energy

Table with 11 columns: Pk, It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. Contains 3 rows of peak data.

Post-NIT Data

It	Energy	Ch	Flux	Rate	Count	Rate	Rate	Rate
0	511.50	149	48	3.23	1023.03	1015	19	13.6
0	559.27	61	31	1.23	1118.63	1102	13	23.2
0	1460.80	57	0	2.02	2923.23	2916	15	13.2

Annihilation  
H<sub>2</sub>O  
K 40

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	57	10.67*	2.300E+00	3.475E-07	3.475E-07	13.25

Flag: "\*" = Keyline

Total number of lines in spectrum 3  
Number of unidentified lines 0  
Number of lines tentatively identified by MID 3 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma %Error	Flags
K-40	1.00E+05Y	1.00	3.475E-07	3.475E-07	0.460E-07	13.23	
Total Activity :			3.475E-07	3.475E-07			

Grand Total Activity : 3.475E-07 3.475E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Nuclide	Half-life	Ratio	Energy	%Found	(uCi/cc)	%Error	Rejected by
F-18	109.74H	711.71	511.00*	100.00	1.000E+35	13.62	Decay
% Abundances Found = 100.00							
AC-76	26.32H	52.81	559.10*	44.70	3.744E+05	23.23	Decay, Abun.
			563.23	1.17	---	---	Not Found
			571.30	0.14	---	---	Not Found
			657.03	6.10	---	---	Not Found
			665.31	0.39	---	---	Not Found
			740.12	0.12	---	---	Not Found
			771.76	0.12	---	---	Not Found
			867.63	0.12	---	---	Not Found
			1129.87	0.14	---	---	Not Found
			1212.72	1.63	---	---	Not Found
			1216.02	3.84	---	---	Not Found
			1220.52	1.39	---	---	Not Found
			1439.13	0.33	---	---	Not Found
			1453.60	0.13	---	---	Not Found
			1787.67	0.33	---	---	Not Found
% Abundances Found = 73.70							
Y-92	3.54H	392.67	448.50	2.30	---	---	Not Found
			561.10	2.40	1.000E+35	23.23	Decay, Abun.
			844.30	1.25	---	---	Not Found
			934.46*	13.90	---	---	Not Found
			1405.40	4.80	---	---	Not Found
% Abundances Found = 9.74							

Flags "\*" = Keyline

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pe	Cts/Sec	%Err	%Eff	Flags
0	511.50	145	42	3.23	1023.03	1015	19	8.96E-02	13.6	4.40E+00	T
0	559.33	61	31	1.23	1118.62	1112	13	3.36E-02	23.2	4.31E+00	T

Flags: "T" = Tentatively associated

\* Sample ID : EFT-5D060006 EF1

Minimum Detectable Activity Report

Nuclide	Background Sum	Energy (keV)	MDA (uCi/cc)
BE-7	40.	477.59	2.1139E-07
F-18	0.	511.00	Half-Life too short
Li-22	1.	1274.54	7.7217E-09
Na-24	0.	1369.53	Half-Life too short
Mg-27	0.	1014.44	Half-Life too short
Cl-38	0.	1642.42	Half-Life too short
Ar-41	0.	1293.64	Half-Life too short
Sc-46	14.	889.25	1.6051E-08
Cr-51	34.	320.08	3.6181E-07
Mn-54	17.	834.83	1.1562E-08
Co-56	14.	1238.75	2.9367E-08
Mn-56	0.	1010.69	Half-Life too short
Ni-56	61.	158.38	6.9901E-06
Co-57	40.	122.06	1.2382E-08
Co-58	14.	810.70	1.6295E-08
Fe-59	19.	1099.22	5.5029E-08
Co-60	13.	1330.42	1.2432E-08
Cu-64	0.	1345.90	Half-Life too short
Ni-65	0.	1401.84	Half-Life too short
Zn-65	13.	1115.52	2.5429E-08
Zn-69m	0.	459.63	Half-Life too short
Se-75	46.	136.00	2.1157E-08
Br-76	0.	559.10	Half-Life too short
Br-82	0.	776.49	Half-Life too short
Br-83	0.	529.64	Half-Life too short
Br-84	0.	881.50	Half-Life too short
Br-85	0.	802.41	Half-Life too short
Kr-85	61.	513.99	3.0704E-06
Kr-85m	0.	151.18	Half-Life too short
Sr-85	61.	513.99	2.4523E-08
Rb-86	14.	1076.63	1.0855E-06
Kr-87	0.	402.59	Half-Life too short
Sr-87m	0.	388.40	Half-Life too short
Kr-88	0.	196.32	Half-Life too short
Rb-88	0.	1302.39	Half-Life too short
Y-88	7.	1836.01	1.6202E-08
Kr-89	0.	220.90	Half-Life too short
Rb-89	0.	1031.88	Half-Life too short
Kr-90	0.	1118.69	Half-Life too short
Rb-90	0.	931.69	Half-Life too short
Rb-90m	0.	824.23	Half-Life too short
Y-90m	0.	202.51	Half-Life too short
Sr-91	0.	1024.30	Half-Life too short
Y-91	14.	1204.90	7.7219E-06
Y-91m	0.	555.60	Half-Life too short
Sr-92	0.	1303.74	Half-Life too short
Y-92	0.	251.46	Half-Life too short



Sample ID : EFT-SD060006 EF1

Acquisition date : 5-AUG-2006 14:04:15

Nuclide	Bkgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	598.28	Half-Life too short
Y-92	0.	256.96	Half-Life too short
NB-94	22.	702.60	9.7226E-09
NB-95	18.	765.79	3.0529E-08
FE-96	0.	235.69	Half-Life too short
ZR-95	17.	750.72	3.1659E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	27.	497.08	2.7889E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	318.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	16.	621.84	8.7614E-08
CD-109	30.	88.03	3.9239E-07
AO-110M	14.	937.48	3.5440E-08
SN-113	27.	391.69	1.7507E-08
SN-117M	62.	158.56	2.1377E-07
SB-122	0.	563.93	Half-Life too short
SB-124	25.	602.71	1.0497E-08
SB-125	23.	427.89	2.0460E-08
FE-125M	44.	109.28	7.0174E-06
TE-127	0.	417.90	Half-Life too short
YF-127M	29.	57.60	3.2594E-05
XE-127	46.	202.34	3.7801E-08
FE-129	0.	489.60	Half-Life too short
TE-129M	18.	695.88	8.0423E-07
XE-129M	53.	196.56	1.7571E-05
I-130	0.	536.09	Half-Life too short
BA-131	39.	123.00	9.3077E-07
I-131	22.	364.48	1.3071E-06
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	38.	163.93	1.1506E-05
I-132	0.	667.69	Half-Life too short
TE-132	0.	228.16	Half-Life too short
BA-133	41.	302.84	5.1158E-08
LA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.58	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	31.	694.70	1.1173E-08
I-134	0.	884.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	268.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : EFT-5D060806 EF1

Acquisition date : 5-AUG-2006 14:04:15

Nuclide	Background Sum	Energy (keV)	MDA (uCi/cc)
CS-136	9.	818.50	1.6596E-07
I-136	0.	1313.02	Half-Life too short
CS-137	15.	661.65	9.1504E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	253.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	48.	165.85	1.4129E-08
CS-139	0.	1333.03	Half-Life too short
BA-140	20.	537.32	7.4700E-07
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	40.	145.44	6.2252E-08
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	53.	133.54	1.0200E-07
FR-144	0.	1489.15	Half-Life too short
ND-147	30.	91.10	1.9297E-06
PM-148M	21.	550.27	2.3201E-08
EU-152	49.	344.27	3.8279E-08
EU-154	10.	1004.76	5.2349E-08
EU-156	13.	646.29	1.4243E-06
HF-157	22.	482.03	2.5007E-08
TA-182	14.	1221.42	6.2168E-08
W-187	0.	685.01	Half-Life too short
RE-188	0.	155.03	Half-Life too short
HG-203	40.	279.19	2.6813E-08
BI-207	26.	569.67	9.5356E-09
TL-208	0.	583.14	Half-Life too short
PB-212	0.	230.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	0.	240.98	Half-Life too short
PO-226	64.	186.21	2.9740E-07
AC-228	44.	338.32	8.5773E-08
TH-228	41.	84.37	1.4062E-06
PA-234	0.	131.20	Half-Life too short
TH-234	40.	63.29	7.1227E-06
U-235	52.	143.76	8.7485E-08
NP-239	0.	106.13	Half-Life too short
AM-241	33.	59.54	1.8157E-07

### FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-5D060806

Sample Location (Well Number): EFT-5D

1. Representative sample collected. Date/Time 06/08/06 / 1616

Sample collected by: Jay Slaback / Jay Marc Slaback <sup>Collecting</sup> Date: 06/08/06  
Printed Name / Signature <sub>Signal 02/01/07</sub>

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample ≥ 50 milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only.

Sample sealed by: Christopher Friling / Christopher A. Friling Date: 08/02/06  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: Russ Buxton Date: 2-5-7  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: William V. Linton Date: 7/15/07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks no tritium detected William V Linton 48657 07/15/07

**Sample Information**

1 . Sample Location	EFT-5D060806
2 . Date Sampled	06/08/2006
3 . Time Sampled	16:16
4 . Sample Volume, (ml)	4 ml

**Instrument Count Data**

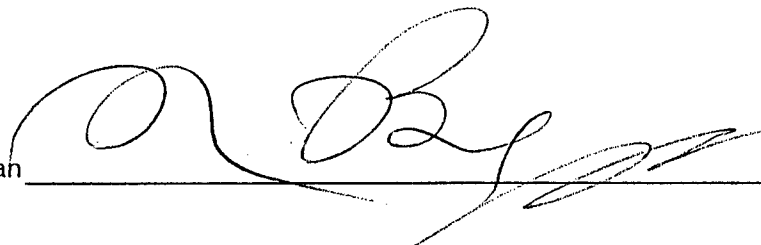
1 . Date Sample Counted	02/02/2007
2 . Time Sample Counted	10:00
3 . Background Inf.:	
Minutes Counted	10 min.
Background Count Rate (cpm)	7.4 cpm
4 . Efficiency Inf.: (Daily Spike Source ID # 111)	
Gross Spike Count Rate (cpm)	3388.1 cpm
Net Spike Count Rate (cpm)	3380.7 cpm
H3 Spike Activity (dpm on count date)	8340.7 dpm
Counter Efficiency	0.4053 cpm/dpm
5 . Sample Info:	
Sample Gross Count Rate (cpm)	7.8 cpm
Sample Count Time (min.)	10.0 min.
Net Sample Count Rate (cpm)	0.4 cpm
6 . Critical Level:	
Critical Level Count Rate (cpm)	2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \frac{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} = 1.12\text{E}-06 \text{ uCi/ml}$$

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ dpm/uCi} \times \text{Sample Volume}} < \text{MDA}$$

Technician  Date 2-5-7

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-50 121406

Sample Location (Well Number): EFT-50

1. Representative sample collected. Date/Time 12/14/06 1 1103

Sample collected by: J. Slaback / Joy Marie Slaback Date: 02/01/07  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / Jennifer Southward Date: 2/2/07  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: D. Howard / DM Howard Date: APR 20 2007  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: KD Lindsey / KD Lindsey Date: 11-14-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1 . Sample Location EFT-5D121406  
 2 . Date Sampled 12/14/2006  
 3 . Time Sampled 11:03  
 4 . Sample Volume, (ml) 4 ml

**Instrument Count Data**

1 . Date Sample Counted 04/19/2007  
 2 . Time Sample Counted 17:27  
 3 . Background Inf.:  
     Minutes Counted 10 min.  
     Background Count Rate (cpm) 7.7 cpm  
 4 . Efficiency Inf.: (Daily Spike Source ID # 111)  
     Gross Spike Count Rate (cpm) 3407.6 cpm  
     Net Spike Count Rate (cpm) 3399.9 cpm  
     H3 Spike Activity (dpm on count date) 8243.8 dpm  
     Counter Efficiency 0.4124 cpm/dpm  
 5 . Sample Info:  
     Sample Gross Count Rate (cpm) 6.5 cpm  
     Sample Count Time (min.) 10.0 min.  
     Net Sample Count Rate (cpm) 0.0 cpm  
 6 . Critical Level:  
     Critical Level Count Rate (cpm) 2.0 cpm

**Minimum Detectable Activity**

$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.12\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency x 2.22E6 uCi/ml x Sample Volume}} < \text{MDA}$$

Technician M. Howard

Date 4.20.07

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-5D 121406

Sample Location (Well Number): EFT-5D

1. Representative sample collected. Date/Time 12/14/06 | 1103

Sample collected by: J. Slaback / Jay Main Slaback Date: 02/11/07  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.

Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 7/11/07  
Printed Name / Signature 2/2/07 7/11/07

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: K. Lindsey / [Signature] Date: 8-8-07  
Fermi 2 RP Printed Name Signature

Sample number: EFT- 5D 121406

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard | [Signature] Date: 7-16-07  
Fermi 2 RP Printed Name Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: KO LINOSEY | [Signature] Date: 8-8-07  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



RADIATION PROTECTION DEPARTMENT

GAMMA SPECTROSCOPY ANALYSIS REPORT

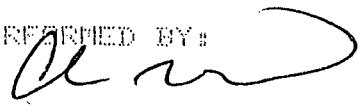
HIGH EFFICIENCY DETECTOR

Sample ID Numbers: EF1 EFT-5D121406

Sample End Time: 14-DEC-2006 11:03:00.00

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PERFORMED BY:



\_\_\_\_\_  
SIGNATURE

REVIEWED BY:



\_\_\_\_\_  
(SIGNATURE/DATE

Sample ID : EF1 EFT-5D121406

Acquisition date : 16-JUL-2007 14:48:01

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: EF1 EFT-5D121406  
 Sample collection start date: 14-DEC-2006 11:03:00.00  
 Sample collection end date : 14-DEC-2006 11:03:00.00  
 Type of sample : 1 L Mari. Liquid  
 Sample quantity : 1.000000E+03 CC  
 Sample geometry : MELL Operator: CMH

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 16-JUL-2007 14:48:01.48  
 Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00  
 Elapsed real time : 0 00:30:00.00 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.10  
 KeV/channel : 4.90730E-01 Zero offset: -1.95000E-01  
 Daily cal date : 16-JUL-2007 00:37:10.01

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : -100 End channel : 4096  
 Height sensitivity : 5.00000 Shape sensitivity : 10.00000  
 Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000  
 Abundance limit : 75.00000 Library : dacmaster.nlt  
 Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

PK-It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1 0	511.17	121	57	2.04	1023.24	1017	15	6.71E-02	16.6	annihilation
2 0	550.70	70	25	1.45	1110.51	1111	16	3.91E-02	19.8	HVC
3 0	600.99	35	25	1.71	1210.99	1214	11	1.94E-02	32.4	Bi-214
4 0	1461.11	45	7	1.01	2923.97	2917	13	2.47E-02	19.1	K-40

Sample Title : EF1 EFT 5D123406  
Decay Time = 214 03:45:01.40  
8

Page : 1  
Acquisition Time = 16 JUL 2007 14:43:01.4

Post-MID Peak Search Report

IC	Energy	Area	Stgnd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	511.17	121	57	2.04	1023.24	1017	15	16.6		
0	550.78	70	25	1.45	1110.51	1111	16	19.6		
0	600.99	35	25	1.71	1210.99	1214	11	32.4		
0	1461.11	45	7	1.01	2923.97	2917	13	19.1		K-40

Nuclide Types: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/CC	Decay Corr uCi/CC	1-Sigma %Error
K-40	1460.01	45	10.67*	2.501E+00	2.504E-07	2.504E-07	19.08

Flags: "\*" = Keyline

Total number of lines in spectrum 4  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 4 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/CC	Decay Corr uCi/CC	Decay Corr 1-Sigma Error	1-Sigma *Error Flags
K-40	1.00E+05Y	1.00	2.504E-07	2.504E-07	0.470E-07	19.08
Total Activity :			2.504E-07	2.504E-07		
Grand Total Activity :			2.504E-07	2.504E-07		

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"G" = Nuclide specific abn. limit

Nuclide	Half-life	Half-Life Ratio	Energy	%Abund	Activity (uCi/CC)	1-Sigma %Error	Rejected by
F-18	109.74M	2010.20	511.00*	193.46	1.000E+35	16.63	Decay
				% Abundances Found =	100.00		
AS-76	26.32H	195.29	559.10*	44.70	1.000E+35	19.63	Decay, Abun.
				563.23	1.17	---- Not Found ----	
				571.30	0.14	---- Not Found ----	
				657.03	6.10	---- Not Found ----	
				665.31	0.39	---- Not Found ----	
				740.12	0.12	---- Not Found ----	
				771.76	0.12	---- Not Found ----	
				867.63	0.12	---- Not Found ----	
				1129.87	0.14	---- Not Found ----	
				1212.72	1.63	---- Not Found ----	
				1216.02	3.04	---- Not Found ----	
				1220.52	1.39	---- Not Found ----	
				1439.13	0.33	---- Not Found ----	
				1453.60	0.13	---- Not Found ----	
				1707.67	0.33	---- Not Found ----	
				% Abundances Found =	73.70		
RU-103	39.35D	5.44	497.00*	09.00	9.021E-06	32.36	Abun.
				610.33	5.60	9.021E-06	32.36
				% Abundances Found =	5.92		
XE-135	9.11H	564.22	249.70*	09.00	1.000E+35	32.36	Decay, Abun.
				600.19	2.09	1.000E+35	32.36
				% Abundances Found =	3.11		
BI-214	19.90M	15497.49	609.31*	46.30	1.000E+35	32.36	Decay
				760.36	5.04	---- Not Found ----	
				934.06	3.21	---- Not Found ----	
				1120.29	15.10	---- Not Found ----	
				1230.11	5.94	---- Not Found ----	
				1377.67	4.11	---- Not Found ----	
				1764.49	15.00	---- Not Found ----	
				% Abundances Found =	40.40	(Abn. Limit = 40.40%)	

Flag: "\*" = Keyline

It	Energy	Area	Dkgnd	FWHM	Channel	Left	Pw	Cts/Sec	SEM	XEff	Flags
0	511.17	121	57	0.04	1023.24	1017	15	6.71E-02	16.6	4.00E+00	T
0	550.78	70	25	1.45	1119.51	1111	16	3.91E-02	19.6	4.60E+00	T
0	689.99	35	25	1.71	1218.99	1214	11	1.94E-02	32.4	4.52E+00	T

Flags: "T" = Tentatively associated

Minimum Detectable Activity Report

Nuclide	Background Sum	Energy (keV)	MDA (uCi/CC)
BE-7	21.	477.59	1.1145E-06
F-10	0.	511.00	Half-Life too short
NA-22	0.	1274.54	1.0634E-08
NA-24	0.	1368.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-38	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-40	11.	209.25	4.8320E-08
CR-51	27.	320.00	1.4749E-05
MN-54	9.	834.83	1.1625E-08
CO-56	12.	1238.25	1.0097E-07
MN-56	0.	1010.69	Half-Life too short
NI-58	0.	150.38	Half-Life too short
CO-57	54.	122.06	1.9423E-08
CO-58	12.	810.76	6.3349E-08
FE-59	0.	1099.22	4.2067E-07
CO-60	0.	1332.49	9.7632E-09
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1401.84	Half-Life too short
ZN-65	17.	1115.52	4.0362E-08
ZN-69M	0.	430.63	Half-Life too short
SE-75	39.	136.00	4.3474E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	601.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	36.	513.99	2.2670E-06
KR-85M	0.	151.18	Half-Life too short
SR-85	36.	513.99	9.3313E-08
RB-86	0.	1076.63	Half-Life too short
KR-87	0.	402.59	Half-Life too short
SR-87M	0.	300.40	Half-Life too short
KR-88	0.	196.32	Half-Life too short
RB-88	0.	1382.39	Half-Life too short
Y-88	4.	1036.01	3.3064E-08
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.80	Half-Life too short
KR-90	0.	1118.69	Half-Life too short
RB-90	0.	331.69	Half-Life too short
RB-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
CR-91	0.	1024.30	Half-Life too short
Y-91	5.	1204.90	3.0167E-05
Y-91M	0.	555.80	Half-Life too short
CR-92	0.	1303.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short



Sample ID : EF1 CFT-SD101406

Acquisition Date : 16 JUL 2007 14:49:01

Nuclide	Background Sum	Energy (keV)	MDA (uCi/CC)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	206.90	Half-Life too short
NB-94	19.	702.63	8.4059E-09
NB-95	11.	765.79	5.0651E-07
NB-95M	0.	235.69	Half-Life too short
ZR-95	11.	756.72	1.3226E-07
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	0.	739.58	Half-Life too short
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	22.	497.00	3.6335E-07
TC-104	0.	357.79	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	17.	621.04	1.1040E-07
CD-109	44.	80.03	5.2760E-07
AG-110M	22.	937.40	8.1339E-08
SN-113	20.	391.69	4.2402E-08
SN-117M	0.	150.56	Half-Life too short
SB-122	0.	563.93	Half-Life too short
SB-124	29.	602.71	1.1056E-07
SB-125	18.	427.09	2.4095E-08
TE-125M	40.	109.20	4.3483E-05
TE-127	0.	417.90	Half-Life too short
TE-127M	17.	57.60	7.2365E-05
XE-127	39.	202.04	6.3012E-07
TE-129	0.	459.60	Half-Life too short
TE-129M	15.	695.00	1.0603E-05
XE-129M	0.	196.56	Half-Life too short
I-130	0.	536.09	Half-Life too short
BA-131	0.	123.00	Half-Life too short
I-131	0.	364.40	Half-Life too short
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	0.	163.93	Half-Life too short
I-132	0.	667.09	Half-Life too short
TE-132	0.	220.16	Half-Life too short
BA-133	21.	392.04	4.1729E-08
BA-133M	0.	276.09	Half-Life too short
I-133	0.	529.87	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	0.	81.00	Half-Life too short
XE-133M	0.	233.22	Half-Life too short
CS-134	21.	604.70	9.0660E-09
I-134	0.	304.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	260.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short

Sample ID : CFI EFT-5D121495

Acquisition date : 16-JUL-2007 14:49:01

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/CC)
CS-136	0.	810.50	Half-Life too short
I-136	0.	1313.02	Half-Life too short
CS-137	14.	661.65	0.3723E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.06	Half-Life too short
XE-138	0.	250.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	46.	165.85	2.7930E-08
CS-139	0.	1203.23	Half-Life too short
BA-140	0.	537.32	Half-Life too short
LA-140	0.	1596.49	Half-Life too short
BA-141	0.	190.22	Half-Life too short
CE-141	45.	145.44	1.5543E-06
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	44.	133.54	1.3690E-07
PR-144	0.	1489.15	Half-Life too short
ND-147	0.	91.10	Half-Life too short
PM-148M	11.	550.27	2.1053E-07
EU-152	34.	344.27	3.0214E-08
EU-154	16.	1004.76	6.0665E-08
EU-156	0.	646.29	Half-Life too short
HF-161	10.	482.03	2.6879E-07
TA-162	9.	1221.42	1.2152E-07
W-187	0.	605.81	Half-Life too short
RC-188	0.	155.03	Half-Life too short
NO-203	54.	279.19	2.7300E-07
BI-207	20.	569.67	7.8963E-09
TL-208	0.	503.14	Half-Life too short
PE-212	0.	230.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PE-214	0.	351.92	Half-Life too short
RA-224	0.	240.90	Half-Life too short
RA-226	39.	106.21	2.1040E-07
AC-228	33.	330.32	7.1310E-08
TH-228	34.	94.37	1.4321E-06
PA-234	0.	131.20	Half-Life too short
TH-234	31.	63.29	4.8676E-04
U-235	30.	143.76	6.2643E-08
NP-239	0.	106.13	Half-Life too short
AM-241	25.	59.54	1.5090E-07

**EFT-5D**

**2007**

## FERMI 1 GROUND WATER MONITORING TRITIUM ANALYSIS CHECKLIST

Sample number: EFT-5D7307

Sample Location (Well Number): EFT-5D

1. Representative sample collected. Date/Time 7/3/07 1 1632

Sample collected by: Joy Marie Slaback / Joy Marie Slaback Date: 12/10/2007  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Prepare sample  $\geq 50$  milliliters. Seal sample adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 12/10/07  
Printed Name / Signature

3. Sample counted in accordance with 76.000.70 or 79 "Operation of the Packard TRICARB 1000 or 2100TR".

Performed by: R. Burgess / R. Burgess Date: 12/14/07  
Fermi 2 Chemistry Printed Name Signature

4. Tritium analysis printout reviewed by Radiation Protection Supervision or delegate.

Performed by: AD LINDREY / AD Lindrey Date: 7-26-08  
Fermi 2 Printed Name Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, analysis printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_

Tritium Activity Calculation

**Sample Information**

1. Sample Location 5D  
 2. Date Sampled 07/03/2007  
 3. Time Sampled 16:32  
 4. Sample Volume, (ml) 4 ml

**Instrument Count Data**

1. Date Sample Counted 12/14/2007  
 2. Time Sample Counted 08:00  
 3. Background Inf.:  
 Minutes Counted 10 min.  
 Background Count Rate (cpm) 8.2 cpm  
 4. Efficiency Inf.: (Daily Spike Source ID # 111)  
 Gross Spike Count Rate (cpm) 3189.3 cpm  
 Net Spike Count Rate (cpm) 3181.1 cpm  
 H3 Spike Activity (dpm on count date) 7944.9 dpm  
 Counter Efficiency 0.4004 cpm/dpm  
 5. Sample Info:  
 Sample Gross Count Rate (cpm) 8.1 cpm  
 Sample Count Time (min.) 10.0 min.  
 Net-Sample Count Rate (cpm) 0.0 cpm  
 6. Critical Level:  
 Critical Level Count Rate (cpm) 2.1 cpm

**Minimum Detectable Activity**

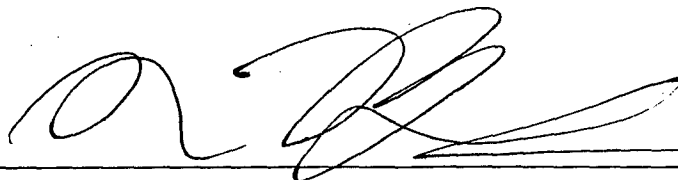
$$\text{Minimum Detectable Activity (uCi/ml)} = 3.3 \times \sqrt{\frac{(\text{Bkg cpm})}{(\text{Bkg min.})} + \frac{(\text{Bkg cpm})}{(\text{Smpl min.})}} = 1.19\text{E-}06 \text{ uCi/ml}$$

Efficiency x 2.22E6 dpm/uCi x Sample Volume

**Sample Activity**

$$\text{Sample Activity (uCi/ml)} = \frac{\text{Sample Net cpm}}{\text{Efficiency} \times 2.22\text{E}6 \text{ uCi/ml} \times \text{Sample Volume}} < \text{MDA}$$

Technician \_\_\_\_\_



Date

12/14/07

## FERMI 1 GROUND WATER MONITORING GAMMA ISOTOPIC ANALYSIS CHECKLIST

Sample number: EFT-5D7307

Sample Location (Well Number): EFT-5D

1. Representative sample collected. Date/Time 07/03/2007 1632

Sample collected by: J. Slaback / Joy Marie Slaback Date: 07/16/2007  
Printed Name / Signature

Note: Qualified Fermi 1 Personnel or other qualified individual will obtain samples

2. Sample container sealed adequately to resist tampering.  
Note: Use new sample containers only

Sample sealed by: J. Southward / J. Southward Date: 08/08/07  
Printed Name / Signature

Note: Sample containers may simply be sealed with red duct tape and initialed by the individual performing the function

3. LLD validation

LLD and Critical Level determinations within 30 days of gamma spectrometry assay; acceptable LLDs shown for radionuclides detected by gamma spectrometry.

Fermi 2 RP Gamma Scintillation Detector # 4

Performed by: KD Lindsey / KD Lindsey Date: 8-8-07  
Fermi 2 RP Printed Name Signature

Sample number: EFT-5D7307

4. Sample counted in accordance with 65.000.115 "Operation of the Gamma Spectroscopy System".  
(Note disposition of unidentified peaks in "Remarks")

Performed by: Chris Hubbard / [Signature] Date: 7-19-07  
Fermi 2 RP      Printed Name      Signature

\* Note: Samples may be counted on Chemistry's Gamma Spectroscopy System. If so, verify the critical levels and LLDs and count sample in accordance with the applicable procedure.

5. Gamma spectrometry evaluation reviewed by Radiation Protection Supervision or delegate.

Performed by: KD Lindsey / [Signature] Date: 8-8-07  
Fermi 2      Printed Name      Signature  
Radiation Protection Supervision/Delegate

Note: Return sample, intrinsic printout, and completed form to Fermi 1 Radiological Engineer

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DETOIT EDISON FERMI -2 POWER PLANT

10-JUL-2007 00:50:55.17

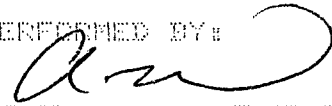
RADIATION PROTECTION DEPARTMENT  
GAMMA SPECTROSCOPY ANALYSIS REPORT  
HIGH EFFICIENCY DETECTOR

Sample ID Number: EF1 EFT-5D7307

Sample End Time: 3-JUL-2007 16:32:00.00

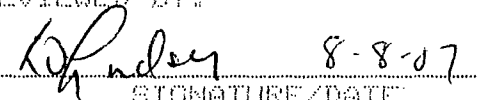
REMARKS

PERFORMED BY:



SIGNATURE

REVIEWED BY:



SIGNATURE/DATE



Sample ID : CF1 EFT-5D7307

Acquisition date : 19-JUL-2007 00:20:51

\*\*\*\*\*

Fermi 2 Radiation Protection Gamma Spectroscopy Report

\*\*\*\*\* Sample Parameters \*\*\*\*\*

Sample ID Number: CF1 EFT-5D7307
Sample collection start date: 3-JUL-2007 16:32:00.00
Sample collection end date : 3-JUL-2007 16:32:00.00
Type of sample : 1 L Mari. Liquid
Sample quantity : 1.00000E+03 cc
Sample geometry : MELL Operator: CMH

\*\*\*\*\* Acquisition Parameters \*\*\*\*\*

Detector number : DET 4 Acquire date : 19-JUL-2007 00:20:51.20
Preset live time : 0 00:30:00.00 Elapsed live time : 0 00:30:00.00
Elapsed real time : 0 00:30:00.91 Percent dead time : 0.05 %

\*\*\*\*\* Calibration Parameters \*\*\*\*\*

Detector number : DET 4 Yearly cal date : 20-JUN-2007 12:16:46.16
KeV/channel : 4.99741E-01 Zero offset: -1.77476E-01
Daily cal date : 19-JUL-2007 00:20:24.04

\*\*\*\*\* Peak Search Parameters \*\*\*\*\*

Start channel : 100 End channel : 4096
Height sensitivity : 5.00000 Shape sensitivity : 10.00000
Maximum number of iterations to resolve multiplets : 5

\*\*\*\*\* Nuclide Identification Parameters \*\*\*\*\*

Energy tolerance : 2.00000 Half-life ratio : 10.00000
Abundance limit : 75.00000 Library : dacmaster.lib
Efficiency file : EFFD4\_m211 Efficiencies at : Peak energy

\*\*\*\*\*

Table with 11 columns: Pk It, Energy, Area, Bkgnd, FWHM, Channel, Left, Pw, Cts/Sec, %Err, Fit. Contains 4 rows of peak data with handwritten notes on the right side.

Sample Title : EF1 EFT-5D7307  
Decay Time = 15 15:48:51.28

Page : 1  
Acquisition Time = 19-JUL-2007 00:20:51.2

Post-MID Peak Search Report

It	Energy	Area	Bkgrd	FWHM	Channel	Left	Pw	%Err	Fit	Nuclides
0	511.22	129	52	1.41	1003.32	1016	16	15.2		
0	558.76	60	25	1.78	1110.43	1111	12	20.9		
0	610.90	35	28	1.99	1222.77	1217	13	40.4		
0	1460.92	54	7	2.22	2923.56	2916	13	16.9		K-40

Nuclide Line Activity Report  
Sample ID : EF1 EFT-SD7387

Page : 2  
Acquisition date : 19-JUL-2007 09:20:51

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected uCi/cc	Decay Corr uCi/cc	1-Sigma %Error
K-40	1460.81	54	10.67*	2.501E+00	3.010E-07	3.010E-07	16.94

Flag: "\*" = Keyline

Summary of Nuclide Activity  
Sample ID : E71 EFT-5D7307

Page : 3  
Acquisition date : 19-JUL-2007 00:20:51

Total number of lines in spectrum 4  
Number of unidentified lines 0  
Number of lines tentatively identified by NID 4 100.00%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected uCi/cc	Decay Corr uCi/cc	Decay Corr 1-Sigma Error	1-Sigma Error	Flags
K-40	1.20E+05Y	1.00	3.010E-07	3.010E-07	0.507E-07	16.94	
Total Activity :			3.010E-07	3.010E-07			

Grand Total Activity : 3.010E-07 3.010E-07

Flags: "K" = Keyline not found  
"E" = Manually edited

"M" = Manually accepted  
"A" = Nuclide specific abn. limit

Rejected Report  
 Sample ID : E71 EFT-507307

Page : 4  
 Acquisition date : 19-JUL-2007 08:20:51

Nuclide	Half-Life		Energy	%Abund	Activity 1-Sigma		Rejected by
	Half-life	Ratio			(uCi/cc)	%Error	
F-18	109.74M	205.61	511.00*	193.46	1.000E+35	15.25	Decay
% Abundances Found =				100.00			
AC-76	26.32H	14.29	559.10*	44.70	8.649E-04	20.78	Decay, Abun.
			563.23	1.17	---	Not Found	---
			571.30	0.14	---	Not Found	---
			657.03	6.10	---	Not Found	---
			665.31	0.39	---	Not Found	---
			740.12	0.12	---	Not Found	---
			771.75	0.12	---	Not Found	---
			867.63	0.12	---	Not Found	---
			1129.87	0.14	---	Not Found	---
			1212.72	1.63	---	Not Found	---
			1216.02	3.04	---	Not Found	---
			1228.52	1.39	---	Not Found	---
			1439.13	0.33	---	Not Found	---
			1453.00	0.13	---	Not Found	---
			1707.67	0.33	---	Not Found	---
% Abundances Found =				73.70			
RU-103	39.35D	0.40	497.00*	89.00	---	Not Found	---
			610.33	5.60	2.742E-07	40.39	Abun.
% Abundances Found =				5.92			
PM-140M	41.30D	0.30	200.11	12.56	---	Not Found	---
			414.07	10.66	---	Not Found	---
			432.70	5.35	---	Not Found	---
			501.26	6.75	---	Not Found	---
			550.27*	94.90	---	Not Found	---
			599.74	12.54	---	Not Found	---
			611.26	5.48	2.766E-07	40.39	
			629.97	89.00	---	Not Found	---
			725.70	32.80	---	Not Found	---
			915.33	17.17	---	Not Found	---
			1013.01	20.30	---	Not Found	---
% Abundances Found =				1.74			
BI-214	19.90M	1133.06	609.31*	46.30	1.000E+35	40.39	Decay
			760.36	5.04	---	Not Found	---
			934.06	3.21	---	Not Found	---
			1120.29	15.10	---	Not Found	---
			1230.11	5.94	---	Not Found	---
			1377.67	4.11	---	Not Found	---
			1764.49	15.00	---	Not Found	---
% Abundances Found =				40.48	(Abn. Limit = 40.48%)		

Flags: "\*" = Keyline

Unidentified Energy Lines  
Sample ID : EF1 EFT-507307

Page : 5  
Acquisition date : 19-JUL-2007 00:00:51

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
0	511.22	129	52	1.41	1023.32	1016	16	7.19E-02	15.2	4.60E+00	T
0	558.76	60	25	1.70	1110.43	1111	12	3.35E-02	20.0	4.60E+00	T
0	610.90	35	20	1.09	1222.77	1217	13	1.95E-02	40.4	4.51E+00	T

Flags: "T" = Tentatively associated

\* Detroit Edison Fermi 2 MDA Report, Generated 19-JUL-2007 00:50:59.01 \*  
 \* Sample ID : EF1 EFT 5D7307 \*

Minimum Detectable Activity Report

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
BE-7	27.	477.59	9.4000E-08
F-10	0.	511.00	Half-Life too short
NA-22	10.	1274.54	9.6624E-09
NA-24	0.	1360.53	Half-Life too short
MG-27	0.	1014.44	Half-Life too short
CL-33	0.	1642.42	Half-Life too short
AR-41	0.	1293.64	Half-Life too short
SC-46	16.	899.25	1.1136E-08
CR-51	30.	320.00	1.0034E-07
MM-54	13.	834.83	9.6222E-09
CO-56	10.	1230.25	1.0317E-08
MM-56	0.	1010.69	Half-Life too short
NI-56	49.	150.30	4.7406E-08
CO-57	51.	122.06	1.1375E-08
CO-58	6.	810.76	6.0444E-09
FE-59	0.	1009.22	1.0301E-08
CO-60	17.	1332.49	1.2700E-08
CU-64	0.	1345.90	Half-Life too short
NI-65	0.	1401.04	Half-Life too short
ZN-65	9.	1115.52	1.7470E-08
ZN-69M	0.	430.63	Half-Life too short
SE-75	36.	136.00	1.3492E-08
AS-76	0.	559.10	Half-Life too short
BR-82	0.	776.49	Half-Life too short
BR-83	0.	529.64	Half-Life too short
BR-84	0.	801.50	Half-Life too short
BR-85	0.	802.41	Half-Life too short
KR-85	42.	513.99	2.3545E-06
KR-85M	0.	151.10	Half-Life too short
SR-85	42.	513.99	1.2025E-08
RB-86	9.	1076.63	1.7170E-07
KR-87	0.	402.50	Half-Life too short
SR-87M	0.	300.40	Half-Life too short
KR-88	0.	190.32	Half-Life too short
RB-88	0.	1302.39	Half-Life too short
Y-88	4.	1036.01	9.4754E-09
KR-89	0.	220.90	Half-Life too short
RB-89	0.	1031.00	Half-Life too short
KR-90	0.	1110.69	Half-Life too short
RB-90	0.	831.69	Half-Life too short
RD-90M	0.	824.23	Half-Life too short
Y-90M	0.	202.51	Half-Life too short
SR-91	0.	1024.30	Half-Life too short
Y-91	13.	1204.90	4.2261E-06
Y-91M	0.	555.60	Half-Life too short
SR-92	0.	1393.94	Half-Life too short
Y-92	0.	934.46	Half-Life too short

## Minimum Detectable Activity Report (continued)

Page : 2

Sample ID : EF1 EFT-5D7307

Acquisition date : 19-JUL-2007 00:20:51

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
SR-93	0.	590.20	Half-Life too short
Y-93	0.	266.90	Half-Life too short
NB-94	14.	702.63	7.3636E-09
NB-95	14.	765.79	1.0020E-08
NB-95M	47.	235.69	6.6307E-07
ZR-95	6.	756.72	1.1777E-08
NB-97	0.	657.90	Half-Life too short
ZR-97	0.	743.36	Half-Life too short
MO-99	16.	739.50	3.3232E-06
TC-99M	0.	140.50	Half-Life too short
TC-101	0.	306.01	Half-Life too short
RU-103	33.	497.00	1.3175E-08
TC-104	0.	357.99	Half-Life too short
RH-105	0.	310.90	Half-Life too short
RU-105	0.	724.50	Half-Life too short
RU-106	17.	621.04	7.7755E-08
CD-109	39.	88.03	3.7388E-07
AG-110M	16.	937.40	3.0493E-08
SN-113	29.	391.69	1.2910E-08
SN-117M	47.	158.56	2.0090E-08
SB-122	10.	563.93	5.6742E-07
SB-124	20.	602.71	9.5410E-09
SB-125	34.	427.09	2.9347E-08
TE-125M	40.	109.20	4.0014E-06
TE-127	0.	417.90	Half-Life too short
TE-127M	32.	57.60	2.6939E-05
XE-127	36.	202.04	1.3970E-08
TE-129	0.	459.60	Half-Life too short
TE-129M	15.	695.00	3.1399E-07
XE-129M	47.	196.56	5.6093E-07
I-130	0.	536.09	Half-Life too short
BA-131	52.	123.00	0.0602E-08
I-131	23.	364.40	3.1677E-08
TE-131	0.	149.72	Half-Life too short
TE-131M	0.	773.67	Half-Life too short
XE-131M	43.	163.93	9.4600E-07
I-132	0.	667.69	Half-Life too short
TE-132	33.	220.16	2.2123E-07
BA-133	44.	302.04	4.6960E-08
BA-133M	30.	276.09	3.4252E-05
I-133	0.	529.07	Half-Life too short
TE-133M	0.	912.50	Half-Life too short
XE-133	43.	81.00	3.7547E-07
XE-133M	40.	233.22	1.0557E-05
CS-134	10.	604.70	7.6914E-09
I-134	0.	604.09	Half-Life too short
TE-134	0.	210.47	Half-Life too short
BA-135M	0.	260.24	Half-Life too short
I-135	0.	1260.41	Half-Life too short
XE-135	0.	249.79	Half-Life too short
XE-135M	0.	526.56	Half-Life too short



## Minimum Detectable Activity Report (continued)

Page : 3

Sample ID : EF1 EFT-5D7307

Acquisition date : 19-JUL-2007 00:20:51

Nuclide	Bckgnd Sum	Energy (keV)	MDA (uCi/cc)
CS-136	0.	810.50	1.5620E-00
I-136	0.	1313.02	Half-Life too short
CS-137	14.	661.65	8.2371E-09
XE-137	0.	455.49	Half-Life too short
CS-138	0.	1435.86	Half-Life too short
XE-138	0.	250.31	Half-Life too short
BA-139	0.	1420.50	Half-Life too short
CE-139	37.	165.85	9.3452E-09
CS-139	0.	1203.23	Half-Life too short
DA-140	12.	537.32	5.5969E-00
LA-140	9.	1596.49	7.3165E-06
BA-141	0.	190.22	Half-Life too short
CE-141	53.	145.44	2.4352E-00
LA-141	0.	1354.52	Half-Life too short
BA-142	0.	255.12	Half-Life too short
LA-142	0.	641.17	Half-Life too short
CE-143	0.	293.26	Half-Life too short
CE-144	41.	133.54	7.5078E-00
PR-144	0.	1409.15	Half-Life too short
ND-147	35.	91.10	1.1569E-07
PM-148M	19.	550.27	1.0037E-00
EU-152	39.	344.27	3.1300E-00
EU-154	5.	1004.76	3.5501E-00
EU-156	14.	646.29	1.9469E-07
NF-181	10.	402.03	1.0443E-00
TA-182	6.	1221.42	3.0270E-00
W-187	0.	605.01	Half-Life too short
RE-188	0.	155.03	Half-Life too short
NO-200	32.	279.19	1.1551E-00
BI-207	25.	569.67	0.6462E-09
TL-208	0.	503.14	Half-Life too short
PD-212	0.	230.63	Half-Life too short
BI-214	0.	609.31	Half-Life too short
PB-214	0.	351.92	Half-Life too short
RA-224	42.	240.98	3.9700E-06
RA-226	43.	186.21	2.2642E-07
AC-228	39.	338.32	7.2596E-00
TH-228	24.	04.37	9.9901E-07
PA-234	0.	131.20	Half-Life too short
TH-234	41.	63.29	1.0442E-06
U-235	54.	143.76	0.1376E-00
NP-239	42.	106.13	4.4779E-06
AM-241	26.	59.54	1.6123E-07