(3,058 Pages)

Group CV

(Records Withheld In Part)

プレス発表資料

ダストサンプリングの測定結果（１／２）

□ :枠内は新規追加データ。

平成23年4月1日10時00分現在
文部科学省

測定試料採取点	採取日時	放射能濃度(Bq/m^3)		空間線量率（μSv/h)	備考
		^{131}I	^{137}Cs		
【1-1】(約45km北西)	3月23日 10:45～10:55	4.0	1.2	5.5	【3】
【1-2】(約40km北西)	3月23日 10:50～11:10	5.2	<1.2	9.0	【36】
【1-3】(約30km西北西)	3月23日 13:54～14:17	8.0	<1.4	9.4	【21】
【1-4】(約35km西)	3月23日 12:40～13:02	2.8	<1.1	2.3	【15】
【1-4】(約35km西)1回目	3月24日 10:58～11:09	3.1	<0.99	2	
【1-4】(約35km西)2回目	3月24日 11:58～12:09	2.4	1.3	2.8	
【1-4】(約35km西)3回目	3月24日 12:58～13:09	2.5	<1.2	2.5	
【1-4】(約35km西)4回目	3月24日 13:58～14:09	2.2	1.6	2.2	
【1-4】(約35km西)5回目	3月24日 14:58～15:09	2.8	<1.2	2.5	
【1-4】(約35km西)6回目	3月24日 15:58～16:09	2.1	<1.0	2.2	
【1-5】(約25km南)走行測定1回目	3月23日 13:15～13:58	530.0	6.6	5.5～14.0	【71】
【1-5】(約25km南)走行測定2回目	3月23日 14:30～15:10	180.0	2.3	5.5～14.0	
【1-5】(約25km南)走行測定3回目	3月23日 15:20～15:59	110.0	2.1	5.5～14.0	
【1-5】(約25km南)走行測定1回目	3月24日 10:06～10:44	5.9	<0.66	5.6	
【1-5】(約25km南)走行測定2回目	3月24日 10:53～11:33	9.2	<0.71	5.6	
【1-5】(約25km南)走行測定3回目	3月24日 11:44～12:26	12.0	1.1	5.6	
【1-5】(約25km南)走行測定	3月25日 11:51～12:38	43.0	2.0	4.1～5.5	
【1-5】(約25km南)1回目	3月25日 13:12～13:42	23.0	1.4	2	
【1-5】(約25km南)2回目	3月25日 14:12～14:42	19.0	1.3	2.8	
【1-5】(約25km南)3回目	3月25日 15:12～15:42	24.0	2.5	2.5	
【1-5】(約25km南)4回目	3月25日 16:12～16:42	10.0	1.3	2.2	
【1-5】(約25km南)1回目	3月26日 12:47～13:21	13.0	1.3	3.9	
【1-5】(約25km南)2回目	3月26日 14:21～14:57	10.0	1.5	3.9	
【1-5】(約25km南)走行測定1回目	3月27日 12:36～13:26	20.0	0.8	2.8～3.8	
【1-5】(約25km南)1回目	3月27日 13:58～14:33	7.1	<0.98	3.8	
【1-5】(約25km南)2回目	3月27日 15:33～16:08	6.6	<1.0	3.8	
【1-5】(約25km南)3回目	3月27日 16:16～16:53	10.0	<1.1	3.8	
【1-5】(約25km南)走行測定2回目	3月27日 14:43～15:18	5.5	1.2	2.8～3.8	
【1-5】(約25km南)1回目	3月28日 9:48～13:03	6.6	0.57	3.0	
【1-5】(約25km南)2回目	3月28日 13:23～14:07	54.0	8.0	3.0	
【1-5】(約25km南)3回目	3月28日 14:18～15:19	20.0	3.0	3.0	
【1-5】(約25km南)1回目	3月31日 12:22～13:12	24.0	4.5	2.1	
【1-5】(約25km南)2回目	3月31日 13:17～14:01	18.0	1.3	2.0	
【1-5】(約25km南)3回目	3月31日 14:06～14:50	13.0	1.0	1.9	
【1-5】(約25km南)4回目	3月31日 15:00～15:44	13.0	<0.79	2.0	
【1-7】(約40km北)1回目	3月25日 12:58～13:09	3.5	<0.99	3.2	【7】
【1-7】(約40km北)1回目	3月25日 13:58～14:09	4.3	1.6	3.2	
【1-7】(約40km北)1回目	3月25日 14:57～15:08	15.0	<0.98	3.2	
【1-7】(約40km北)1回目	3月25日 15:58～16:09	22.0	1.1	3.2	
【1-7】(約40km北)1回目	3月26日 11:27～11:38	2.9	1.0	1.5	
【1-7】(約40km北)1回目	3月26日 13:00～13:11	2.2	1.3	1.5	
【1-8】(約45km北)1回目	3月28日 13:00～16:00	19.0	3.2	0.6～1.2	【5】

測定試料採取点	採取日時	放射能濃度(Bq/m^3)		空間線量率 (μSv/h)	備考
		^{131}I	^{137}Cs		
【2-1】(約40km北西)1回目	3月29日 12:50～13:45	4.2	0.73	7.0	【61】
【2-1】(約40km北西)2回目	3月29日 13:49～14:46	3.4	0.79	7.0	
【2-1】(約40km北西)3回目	3月29日 14:47～15:50	2.9	<0.74	7.0	
【2-1】(約40km北西)1回目	3月30日 11:15～11:35	4.8	<1.8	6.7	
【2-1】(約40km北西)2回目	3月30日 12:15～12:35	4.7	2.00	7.2	
【2-1】(約40km北西)3回目	3月30日 13:15～13:35	3.4	1.80	7.0	
【2-1】(約40km北西)4回目	3月30日 14:15～14:35	28.0	20.00	7.4	
【2-1】(約40km北西)5回目	3月30日 15:15～15:35	7.7	1.90	7.5	
【2-4】(約25km北)1回目	3月29日 11:17～12:15	75.0	46.0	1.7	【80】
【2-4】(約25km北)2回目	3月29日 12:15～13:15	29.0	34.0	0.4	
【2-4】(約25km北)3回目	3月29日 13:15～14:15	32.0	23.0	0.6	
【2-4】(約25km北)4回目	3月29日 14:15～15:00	29.0	25.0	0.5	
【2-4】(約25km北)1回目	3月30日 11:09～11:29	1.8	0.5	0.0	
【2-4】(約25km北)2回目	3月30日 12:10～12:30	1.6	0.5	0.8	
【2-4】(約25km北)3回目	3月30日 13:10～13:30	1.2	0.4	0.2	
【2-4】(約25km北)4回目	3月30日 14:10～14:30	1.5	0.5	0.3	
【2-4】(約25km北)5回目	3月30日 15:10～15:30	1.1	<0.49	0.6	
【2-7】(約35Km北西)	3月29日 12:00～13:00	0.95	0.59	8.0	【46】
【2-7】(約35Km北西)	3月29日 13:00～14:00	0.66	<0.70	8.0	
【2-7】(約35Km北西)	3月29日 14:00～15:00	0.75	<0.76	8.0	
【2-7】(約35Km北西)	3月29日 15:00～16:00	0.90	<0.58	8.0	
【2-7】(約35Km北西)	3月29日 16:00～17:00	0.69	<0.59	8.0	
【2-7】(約35km北西)1回目	3月30日 12:11～12:31	1.9	1.0	13.9	
【2-7】(約35km北西)2回目	3月30日 13:11～13:33	1.3	1.0	15.2	
【2-7】(約35km北西)3回目	3月30日 14:11～14:32	89.0	91.0	14.6	
【2-7】(約35km北西)4回目	3月30日 15:11～15:32	180.0	140.0	15.0	
【3-1】(約30km北西)1回目	3月24日 11:20～11:41	43.0	2.0	30	【33】
【3-1】(約30km北西)2回目	3月24日 12:20～12:40	3.3	<0.98	30	
【3-1】(約30km北西)3回目	3月24日 13:20～13:42	3.8	<1.2	30	
【3-1】(約30km北西)4回目	3月24日 14:20～14:42	3.8	1.5	30	
【3-1】(約30km北西)5回目	3月24日 15:20～15:42	3.3	1.7	30	
【3-1】(約30km北西)1回目	3月26日 11:38～12:00	5.8	4.8	26	
【3-1】(約30km北西)2回目	3月26日 13:18～13:39	5.2	2.2	26	
【3-1】(約30km北西)1回目	3月28日 11:31～11:52	2.6	1.8	26	
【3-1】(約30km北西)2回目	3月28日 12:53～13:15	2.7	<1.2	26	
【3-1】(約30km北西)1回目	3月29日 11:18～11:40	2.4	1.1	18.9	
【3-1】(約30km北西)2回目	3月29日 13:23～13:50	1.9	<1.0	－	

備考欄の番号は、モニタリングカーによる測定箇所を示す。
空間線量率は、別途発表済み。

ダストサンプリングの測定結果(2/2)

□ :枠内は新規追加データです。

採取地点	採取日時		放射能濃度(Bq/m³)		空間線量率
			131I	137Cs	(μSv/h)
【1】(約60km北西)	3月19日	18:30～18:50	1.22	ND	7.2
	3月20日	18:30～18:50	203.00	32.20	5.0
	3月21日	18:30～18:50	2.50	ND	4.5
	3月22日	18:30～18:50	3.06	ND	5.2
	3月23日	19:38～19:58	3.69	1.20	4.0
	3月24日	18:30～18:55	ND	ND	3.6
	3月25日	19:10～19:20	24.00	14.20	2.5
	3月26日	18:30～18:40	1.75	ND	2.5
	3月27日	18:30～18:50	0.87	ND	3.5
	3月28日	18:33～18:43	1.13	ND	3.2
	3月29日	18:30～18:50	1.56	ND	2.1
	3月30日	18:40～19:00	0.91	ND	2.0
【2-1】(約40km北西)	3月21日	13:00～13:20	12.80	2.37	4.1
	3月22日	12:26～12:46	5.87	ND	4.2
	3月23日	12:50～13:10	2.99	ND	16.8
	3月24日	13:30～13:50	5.80	1.51	10.0
	3月25日	12:45～13:05	5.87	ND	12.3
	3月26日	12:26～12:46	5.39	1.33	7.8
	3月27日	12:06～12:26	2.22	ND	11.2
	3月28日	12:05～12:25	1.66	ND	9.6
	3月29日	12:07～12:27	2.42	6.79	9.2
	3月30日	13:22～13:42	3.47	LTD	8.5
【2-2】(約45km北西)	3月22日	11:10～11:30	10.50	ND	7.8
	3月23日	11:31～11:51	1.47	ND	6.0
	3月24日	11:20～11:40	1.47	ND	2.0
	3月25日	11:25～11:45	2.15	ND	7.5
	3月26日	11:10～11:30	1.19	ND	4.3
	3月27日	10:50～11:10	2.97	ND	5.5
	3月28日	11:00～11:20	1.66	0.87	5.5
	3月29日	11:30～11:23	1.10	2.02	4.8
	3月30日	11:37～11:57	1.38	1.11	4.6
【2-3】(約40km西)	3月21日	12:30～12:50	3.74	ND	0.9
	3月22日	11:32～11:52	3.92	ND	2.2
	3月23日	11:50～12:10	1.75	ND	1.0
	3月24日	12:12～12:32	0.97	ND	–
	3月25日	13:33～13:53	37.00	1.45	0.8
	3月26日	11:52～12:12	1.77	ND	0.8
	3月27日	11:48～12:08	1.07	ND	0.8
	3月28日	11:39～11:59	ND	ND	0.7
	3月29日	13:44～13:54	2.29	0.63	0.7
	3月30日	12:25～12:35	1.59	ND	0.5

採取地点	採取日時		放射能濃度(Bq/m^3) ^{131}I	放射能濃度(Bq/m^3) ^{137}Cs	空間線量率 (μSv/h)
【2-4】(約25km北)	3月21日	14:20〜14:40	13.20	0.74	2.8
	3月22日	13:35〜13:55	3.81	ND	1.8
	3月23日	14:10〜14:30	2.62	ND	1.1
	3月24日	14:55〜15:15	193.00	2.94	1.2
	3月25日	14:20〜14:40	16.10	ND	0.7
	3月26日	13:57〜14:17	2.62	ND	1.3
	3月27日	13:38〜13:58	1.31	ND	1.4
	3月28日	13:30〜13:50	16.40	2.80	0.7
	3月29日	13:30〜13:50	63.40	38.60	1.0
	3月30日	14:50〜15:10	ND	LTD	0.0〜1.3
【2-5】(約40km南西)	3月20日	13:57〜14:17	24.00	1.75	0.6
	3月21日	13:37〜13:57	2.69	ND	0.5
	3月22日	12:32〜12:52	6.29	ND	0.4
	3月23日	12:50〜13:10	1.86	ND	0.5
	3月24日	13:21〜13:41	1.19	ND	−
	3月25日	13:35〜13:55	12.40	ND	0.4
	3月26日	11:55〜12:15	ND	ND	0.6
	3月27日	11:05〜11:25	1.04	ND	0.5
	3月28日	11:25〜11:45	0.82	ND	−
	3月29日	11:25〜11:45	0.89	ND	0.3
	3月30日	11:00〜11:20	ND	ND	0.3
【2-6】(約45km南)	3月20日	15:25〜15:45	6.89	ND	0.6
	3月21日	15:00〜15:20	28.90	ND	1.5
	3月22日	14:00〜14:20	17.00	ND	0.6
	3月23日	14:15〜14:35	6.93	ND	1.0
	3月24日	15:12〜15:32	8.25	ND	1.4
	3月25日	13:47〜14:07	40.60	ND	1.1
	3月27日	12:30〜12:50	1.55	ND	0.8
	3月28日	13:10〜13:30	3.56	ND	0.3
	3月29日	12:55〜13:15	2.68	ND	0.7
	3月30日	12:32〜12:52	4.59	1.56	0.3
【2-7】(約35km北西)	3月25日	15:05〜15:22	555.00	12.40	12.0
	3月26日	14:06〜14:26	1.54	ND	8.8
	3月27日	13:51〜14:11	1.02	ND	8.7
	3月28日	13:39〜13:59	2.14	ND	8.4
	3月29日	15:02〜15:12	3.51	1.46	8.0
	3月30日	14:05〜14:15	1.33	0.89	13.9〜15.4
【2-8】(約50km北西)	3月24日	12:05〜12:25	2.71	ND	−
	3月25日	16:13〜16:33	34.00	ND	−
	3月26日	15:15〜15:35	ND	ND	−
	3月27日	14:52〜15:12	ND	ND	−
	3月28日	14:38〜14:58	ND	ND	−
	3月29日	15:59〜16:09	1.60	ND	1.6
	3月30日	16:05〜16:15	2.09	0.77	−

採取地点	採取日時		放射能濃度(Bq/m^3)		空間線量率
			^{131}I	^{137}Cs	(μSv/h)
【2-9】(約45km西北西)	3月25日	11:32～11:52	8.67	ND	–
	3月26日	10:10～10:30	7.98	ND	–
	3月27日	10:28～10:48	ND	ND	–
	3月28日	10:12～10:32	0.78	ND	–
	3月29日	11:56～12:06	2.53	0.59	–
	3月30日	11:00～11:10	1.54	ND	–
【2-10】(約50km北)	3月25日	16:25～16:45	33.60	0.84	–

上記測定結果は政府現地対策本部が、福島県に依頼し、その結果を入手したもの。

土壌モニタリング結果

□ :枠内は新規追加データです。太字下線は訂正箇所。

測定試料採取点	採取日時	放射能濃度(Bq/kg)		空間線量率	備考
		^{131}I	^{137}Cs	(μSv/h)	
【1-1】(約45km北西)	3月31日 11:19	29,000	9,400	4.8	【3】
【2】(約55km北西)	3月31日 10:20	48,000	15,000	4.1	【2】
【2】(約55km北西)	3月31日 11:08	24,000	21,000	4.4	【2】
【2】(約55km北西)	3月31日 14:35	16,000	6,300	2.1	【2】
【3-1】(約30km北西)	3月23日 11:10	200,000	45,000	103.0	【33】
【3-1】(約30km北西)	3月25日 14:45	251,000	60,100	27.0	【33】
【3-1】(約30km北西)	3月26日 10:55	7,500	1,500	26.0	【33】
【3-1】(約30km北西)	3月27日 12:15	93,000	29,000	26.0	【33】
【3-1】(約30km北西)	3月28日 11:18	110,000	36,000	43.0	【33】
【3-1】(約30km北西)	3月30日 11:30	190,000	70,000	17.3	【33】
【3-2】(約30km北西)	3月23日 13:17	92,000	15,000	15.0	【34】
【3-3】(約35km西)	3月23日 12:50	11,000	3,300	2.3	【15】
【3-3】(約35km西)	3月24日 12:58	4,900	220	2.5	【15】
【3-4】(約40km北西)	3月23日 11:08	33,000	8,600	2.8	【11】
【3-5】(約50km北西)	3月23日 10:30	4,200	770	2.8	【4】
【3-6】(約30km西北西)	3月23日 14:00	70,000	12,000	9.4	【21】
【3-6】(約30km西北西)	3月26日 15:33	13,000	2,900	6.5	【21】
【3-6】(約30km西北西)	3月28日 11:03	14,000	4,600	5.3	【21】
【3-6】(約30km西北西)	3月29日 11:34	25,000	7,100	−	【21】
【3-7】(約25km南)	3月23日 13:00	69,000	2,600	14.0	【71】
【3-8】(約25km南)	3月23日 16:22	140,000	2,900	14.0	【71】
【3-9】(約45km北)	3月25日 11:24	6,900	1,600	2.7	【5】
【3-9】(約45km北)	3月26日 10:48	6,900	1,600	1.0	【5】
【3-9】(約45km北)	3月26日 12:30	110,000	2,800	1.0	【5】
【3-9】(約45km北)	3月28日 13:00	12,000	4,100	0.6～1.2	【5】
【3-10】(約40km北)	3月25日 12:18	11,000	3,300	3.7	【6】
【3-10】(約40km北)	3月26日 11:12	14,000	3,800	1.5	【6】
【3-10】(約40km北)	3月28日 10:32	11,000	3,600	1.2	【6】
【3-10】(約40km北)	3月29日 15:20	8,400	3,200	1.3	【6】
【3-10】(約40km北)	3月30日 15:54	6,100	2,000	1.4	【6】
【3-10】(約40km北)	3月31日 12:18	9,600	4,700	1.3	【6】
【3-11】(約40km北)	3月25日 12:33	8,000	1,300	3.2	【7】
【3-11】(約40km北)	3月26日 11:33	13,000	4,300	1.5	【7】
【3-11】(約40km北)	3月28日 10:38	8,200	2,000	3.3	【7】
【3-12】(約30km西北西)	3月25日 14:13	29,000	627	30.5	【31】
【3-12】(約30km西北西)	3月26日 10:15	22,000	1,600	17.8	【31】
【3-12】(約30km西北西)	3月26日 10:40	290,000	33,000	46.0	【31】
【3-12】(約30km西北西)	3月26日 10:55	15,000	3,000	26.0	【31】
【3-12】(約30km西北西)	3月27日 11:30	120,000	27,000	25.0	【31】
【3-12】(約30km西北西)	3月28日 10:29	120,000	28,000	23.0	【31】
【3-12】(約30km西北西)	3月29日 9:59	710,000	220,000	18.3	【31】
【3-12】(約30km西北西)	3月29日 10:57	660,000	94,000	43.0	【31】
【3-12】(約30km西北西)	3月29日 11:18	220,000	65,000	18.9	【31】
【3-12】(約30km西北西)	3月30日 10:50	710,000	290,000	16.3	【31】
【3-13】(約30km北西)	3月25日 14:30	88,700	9,260	65.0	【32】
【3-13】(約30km北西)	3月27日 11:55	550,000	80,000	45.0	【32】
【3-13】(約30km北西)	3月28日 10:51	210,000	9,200	50.0	【32】
【3-13】(約30km北西)	3月30日 11:08	260,000	52,000	41.6	【32】
【3-14】(約40km北西)	3月25日 15:35	73,000	18,000	7.0	【36】
【3-14】(約40km北西)	3月26日 19:30	49,000	9,300	7.8	【36】
【3-14】(約40km北西)	3月28日 9:15	65,000	21,000	8.0	【36】
【3-14】(約40km北西)	3月29日 9:41	63,000	21,000	6.0	【36】
【3-14】(約40km北西)	3月30日 10:18	71,000	24,000	5.6	【36】
【3-14】(約40km北西)	3月31日 10:21	59,000	28,000	5.3	【36】
【3-15】(約25km南)	3月25日 14:15	560	410	5.5	【71】

【3-15】(約25km南)	3月26日　12:55	31,000	1,800	3.9	【71】
【3-15】(約25km南)	3月28日　9:54	42,000	1,500	3.0	【71】
【72】(約30km南)	3月31日　12:00	18,000	1,500	1.5	【72】
【73】(約35km南)	3月31日　12:39	13,000	1,100	1.3	【73】
【74】(約35km南)	3月31日　13:18	4,300	330	0.5	【74】
【75】(約45km南)	3月31日　14:03	14,000	650	0.7	【75】
【83】(約20km北西)	3月30日　15:40	340,000	170,000	59.3	【83】
【3-16】(約45km北西)	3月28日　16:18	7,800	3,500	1.7	-

備考欄の番号は、モニタリングカーによる測定箇所を示す。

環境試料の測定結果

□ :枠内は新規追加データです。

採取地点	市町村名	試料名	種類又は部位	採取日時	放射能濃度(Bq/kg) ^{131}I	放射能濃度(Bq/kg) ^{137}Cs	空間線量率(μSv/h)	備考
【2-1】(約40km北西)	飯舘村	雑草	葉菜	3月18日 12:20	2,520,000	1,800,000	30以上	
【2-1】(約40km北西)	飯舘村	雑草	葉菜	3月19日 11:40	845,000	1,010,000	26.5	
【2-1】(約40km北西)	飯舘村	雑草	葉菜	3月20日 12:40	2,540,000	2,650,000	25.8	
【2-1】(約40km北西)	飯舘村	雑草	葉菜	3月21日 12:32	1,330,000	1,240,000	20.4	
【2-1】(約40km北西)	飯舘村	雑草	葉菜	3月22日 12:00	1,110,000	1,600,000	15.3	
【2-1】(約40km北西)	飯舘村	雑草	葉菜	3月23日 11:30	819,000	1,620,000	16.8	
【2-1】(約40km北西)	飯舘村	雑草	葉菜	3月24日 13:05	805,000	1,050,000	13.2	
【2-1】(約40km北西)	飯舘村	雑草	葉菜	3月25日 12:20	400,000	398,000	12.3	
【2-1】(約40km北西)	飯舘村	雑草	葉菜	3月26日 12:00	1,030,000	2,870,000	10.2	
【2-1】(約40km北西)	飯舘村	雑草	葉菜	3月27日 11:40	508,000	910,000	11.2	
【2-1】(約40km北西)	飯舘村	雑草	葉菜	3月28日 11:50	381,000	480,000	9.6	
【2-1】(約40km北西)	飯舘村	雑草	葉菜	3月29日 11:10	330,000	311,000	9.2	
【2-1】(約40km北西)	飯舘村	雑草	葉菜	3月30日 12:25	576,000	1,890,000	8.5	
【2-2】(約45km北西)	川俣町	雑草	葉菜	3月18日 11:45	173,000	72,800	−	
【2-2】(約45km北西)	川俣町	雑草	葉菜	3月19日 11:00	184,000	65,100	−	
【2-2】(約45km北西)	川俣町	雑草	葉菜	3月20日 12:05	308,000	138,000	4.2	
【2-2】(約45km北西)	川俣町	雑草	葉菜	3月21日 12:03	315,000	120,000	3.5	
【2-2】(約45km北西)	川俣町	雑草	葉菜	3月22日 11:00	180,000	89,000	7.8	
【2-2】(約45km北西)	川俣町	雑草	葉菜	3月23日 11:30	170,000	73,700	5.5	
【2-2】(約45km北西)	川俣町	雑草	葉菜	3月23日 11:30	74,400	23,100	5.5	洗浄なし
【2-2】(約45km北西)	川俣町	雑草	葉菜	3月23日 11:30	46,200	16,000	5.5	洗浄あり
【2-2】(約45km北西)	川俣町	雑草	葉菜	3月24日 11:20	141,000	43,200	5.0	
【2-2】(約45km北西)	川俣町	雑草	葉菜	3月25日 11:30	155,000	53,000	7.5	
【2-2】(約45km北西)	川俣町	雑草	葉菜	3月26日 11:20	79,500	54,700	4.3	
【2-2】(約45km北西)	川俣町	雑草	葉菜	3月27日 10:45	50,000	32,900	5.5	
【2-2】(約45km北西)	川俣町	雑草	葉菜	3月28日 11:05	46,000	33,600	5.5	
【2-2】(約45km北西)	川俣町	雑草	葉菜	3月29日 11:00	71,900	67,900	4.8	
【2-2】(約45km北西)	川俣町	雑草	葉菜	3月30日 11:35	33,500	27,500	4.6	
【2-3】(約40km西)	田村市	雑草	葉菜	3月18日 11:35	36,000	40,100	1.6	
【2-3】(約40km西)	田村市	雑草	葉菜	3月19日 11:35	68,000	38,500	0.8	
【2-3】(約40km西)	田村市	雑草	葉菜	3月20日 12:40	75,700	50,000	0.7	
【2-3】(約40km西)	田村市	雑草	葉菜	3月21日 12:30	30,800	25,000	0.7	
【2-3】(約40km西)	田村市	雑草	葉菜	3月22日 11:30	43,200	25,000	1.4	
【2-3】(約40km西)	田村市	雑草	葉菜	3月23日 11:50	24,100	17,000	1.0	
【2-3】(約40km西)	田村市	雑草	葉菜	3月24日 11:35	29,400	32,600	0.5	
【2-3】(約40km西)	田村市	雑草	葉菜	3月25日 13:28	23,400	13,700	0.8	
【2-3】(約40km西)	田村市	雑草	葉菜	3月26日 11:35	33,100	10,700	0.6	
【2-3】(約40km西)	田村市	雑草	葉菜	3月27日 11:45	33,300	19,800	0.4	
【2-3】(約40km西)	田村市	雑草	葉菜	3月28日 11:36	37,000	22,400	0.7	
【2-3】(約40km西)	田村市	雑草	葉菜	3月29日 13:35	24,800	34,500	0.7	
【2-3】(約40km西)	田村市	雑草	葉菜	3月30日 12:30	18,600	18,800	0.5	
【2-4】(約25km北)	南相馬市	雑草	葉菜	3月18日 13:30	88,600	17,800	−	
【2-4】(約25km北)	南相馬市	雑草	葉菜	3月19日 13:00	455,000	24,900	−	
【2-4】(約25km北)	南相馬市	雑草	葉菜	3月20日 14:30	497,000	24,700	3.4	
【2-4】(約25km北)	南相馬市	雑草	葉菜	3月21日 14:07	289,000	13,400	2.8	
【2-4】(約25km北)	南相馬市	雑草	葉菜	3月22日 13:35	140,000	17,200	1.8	
【2-4】(約25km北)	南相馬市	雑草	葉菜	3月23日 14:10	185,000	17,200	1.1	
【2-4】(約25km北)	南相馬市	雑草	葉菜	3月24日 14:40	184,000	27,900	1.2	
【2-4】(約25km北)	南相馬市	雑草	葉菜	3月25日 14:20	217,000	18,800	0.7	
【2-4】(約25km北)	南相馬市	雑草	葉菜	3月26日 13:50	83,700	10,500	1.3	
【2-4】(約25km北)	南相馬市	雑草	葉菜	3月27日 13:25	161,000	39,900	1.4	
【2-4】(約25km北)	南相馬市	雑草	葉菜	3月28日 13:27	113,000	23,900	0.7	
【2-4】(約25km北)	南相馬市	雑草	葉菜	3月29日 13:30	109,000	17,000	1.0	
【2-4】(約25km北)	南相馬市	雑草	葉菜	3月30日 14:45	113,000	13,100	0.0〜1.3	
【2-5】(約40km南西)	小野町	雑草	葉菜	3月18日 12:35	181,000	28,300	0.9	
【2-5】(約40km南西)	小野町	雑草	葉菜	3月19日 12:15	201,000	73,800	0.7	
【2-5】(約40km南西)	小野町	雑草	葉菜	3月20日 13:50	36,900	11,700	0.6	
【2-5】(約40km南西)	小野町	雑草	葉菜	3月21日 13:40	20,300	11,200	0.4	
【2-5】(約40km南西)	小野町	雑草	葉菜	3月22日 12:40	32,000	8,120	0.5	
【2-5】(約40km南西)	小野町	雑草	葉菜	3月23日 12:50	22,300	10,300	0.5	
【2-5】(約40km南西)	小野町	雑草	葉菜	3月24日 13:18	29,700	4,900	0.4	
【2-5】(約40km南西)	小野町	雑草	葉菜	3月25日 11:30	21,800	8,040	0.4	

採取地点	市町村名	試料名	種類又は部位	採取日時	放射能濃度(Bq/kg)		空間線量率(μSv/h)	備考
					131I	137Cs		
【2-5】(約40km南西)	小野町	雑草	葉菜	3月26日 11:50	25,800	5,150	0.6	
【2-5】(約40km南西)	小野町	雑草	葉菜	3月27日 11:10	18,600	4,970	0.5	
【2-5】(約40km南西)	小野町	雑草	葉菜	3月28日 11:25	16,700	4,550	－	
【2-5】(約40km南西)	小野町	雑草	葉菜	3月29日 11:30	16,700	3,770	0.3	
【2-5】(約40km南西)	小野町	雑草	葉菜	3月30日 11:08	10,300	6,280	0.3	
【2-6】(約45km南)	いわき市	雑草	葉菜	3月18日 13:15	690,000	17,400	－	
【2-6】(約45km南)	いわき市	雑草	葉菜	3月18日 13:40	468,000	10,100	－	
【2-6】(約45km南)	いわき市	雑草	葉菜	3月20日 15:25	548,000	17,500	0.6	
【2-6】(約45km南)	いわき市	雑草	葉菜	3月21日 15:10	115,000	2,380	1.5	
【2-6】(約45km南)	いわき市	雑草	葉菜	3月22日 13:50	448,000	18,600	0.6	
【2-6】(約45km南)	いわき市	雑草	葉菜	3月23日 14:20	451,000	30,300	1.0	
【2-6】(約45km南)	いわき市	雑草	葉菜	3月24日 15:00	454,000	6,210	1.4	
【2-6】(約45km南)	いわき市	雑草	葉菜	3月25日 13:45	170,000	6,860	1.1	
【2-6】(約45km南)	いわき市	雑草	葉菜	3月26日 13:50	291,000	12,800	1.0	
【2-6】(約45km南)	いわき市	雑草	葉菜	3月27日 12:30	126,000	7,470	0.8	
【2-6】(約45km南)	いわき市	雑草	葉菜	3月28日 12:50	71,800	4,370	0.3	
【2-6】(約45km南)	いわき市	雑草	葉菜	3月29日 13:05	132,000	9,310	0.7	
【2-6】(約45km南)	いわき市	雑草	葉菜	3月30日 12:30	121,000	10,100	0.3	
【2-7】(約35km北西)	川俣町	雑草	葉菜	3月25日 15:07	663,000	497,000	12.0	
【2-7】(約35km北西)	川俣町	雑草	葉菜	3月26日 14:03	488,000	571,000	8.8	
【2-7】(約35km北西)	川俣町	雑草	葉菜	3月27日 13:44	402,000	490,000	8.7	
【2-7】(約35km北西)	川俣町	雑草	葉菜	3月28日 13:39	443,000	689,000	8.4	
【2-7】(約35km北西)	川俣町	雑草	葉菜	3月29日 14:50	242,000	383,000	8.0	
【2-7】(約35km北西)	川俣町	雑草	葉菜	3月30日 14:00	267,000	338,000	13.9～15.4	
【2-8】(約50km北西)	伊達市	雑草	葉菜	3月25日 16:18	77,100	40,700	－	
【2-8】(約50km北西)	伊達市	雑草	葉菜	3月26日 15:13	39,400	24,000	－	
【2-8】(約50km北西)	伊達市	雑草	葉菜	3月27日 15:50	43,900	44,600	－	
【2-8】(約50km北西)	伊達市	雑草	葉菜	3月28日 14:37	43,300	52,000	－	
【2-8】(約50km北西)	伊達市	雑草	葉菜	3月29日 15:50	37,100	62,100	1.6	
【2-8】(約50km北西)	伊達市	雑草	葉菜	3月30日 16:05	33,800	44,300	－	
【2-9】(約45km西北西)	二本松市	雑草	葉菜	3月25日 11:40	73,400	235,000	－	
【2-9】(約45km西北西)	二本松市	雑草	葉菜	3月26日 10:13	24,300	106,000	－	
【2-9】(約45km西北西)	二本松市	雑草	葉菜	3月27日 10:30	73,400	230,000	－	
【2-9】(約45km西北西)	二本松市	雑草	葉菜	3月28日 10:13	34,500	223,000	－	
【2-9】(約45km西北西)	二本松市	雑草	葉菜	3月29日 11:45	34,000	160,000	－	
【2-9】(約45km西北西)	二本松市	雑草	葉菜	3月30日 10:35	31,500	153,000	－	
【2-10】(約50km北)	新地町	雑草	葉菜	3月25日 16:20	29,300	12,500	－	

上記測定結果は政府現地対策本部が、福島県に依頼し、その結果を入手したもの。

環境試料の測定結果

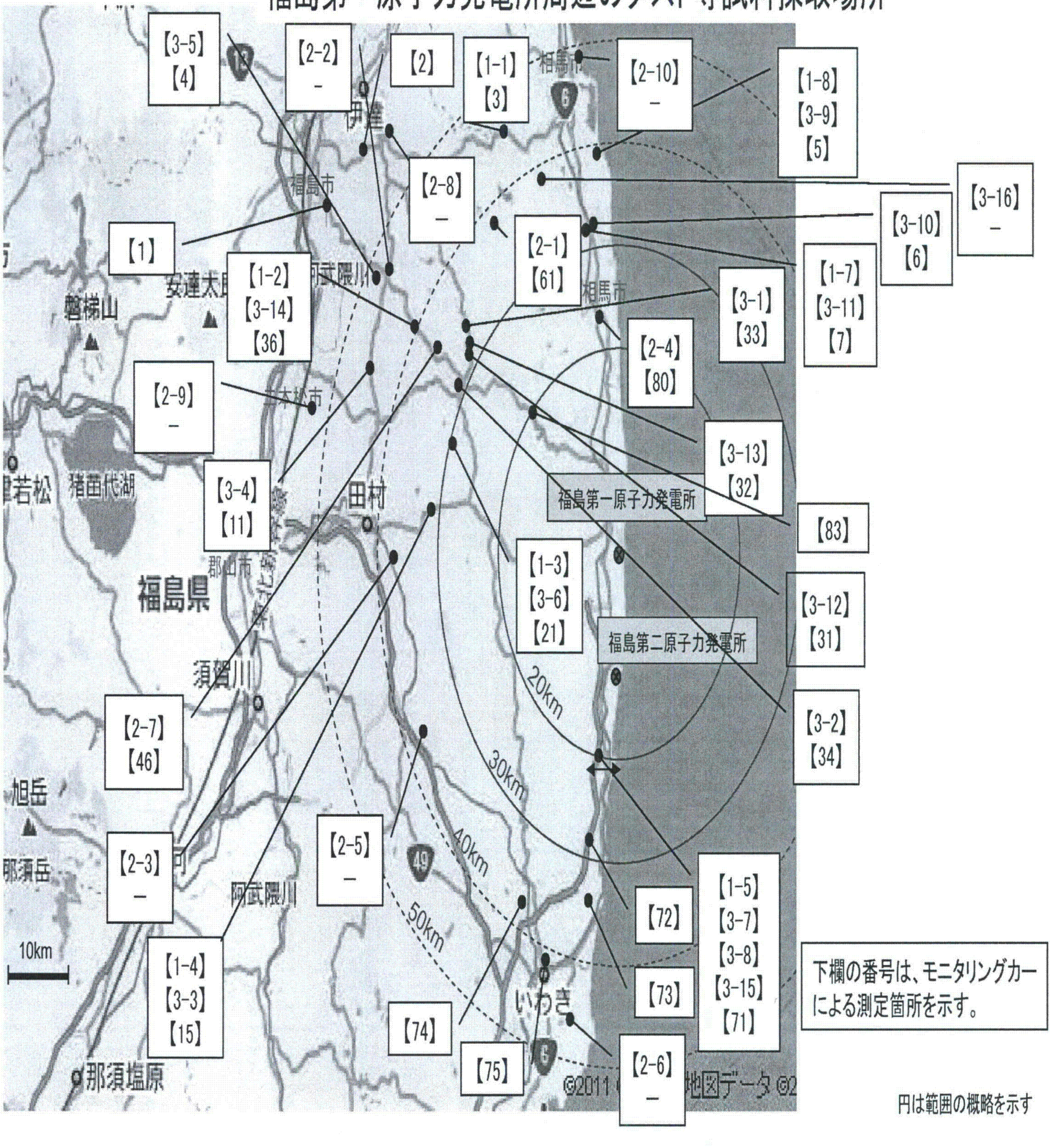
□ :枠内は新規追加データです。

採取地点	市町村名	試料名	種類又は部位	採取日時	放射能濃度(Bq/kg) ^{131}I	放射能濃度(Bq/kg) ^{137}Cs	備考
【2-1】(約40km北西)	飯舘村	陸水	池水	3月18日 12:20	2,090	511	
	飯舘村	陸水	池水	3月19日 11:36	2,450	940	
	飯舘村	陸水	池水	3月20日 12:40	2,010	437	
	飯舘村	陸水	池水	3月21日 12:35	1,720	246	
	飯舘村	陸水	池水	3月22日 12:00	1,330	172	
	飯舘村	陸水	池水	3月23日 12:25	1,260	145	
	飯舘村	陸水	池水	3月24日 13:05	1,330	268	
	飯舘村	陸水	池水	3月25日 12:20	1,280	507	
	飯舘村	陸水	池水	3月26日 12:00	835	162	
	飯舘村	陸水	池水	3月27日 11:40	828	145	
	飯舘村	陸水	池水	3月28日 11:50	884	183	
	飯舘村	陸水	池水	3月29日 11:50	701	158	
	飯舘村	陸水	池水	3月30日 12:25	629	113	
	飯舘村	陸土	土壌	3月19日 11:40	300,000	28,100	
	飯舘村	陸土	土壌	3月20日 12:40	1,170,000	163,000	
	飯舘村	陸土	土壌	3月21日 12:32	207,000	39,900	
	飯舘村	陸土	土壌	3月22日 12:00	256,000	57,400	
	飯舘村	陸土	土壌	3月23日 12:25	135,000	32,200	
	飯舘村	陸土	土壌	3月24日 13:05	45,500	1,870	
	飯舘村	陸土	土壌	3月25日 13:05	265,000	27,900	
	飯舘村	陸土	土壌	3月26日 12:00	564,000	227,000	
	飯舘村	陸土	土壌	3月26日 15:20	82,000	28,000	
	飯舘村	陸土	土壌	3月27日 11:40	169,000	29,100	
	飯舘村	陸土	土壌	3月27日 12:00	69,800	20,800	
	飯舘村	陸土	土壌	3月28日 11:50	14,000	2,040	
	飯舘村	陸土	土壌	3月28日 12:10	23,100	860	
	飯舘村	陸土	土壌	3月29日 11:50	53,700	5,650	
	飯舘村	陸土	土壌	3月29日 12:10	58,400	25,100	
	飯舘村	陸土	土壌	3月30日 12:25	89,000	32,300	
	飯舘村	陸土	土壌	3月30日 12:45	11,900	408	
【2-2】(約45km北西)	川俣町	陸土	土壌	3月18日 11:45	84,300	14,200	
	川俣町	陸土	土壌	3月19日 11:00	85,400	8,690	
	川俣町	陸土	土壌	3月20日 12:04	151,000	15,100	
	川俣町	陸土	土壌	3月21日 12:10	157,000	16,500	
	川俣町	陸土	土壌	3月22日 11:00	38,900	4,720	
	川俣町	陸土	土壌	3月23日 11:30	44,600	6,010	
	川俣町	陸土	土壌	3月24日 11:20	21,500	1,160	
	川俣町	陸土	土壌	3月26日 11:20	29,300	3,760	
	川俣町	陸土	土壌	3月27日 10:45	44,900	7,580	
	川俣町	陸土	土壌	3月28日 11:05	31,100	2,470	
	川俣町	陸土	土壌	3月29日 11:00	34,400	5,900	
	川俣町	陸土	土壌	3月30日 11:35	23,800	5,280	
【2-3】(約40km西)	田村市	陸土	土壌	3月18日 11:50	19,300	3,510	
	田村市	陸土	土壌	3月19日 11:35	6,970	1,260	
	田村市	陸土	土壌	3月20日 12:40	5,390	1,250	
	田村市	陸土	土壌	3月21日 12:30	3,000	390	
	田村市	陸土	土壌	3月22日 11:30	7,290	1,290	
	田村市	陸土	土壌	3月24日 11:35	6,600	1,310	
	田村市	陸土	土壌	3月25日 13:35	5,480	778	
	田村市	陸土	土壌	3月26日 11:51	5,250	1,010	
	田村市	陸土	土壌	3月27日 11:45	3,700	796	
	田村市	陸土	土壌	3月28日 11:37	4,360	1,110	
	田村市	陸土	土壌	3月29日 13:35	5,080	1,610	
	田村市	陸土	土壌	3月30日 12:30	5,040	834	

採取地点	市町村名	試料名	種類又は部位	採取日時	放射能濃度(Bq/kg) ^{131}I	放射能濃度(Bq/kg) ^{137}Cs	備考
【2-4】(約25km北)	南相馬市	陸土	土壌	3月18日 13:30	22,600	3,280	
	南相馬市	陸土	土壌	3月19日 13:00	35,800	4,040	
	南相馬市	陸土	土壌	3月20日 14:30	35,800	4,850	
	南相馬市	陸土	土壌	3月21日 14:07	83,200	8,660	
	南相馬市	陸土	土壌	3月23日 14:10	16,600	1,720	
	南相馬市	陸土	土壌	3月24日 14:40	14,900	1,990	
	南相馬市	陸土	土壌	3月25日 14:20	2,480	189	
	南相馬市	陸土	土壌	3月26日 13:50	15,100	2,490	
	南相馬市	陸土	土壌	3月27日 13:25	10,100	1,520	
	南相馬市	陸土	土壌	3月28日 13:27	7,730	1,330	
	南相馬市	陸土	土壌	3月29日 13:30	9,010	2,200	
	南相馬市	陸土	土壌	3月30日 14:45	14,900	3,300	
【2-5】(約40km南西)	小野町	陸水	雨水	3月22日 12:40	7,440	107	
	小野町	陸水	雨水	3月25日 11:38	3,000	800	
	小野町	陸土	土壌	3月18日 12:30	8,170	2,260	
	小野町	陸土	土壌	3月19日 12:15	14,100	4,630	
	小野町	陸土	土壌	3月20日 13:50	10,300	3,020	
	小野町	陸土	土壌	3月21日 13:40	4,830	910	
	小野町	陸土	土壌	3月22日 11:40	3,220	466	
	小野町	陸土	土壌	3月23日 12:50	6,430	1,590	
	小野町	陸土	土壌	3月24日 13:18	2,830	747	
	小野町	陸土	土壌	3月25日 11:39	3,000	800	
	小野町	陸土	土壌	3月26日 11:50	1,510	159	
	小野町	陸土	土壌	3月27日 11:10	2,140	158	
	小野町	陸土	土壌	3月28日 11:25	505	59	
	小野町	陸水	土壌	3月29日 11:30	2,290	161	
	小野町	陸土	土壌	3月30日 11:02	2,230	947	
【2-6】(約45km南)	いわき市	陸土	土壌	3月19日 13:15	12,600	288	
	いわき市	陸土	土壌	3月20日 15:17	14,600	460	
	いわき市	陸土	土壌	3月21日 15:10	30,700	1,220	
	いわき市	陸土	土壌	3月22日 13:50	1,960	1,290	
	いわき市	陸土	土壌	3月23日 14:20	32,600	840	
	いわき市	陸土	土壌	3月24日 15:00	27,100	951	
	いわき市	陸土	土壌	3月25日 13:45	23,900	519	
	いわき市	陸土	土壌	3月26日 13:50	41,100	875	
	いわき市	陸土	土壌	3月27日 12:30	25,100	849	
	いわき市	陸土	土壌	3月28日 12:50	11,500	465	
	いわき市	陸土	土壌	3月29日 13:05	15,700	617	
	いわき市	陸土	土壌	3月30日 12:30	1,420	ND	
【2-7】(約35km北西)	川俣町	陸土	土壌	3月25日 15:05	112,000	21,800	
	川俣町	陸土	土壌	3月26日 13:59	100,000	21,900	
	川俣町	陸土	土壌	3月27日 13:47	50,800	7,350	
	川俣町	陸土	土壌	3月28日 13:39	39,800	4,330	
	川俣町	陸土	土壌	3月29日 14:50	61,800	23,400	
	川俣町	陸土	土壌	3月30日 14:00	42,600	7,750	
【2-8】(約50km北西)	伊達市	陸土	土壌	3月24日 12:10	41,200	6,850	
	伊達市	陸土	土壌	3月25日 16:15	20,800	3,790	
	伊達市	陸土	土壌	3月26日 15:13	16,000	3,740	
	伊達市	陸土	土壌	3月27日 14:54	16,900	3,070	
	伊達市	陸土	土壌	3月28日 14:34	22,300	5,320	
	伊達市	陸土	土壌	3月29日 15:50	25,700	5,800	
	伊達市	陸土	土壌	3月30日 16:05	20,500	3,360	
【2-9】(約45km西北西)	二本松市	陸土	土壌	3月25日 11:35	32,900	9,330	
	二本松市	陸土	土壌	3月26日 10:14	39,000	16,900	
	二本松市	陸土	土壌	3月27日 10:26	49,300	22,700	
	二本松市	陸土	土壌	3月28日 10:13	34,100	15,700	
	二本松市	陸土	土壌	3月29日 11:45	36,400	21,100	
	二本松市	陸土	土壌	3月30日 10:35	24,000	14,800	
【2-10】(約50km北)	新地町	陸土	土壌	3月25日 16:20	44	3,740	

上記測定結果は政府現地対策本部が、福島県に依頼し、その結果を入手したもの。

福島第一原子力発電所周辺のダスト等試料採取場所



下欄の番号は、モニタリングカーによる測定箇所を示す。

円は範囲の概略を示す

H23.3.31　19:00　(MBq/km^2)

	都道府県名	定時降下物		
		I−131	Cs−137	備考
1	北海道(札幌市)	不検出	不検出	
2	青森県(青森市)	不検出	不検出	
3	岩手県(盛岡市)	不検出	不検出	
4	宮城県	−	−	震災被害によって計測不能
5	秋田県(秋田市)	不検出	不検出	
6	山形県(山形市)	−	−	機器調整中
7	**福島県(福島市)**	**114**	**146**	**測定中であったが到達**
8	茨城県(ひたちなか市)	540	390	
9	**栃木県(宇都宮市)**	**1,350**	**505**	**測定中であったが到達**
10	群馬県(前橋市)	120	130	
11	埼玉県(さいたま市)	270	260	
12	千葉県(市原市)	63	75	
13	東京都(新宿区)	50	68	
14	神奈川県(茅ヶ崎市)	29	52	
15	新潟県(新潟市)	不検出	不検出	
16	富山県(射水市)	不検出	不検出	
17	石川県(金沢市)	不検出	不検出	
18	福井県(福井市)	不検出	不検出	
19	山梨県(甲府市)	不検出	3.6	
20	長野県(長野市)	不検出	不検出	
21	岐阜県(各務原市)	−	−	現在測定中
22	静岡県(御前崎市)	不検出	4.6	
23	愛知県(名古屋市)	不検出	不検出	
24	三重県(四日市市)	不検出	不検出	
25	滋賀県(大津市)	不検出	不検出	
26	京都府(京都市)	不検出	不検出	
27	大阪府(大阪市)	不検出	不検出	
28	兵庫県(神戸市)	不検出	不検出	
29	奈良県(奈良市)	不検出	不検出	
30	和歌山県(和歌山市)	不検出	不検出	
31	鳥取県(東伯郡)	不検出	不検出	
32	島根県(松江市)	不検出	不検出	
33	岡山県(岡山市)	不検出	不検出	
34	広島県(広島市)	不検出	不検出	
35	山口県(山口市)	不検出	不検出	
36	徳島県(徳島市)	不検出	不検出	
37	香川県(高松市)	不検出	不検出	
38	愛媛県(八幡浜市)	不検出	不検出	
39	高知県(高知市)	不検出	不検出	
40	福岡県(太宰府市)	不検出	不検出	
41	佐賀県(佐賀市)	不検出	不検出	
42	長崎県(大村市)	不検出	不検出	
43	熊本県(宇土市)	不検出	不検出	
44	大分県(大分市)	不検出	不検出	
45	宮崎県(宮崎市)	不検出	不検出	
46	鹿児島県(鹿児島市)	不検出	不検出	
47	沖縄県(南城市)	不検出	不検出	

*文部科学省が各都道府県等からの報告に基づき作成

From: PMT09 Hoc
Sent: Friday, April 01, 2011 10:26 AM
To: Hoc, PMT12
Subject: RadNet Deployables Capabilities.doc
Attachments: RadNet Deployables Capabilities.doc

Here is what we know after talking to EPA/NAREL contact. Note that spelling of his name was incorrect in task tracker. It should be Fraass.

Capabilities of EPA RadNet Deployable Monitoring Stations

- Discussed briefly with Ron Fraass, EPA, NAREL in Alabama (fraass.ron@epa.gov, 334-270-3400) 04/01/2011. Ron is the best contact. (pronounce his name like Frost, without the T.)
- Deployable RadNet Unit Capabilites/Limitations
    - Near-real-time (satellite telemetry) data is limited to exposure rate only (compensated GM detector). Spectral data is not available.
    - Also have low-volume and high-volume air sampling units. Filters must be manually changed out daily, transported to a laboratory, and analyzed.
    - Require ac power, so usually set up at police stations or other public buildings.
    - Deployed on a 4 ft x 4 ft pallet.
    - EPA would want an EPA staffer to deploy to setup units and initiate local staff to continue operation.
- EPA staff thinks they may have approximately a dozen units that could be deployed.
- At this time (04/01/2011, 10:00 EDT), NRC has not asked EPA to deploy monitors.

M:\PMT\Fukushima\1 April files\RadNet Deployables Capabilities.doc

From: PMT09 Hoc
Sent: Friday, April 01, 2011 5:37 AM
To: (b)(6)
Subject: Source information

Here is another website that has data on seawater contamination close to the site.

http://www.iaea.org/newscenter/news/tsunamiupdate01.html

Protective Measures Team

From:	PMT09 Hoc
Sent:	Friday, April 01, 2011 3:36 AM
To:	(b)(6)
Cc:	Hoc, PMT12
Subject:	Source Terms for Liquid Effluent from Fukushima Plants
Attachments:	MEXT Ocean Samples_0331.pdf

Lt. Commander O'Neill:

While NRC does produce source term estimates for airborne released from the Fukushima plants, we do not generate source terms for liquid effluents. We were able to confirm that MEXT of Japan has been collecting samples at various sampling points at sea, including at varying depths, and posting the results at the following website:

http://www.mext.go.jp/english/radioactivity_level/detail/1304192.htm

The most recent data file, dated March 31, is attached. Hope this information is useful for your modeling needs.

NRC Protective Measures Team

Attachment MEXT Ocean Samples_0331.pdf(108002 bytes) cannot be converted to PDF format.

From: Holahan, Vincent
Sent: Friday, April 01, 2011 12:55 AM
To: PMT09 Hoc
Subject: RE: TEPCO Press Release detection of radioactive materials in the water.

Thanks a lot. The J2 was excited to see this. The J5 actually had me brief this during our Principal Update Brief at 1430 hr.

Cheers,
Vince

From: PMT09 Hoc
Sent: Thursday, March 31, 2011 7:30 PM
To: Holahan, Vincent
Subject: TEPCO Press Release detection of radioactive materials in the water.

Here's a link to the press release
http://www.tepco.co.jp/en/press/corp-com/release/11033112-e.html

From: PMT09 Hoc
Sent: Thursday, March 31, 2011 1:36 AM
To: PMT09 Hoc

From: Hoc, PMT12
Sent: Wednesday, March 30, 2011 10:33 PM
To: PMT09 Hoc
Subject: FW: Fax from 81355105111
Attachments: File1.PDF

-----Original Message-----
From: HOO Hoc
Sent: Wednesday, March 30, 2011 10:24 PM
To: Hoc, PMT12
Subject: FW: Fax from 81355105111

Headquarters Operations Officer
U.S. Nuclear Regulatory Commission
Phone: 301-816-5100
Fax: 301-816-5151
email: hoo.hoc@nrc.gov
secure e-mail: hoo1@nrc.sgov.gov

-----Original Message-----
From: hoo1 [mailto:hoo1.hoc@nrc.gov]
Sent: Wednesday, March 30, 2011 10:23 PM
To: HOO Hoc
Subject: Fax from 81355105111

RECEIVE NOTIFICATION FOR JOB 00018041

Notice for: HOO1

Remote ID: 81355105111

Received at: 03/30/2011 22:21

Pages: 4

Routed by:

Routed at: 03/30/2011 22:21

From: PMT09 Hoc
Sent: Wednesday, March 30, 2011 4:21 PM
To: Milligan, Patricia
Subject: Relaxing protective action criteria 03-22-2011 (final).doc
Attachments: Relaxing protective action criteria 03-22-2011 (final).doc

From: Brandon, Lou
Sent: Friday, April 01, 2011 5:05 AM
To: Evans, Lynn (CDC/ONDIEH/NCEH)
Subject: RE: Request NRC representative on Advisory Team Conference Calls

Yes, some difficulty getting to emails. Sounds like the NRC PMT has been dialing into the regular calls.

From: Evans, Lynn (CDC/ONDIEH/NCEH) [mailto:gfn6@cdc.gov]
Sent: Thursday, March 17, 2011 10:35 AM
To: Brandon, Lou
Subject: Request NRC representative on Advisory Team Conference Calls
Importance: High

Hi, Lou!

I am sure you are very busy but I wanted to ask if you could find someone to represent the NRC on the Advisory Team conference calls. Although the Advisory Team is NOT activated, we are having these calls to stay connected and aware of what our parent agencies are doing. We really would appreciate having an NRC representative on these calls.

The Advisory Team conference call will be at 1:00 PM (EDT) on March 17, 2011.

Please use the following call-in numbers:

Phone number: 866-561-4509
Pass code: (b)(6)

We hope NRC can be on this call.

Thanks!
Lynn

D. Lynn Evans, MS
CAPT, USPHS
Centers for Disease Control and Prevention
NCEH/EHHE/Radiation Studies Branch
Mail Stop F58
4770 Buford Highway NE
Atlanta, GA 30341-3717
Phone: (770) 488-3656
Fax: (770) 488-1539
Email: gfn6@cdc.gov

From: Hoc, PMT12
Sent: Tuesday, March 29, 2011 8:52 PM
To: PMT02 Hoc; PMT09 Hoc; PMT11 Hoc
Subject: FW: More Information
Attachments: Consequence_Report_-_same_map_scale.pdf; Consequence_Report_2.pdf

-----Original Message-----
From: Bertram, William (CONTR) [mailto:William.Bertram@nnsa.doe.gov]
Sent: Tuesday, March 29, 2011 8:50 PM
To: Hoc, PMT12
Subject: More Information

These two attachments were also in the request.

Nuclear Incident Team (NIT)
Office of Emergency Response (NA-42)
National Nuclear Security Administration U.S. Department of Energy nitops@nnsa.doe.gov nit@doe.sgov.gov 202-586-8100

APPROVED PRODUCT
NARAC
National Atmospheric Release Advisory Center

Consequence Report

Issued: March 30, 2011 00:29 UTC

Japan Impacts - NRC Plausible Realistic Case V3 (U1Exp)

NARAC Report - Potential Release

SUMMARY:

This report describes the health effect consequences associated with a hypothetical unknown release to the atmosphere from a radiological source. This is an initial, automated NARAC product, not a final recommendation. Initial predictions are for a limited time period and areas affected may change at later times. Please consult NARAC staff (925-422-7627) for refined, quality assured predictions. Predictions should be confirmed and refined using measurements.

PRODUCTS:

Early Phase Dose (0-4d) : (Total Effective Dose)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133

This product identifies areas that could exceed doses of 5 and 1 rem over a 4-day exposure period, which begins at the start of the release. If used to project doses from a potential future release, these levels correspond to the EPA/DHS guidelines for the Early Phase based on the dose that may be avoided if shelter and evacuation guidance can be implemented prior to the beginning of the release. These Protective Action Guideline (PAG) limits are based on an assessment of the long-term risk of developing cancer in exposed individuals over their lifetime or producing genetic disorders in subsequent generations. These risks result from the projected combined dose caused by radiation from the material deposited onto the surface, radiation from the material as it is carried in the air, and radiation from the material that has been inhaled and retained by the body. Upon request, estimates of the total number of people exposed, and (after accounting for estimated deaths from acute, short-term effects) the number of expected subsequent fatal cancers and combined number of expected subsequent fatal and non-fatal cancers may be displayed. These are computer model estimates assuming unprotected exposure and no mitigating action (such as evacuation or sheltering) for the entire time period of this prediction, and therefore may be over-estimates of the actual effects.

Early Phase Dose (4-8d) : (Total Effective Dose)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133

This product identifies areas that could exceed doses of 5 and 1 rem over a 4-day exposure period, which begins at the start of the release. If used to project doses from a potential future release, these levels correspond to the EPA/DHS guidelines for the Early Phase based on the dose that may be avoided if shelter and evacuation guidance can be implemented prior to the beginning of the release. These Protective Action Guideline (PAG) limits are based on an assessment of the long-term risk of developing cancer in exposed individuals over their lifetime or producing genetic disorders in subsequent generations. These risks result from the projected combined dose caused by radiation from the material deposited onto the surface, radiation from the material as it is carried in the air, and radiation from the material that has been inhaled and retained by the body. Upon request, estimates of the total number of people exposed, and (after accounting for estimated deaths from acute, short-term effects) the number of expected subsequent fatal cancers and combined number of expected subsequent fatal and non-fatal cancers may be displayed. These are computer model estimates assuming unprotected exposure and no mitigating action (such as evacuation or sheltering) for the entire time period of this prediction, and therefore may be over-estimates of the actual effects.

Early Phase Dose (8-12d) : (Total Effective Dose)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133

This product identifies areas that could exceed doses of 5 and 1 rem over a 4-day exposure period, which begins at the start of the release. If used to project doses from a potential future release, these levels correspond to the EPA/DHS guidelines for the Early Phase based on the dose that may be avoided if shelter and evacuation guidance can be implemented prior to the beginning of the release. These Protective Action Guideline (PAG) limits are based on an assessment of the long-term risk of developing cancer in exposed individuals over their lifetime or producing genetic disorders in subsequent generations. These risks result from the projected combined dose caused by radiation from the material deposited onto the surface, radiation from the material as it is carried in the air, and radiation from the material that has been inhaled and retained by the body. Upon request, estimates of the total number of people exposed, and (after accounting for estimated deaths from acute, short-term effects) the number of expected subsequent fatal cancers and combined number of expected subsequent fatal and non-fatal cancers may be displayed. These are computer model estimates assuming unprotected exposure and no mitigating action (such as evacuation or sheltering) for the entire time period of this prediction, and therefore may be over-estimates of the actual effects.

Early Phase Dose (0-14d) : (Total Effective Dose)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133

This product identifies areas that could exceed doses of 5 and 1 rem over a 4-day exposure period, which begins at the start of the release. If used to project doses from a potential future release, these levels correspond to the EPA/DHS guidelines for the Early Phase based on the dose that may be avoided if shelter and evacuation guidance can be implemented prior to the beginning of the release. These Protective Action Guideline (PAG) limits are based on an assessment of the long-term risk of developing cancer in exposed individuals over their lifetime or producing genetic disorders in subsequent generations. These risks result from the projected combined dose caused by radiation from the material deposited onto the surface, radiation from the material as it is carried in the air, and radiation from the material that has been inhaled and retained by the body. Upon request, estimates of the total number of people exposed, and (after accounting for estimated deaths from acute, short-term effects) the number of expected subsequent fatal cancers and combined number of expected subsequent fatal and non-fatal cancers may be displayed. These are computer model estimates assuming unprotected exposure and no mitigating action (such as evacuation or sheltering) for the entire time period of this prediction, and therefore may be over-estimates of the actual effects.

Early Phase Guidance (Radioiodine) (0-14 d) : (KI Administration based on Thyroid Radioiodine Dose)

Material: I-131 + I-132 + TE-132 + I-133 + TE-129M

The U.S. Environmental Protection Agency (EPA) and Department of Homeland Security (DHS) have proposed or accepted similar sets of Protective Action Guides (PAGs) to indicate when protective actions should be considered/implemented to protect the population. These Guides correspond to specific dose levels and are primarily based on an assessment of the risk in developing cancer over an exposed individual's lifetime. Thus the health effects produced by these doses may develop over a period of years. In the event radioiodines are released into the atmosphere, the PAG level is based on the projected dose to a child's thyroid which may be avoided by the administering of potassium iodide. Additional levels based on guidance from the U.S. Food and Drug Administration for adults may also be shown. (Note that the PAG level for potassium iodide administration to pregnant women is 5 rem to the adult thyroid.) These model predictions are based on the effects of radiation from the material inhaled and retained by the body, and use the conservative assumption that individuals are unsheltered and remain in the area during the time period specified in the figure's legend. Health effects could be significantly different for sheltered individuals or for those exposed in these areas for different time periods. Estimates of the number of exposed individuals expected to experience these effects may be given in the legend. If so, the counts given for all illnesses include those leading to pre-mature death. Note that the counts and area covered by each contour are cumulative such that outer contours include the counts and areas of all inner contours.

Worker Protection Dose Rate at 4 d : (Groundshine Dose Rate at 03/16/2011 15:25:00 JST)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

This product identifies the locations where the Federal Radiation Protection Guidance occupational upper limit dose may be exceeded for various exposure periods by unprotected workers performing emergency services. These limits are based on the risk of workers developing cancer over their lifetimes, and ensure that exposures will not result in detrimental acute or early health effects. Although these doses may be expressed in terms of the EPA Response Worker Guidelines, these contours may also be used to estimate the ongoing dose received by the unsheltered general population. NCRP and NRC administrative control areas are also shown. Note: EPA and NRC guidelines are based on a total dose limit. These contoured dose rate values, if constant over the indicated exposure period, will deliver the equivalent limiting dose. For rapidly-decaying dose rates, these predictions will be conservative. The dose associated with potential inhalation of resuspended material is not included in these estimates. The relative importance of any committed inhalation dose from resuspended material is dependent on a variety of factors (e.g. weather, radionuclides, etc.). Note that the population count and area covered by each contour are cumulative such that outer contours include the counts and areas of all inner contours.

Worker Protection Dose Rate at 8 d : (Groundshine Dose Rate at 03/20/2011 15:25:00 JST)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

This product identifies the locations where the Federal Radiation Protection Guidance occupational upper limit dose may be exceeded for various exposure periods by unprotected workers performing emergency services. These limits are based on the risk of workers developing cancer over their lifetimes, and ensure that exposures will not result in detrimental acute or early health effects. Although these doses may be expressed in terms of the EPA Response Worker Guidelines, these contours may also be used to estimate the ongoing dose received by the unsheltered general population. NCRP and NRC administrative control areas are also shown. Note: EPA and NRC guidelines are based on a total dose limit. These contoured dose rate values, if constant over the indicated exposure period, will deliver the equivalent limiting dose. For rapidly-decaying dose rates, these predictions will be conservative. The dose associated with potential inhalation of resuspended material is not included in these estimates. The relative importance of any committed inhalation dose from resuspended material is dependent on a variety of factors (e.g. weather, radionuclides, etc.). Note that the population count and area covered by each contour are cumulative such that outer contours include the counts and areas of all inner contours.

Worker Protection Dose Rate at 12 d : (Groundshine Dose Rate at 03/24/2011 15:25:00 JST)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

This product identifies the locations where the Federal Radiation Protection Guidance occupational upper limit dose may be exceeded for various exposure periods by unprotected workers performing emergency services. These limits are based on the risk of workers developing cancer over their lifetimes, and ensure that exposures will not result in detrimental acute or early health effects. Although these doses may be expressed in terms of the EPA Response Worker Guidelines, these contours may also be used to estimate the ongoing dose received by the unsheltered general population. NCRP and NRC administrative control areas are also shown. Note: EPA and NRC guidelines are based on a total dose limit. These contoured dose rate values, if constant over the indicated exposure period, will deliver the equivalent limiting dose. For rapidly-decaying dose rates, these predictions will be conservative. The dose associated with potential inhalation of resuspended material is not included in these estimates. The relative importance of any committed inhalation dose from resuspended material is dependent on a variety of factors (e.g. weather, radionuclides, etc.). Note that the population count and area covered by each contour are cumulative such that outer contours include the counts and areas of all inner contours.

Deposition at 14 d : (Surface Contamination from Deposited Radionuclides)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

This product identifies the more highly contaminated areas due to fallout and deposition of the radioactive material. This material, depending upon the type of radiation emitted, may continue to give significant doses to individuals in these areas through inhalation of resuspended radioactive material or from direct external radiation. These levels of deposited radioactivity should be confirmed by monitoring surverys.

SOURCE INFORMATION:

Release Start Time:	March 12, 2011 06:25 UTC
Release Stop Time:	March 26, 2011 06:25 UTC
Release Location:	(37.421389, 141.0325) Fukushima 1
Source Material and Amount:	Early Phase Dose (0-4d)

Early Phase Dose (4-8d)

Early Phase Dose (8-12d)

Early Phase Dose (0-14d)

138969 Ci of BA-140 (100% respirable) over 1036800 sec

3162.34 Ci of CE-144 (100% respirable) over 1036800 sec

40.1641 Ci of CM-242 (100% respirable) over 1036800 sec

177591 Ci of CS-134 (100% respirable) over 1036800 sec

61424.6 Ci of CS-136 (100% respirable) over 1036800 sec

129073 Ci of CS-137 (100% respirable) over 1036800 sec

1.1998e+06 Ci of I-131 (100% respirable) over 1036800 sec

743463 Ci of I-132 (100% respirable) over 1036800 sec

312127 Ci of I-133 (100% respirable) over 1036800 sec

305.666 Ci of PU-241 (100% respirable) over 1036800 sec

2277.81 Ci of RB-86 (100% respirable) over 1036800 sec

18478.1 Ci of RU-103 (100% respirable) over 1036800 sec

5395.12 Ci of RU-106 (100% respirable) over 1036800 sec

12057.3 Ci of SB-127 (100% respirable) over 1036800 sec

83562.2 Ci of SR-89 (100% respirable) over 1036800 sec

6698.63 Ci of SR-90 (100% respirable) over 1036800 sec

3537.12 Ci of TE-127M (100% respirable) over 1036800 sec

14672.2 Ci of TE-129M (100% respirable) over 1036800 sec

177062 Ci of TE-132 (100% respirable) over 1036800 sec

8.3307e+07 Ci of XE-133 (100% respirable) over 1036800 sec

Early Phase Guidance (Radioiodine) (0-14 d)

1.1998e+06 Ci of I-131 (100% respirable) over 1036800 sec

743463 Ci of I-132 (100% respirable) over 1036800 sec

312127 Ci of I-133 (100% respirable) over 1036800 sec

14672.2 Ci of TE-129M (100% respirable) over 1036800 sec

177062 Ci of TE-132 (100% respirable) over 1036800 sec

Worker Protection Dose Rate at 4 d

Worker Protection Dose Rate at 8 d

Worker Protection Dose Rate at 12 d

Deposition at 14 d

138969 Ci of BA-140 (100% respirable) over 1036800 sec

3162.34 Ci of CE-144 (100% respirable) over 1036800 sec

40.1641 Ci of CM-242 (100% respirable) over 1036800 sec

177591 Ci of CS-134 (100% respirable) over 1036800 sec

61424.6 Ci of CS-136 (100% respirable) over 1036800 sec

129073 Ci of CS-137 (100% respirable) over 1036800 sec

	1.1998e+06 Ci of I-131 (100% respirable) over 1036800 sec
	743463 Ci of I-132 (100% respirable) over 1036800 sec
	312127 Ci of I-133 (100% respirable) over 1036800 sec
	305.666 Ci of PU-241 (100% respirable) over 1036800 sec
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	18478.1 Ci of RU-103 (100% respirable) over 1036800 sec
	5395.12 Ci of RU-106 (100% respirable) over 1036800 sec
	12057.3 Ci of SB-127 (100% respirable) over 1036800 sec
	83562.2 Ci of SR-89 (100% respirable) over 1036800 sec
	6698.63 Ci of SR-90 (100% respirable) over 1036800 sec
	3537.12 Ci of TE-127M (100% respirable) over 1036800 sec
	14672.2 Ci of TE-129M (100% respirable) over 1036800 sec
	177062 Ci of TE-132 (100% respirable) over 1036800 sec
Source Geometry:	gaussian cloud top at 200 m
Particle Size Distribution:	All particulate is in the respirable range from 0.1 to 10 microns

METEOROLOGY:

ADAPT Gridded Metdata from 03/11/2011 21:00:00 JST to 03/26/2011 15:00:00 JST at 2 hr intervals were used in this calculation

Gridded Met Source	Obs Time
ADAPT	March 11, 2011 12:00 UTC
ADAPT	March 11, 2011 14:00 UTC
ADAPT	March 11, 2011 16:00 UTC
ADAPT	March 11, 2011 18:00 UTC
ADAPT	March 11, 2011 20:00 UTC
ADAPT	March 11, 2011 22:00 UTC
ADAPT	March 12, 2011 00:00 UTC
ADAPT	March 12, 2011 02:00 UTC
ADAPT	March 12, 2011 04:00 UTC
ADAPT	March 12, 2011 06:00 UTC
ADAPT	March 12, 2011 08:00 UTC
ADAPT	March 12, 2011 10:00 UTC
ADAPT	March 12, 2011 12:00 UTC

Gridded Met

Source	Obs Time
ADAPT	March 12, 2011 13:00 UTC
ADAPT	March 12, 2011 15:00 UTC
ADAPT	March 12, 2011 16:00 UTC
ADAPT	March 12, 2011 18:00 UTC
ADAPT	March 12, 2011 20:00 UTC
ADAPT	March 12, 2011 22:00 UTC
ADAPT	March 13, 2011 00:00 UTC
ADAPT	March 13, 2011 02:00 UTC
ADAPT	March 13, 2011 04:00 UTC
ADAPT	March 13, 2011 06:00 UTC
ADAPT	March 13, 2011 08:00 UTC
ADAPT	March 13, 2011 10:00 UTC
ADAPT	March 13, 2011 12:00 UTC
ADAPT	March 13, 2011 14:00 UTC
ADAPT	March 13, 2011 16:00 UTC
ADAPT	March 13, 2011 18:00 UTC
ADAPT	March 13, 2011 19:00 UTC
ADAPT	March 13, 2011 22:00 UTC
ADAPT	March 14, 2011 00:00 UTC
ADAPT	March 14, 2011 02:00 UTC
ADAPT	March 14, 2011 04:00 UTC
ADAPT	March 14, 2011 06:00 UTC
ADAPT	March 14, 2011 08:00 UTC
ADAPT	March 14, 2011 10:00 UTC
ADAPT	March 14, 2011 12:00 UTC
ADAPT	March 14, 2011 14:00 UTC
ADAPT	March 14, 2011 16:00 UTC
ADAPT	March 14, 2011 18:00 UTC
ADAPT	March 14, 2011 20:00 UTC
ADAPT	March 14, 2011 22:00 UTC

Gridded Met

Source	Obs Time
ADAPT	March 15, 2011 00:00 UTC
ADAPT	March 15, 2011 02:00 UTC
ADAPT	March 15, 2011 04:00 UTC
ADAPT	March 15, 2011 06:00 UTC
ADAPT	March 15, 2011 08:00 UTC
ADAPT	March 15, 2011 10:00 UTC
ADAPT	March 15, 2011 12:00 UTC
ADAPT	March 15, 2011 14:00 UTC
ADAPT	March 15, 2011 16:00 UTC
ADAPT	March 15, 2011 18:00 UTC
ADAPT	March 15, 2011 20:00 UTC
ADAPT	March 15, 2011 22:00 UTC
ADAPT	March 16, 2011 00:00 UTC
ADAPT	March 16, 2011 02:00 UTC
ADAPT	March 16, 2011 04:00 UTC
ADAPT	March 16, 2011 06:00 UTC
ADAPT	March 16, 2011 08:00 UTC
ADAPT	March 16, 2011 10:00 UTC
ADAPT	March 16, 2011 12:00 UTC
ADAPT	March 16, 2011 14:00 UTC
ADAPT	March 16, 2011 16:00 UTC
ADAPT	March 16, 2011 18:00 UTC
ADAPT	March 16, 2011 20:00 UTC
ADAPT	March 16, 2011 22:00 UTC
ADAPT	March 17, 2011 00:00 UTC
ADAPT	March 17, 2011 02:00 UTC
ADAPT	March 17, 2011 04:00 UTC
ADAPT	March 17, 2011 06:00 UTC
ADAPT	March 17, 2011 08:00 UTC
ADAPT	March 17, 2011 10:00 UTC

Gridded Met

Source	Obs Time
ADAPT	March 17, 2011 12:00 UTC
ADAPT	March 17, 2011 14:00 UTC
ADAPT	March 17, 2011 16:00 UTC
ADAPT	March 17, 2011 18:00 UTC
ADAPT	March 17, 2011 20:00 UTC
ADAPT	March 17, 2011 22:00 UTC
ADAPT	March 18, 2011 00:00 UTC
ADAPT	March 18, 2011 02:00 UTC
ADAPT	March 18, 2011 04:00 UTC
ADAPT	March 18, 2011 06:00 UTC
ADAPT	March 18, 2011 08:00 UTC
ADAPT	March 18, 2011 10:00 UTC
ADAPT	March 18, 2011 12:00 UTC
ADAPT	March 18, 2011 14:00 UTC
ADAPT	March 18, 2011 16:00 UTC
ADAPT	March 18, 2011 21:00 UTC
ADAPT	March 18, 2011 23:00 UTC
ADAPT	March 19, 2011 01:00 UTC
ADAPT	March 19, 2011 03:00 UTC
ADAPT	March 19, 2011 05:00 UTC
ADAPT	March 19, 2011 07:00 UTC
ADAPT	March 19, 2011 10:00 UTC
ADAPT	March 19, 2011 12:00 UTC
ADAPT	March 19, 2011 14:00 UTC
ADAPT	March 19, 2011 16:00 UTC
ADAPT	March 19, 2011 17:00 UTC
ADAPT	March 19, 2011 21:00 UTC
ADAPT	March 19, 2011 23:00 UTC
ADAPT	March 20, 2011 01:00 UTC
ADAPT	March 20, 2011 03:00 UTC

Gridded Met

Source	Obs Time
ADAPT	March 20, 2011 05:00 UTC
ADAPT	March 20, 2011 07:00 UTC
ADAPT	March 20, 2011 09:00 UTC
ADAPT	March 20, 2011 11:00 UTC
ADAPT	March 20, 2011 13:00 UTC
ADAPT	March 20, 2011 15:00 UTC
ADAPT	March 20, 2011 17:00 UTC
ADAPT	March 20, 2011 19:00 UTC
ADAPT	March 20, 2011 21:00 UTC
ADAPT	March 20, 2011 23:00 UTC
ADAPT	March 21, 2011 01:00 UTC
ADAPT	March 21, 2011 03:00 UTC
ADAPT	March 21, 2011 05:00 UTC
ADAPT	March 21, 2011 07:00 UTC
ADAPT	March 21, 2011 09:00 UTC
ADAPT	March 21, 2011 11:00 UTC
ADAPT	March 21, 2011 13:00 UTC
ADAPT	March 21, 2011 15:00 UTC
ADAPT	March 21, 2011 17:00 UTC
ADAPT	March 21, 2011 19:00 UTC
ADAPT	March 21, 2011 21:00 UTC
ADAPT	March 21, 2011 23:00 UTC
ADAPT	March 22, 2011 01:00 UTC
ADAPT	March 22, 2011 03:00 UTC
ADAPT	March 22, 2011 05:00 UTC
ADAPT	March 22, 2011 07:00 UTC
ADAPT	March 22, 2011 09:00 UTC
ADAPT	March 22, 2011 11:00 UTC
ADAPT	March 22, 2011 13:00 UTC
ADAPT	March 22, 2011 15:00 UTC

Gridded Met

Source	Obs Time
ADAPT	March 22, 2011 17:00 UTC
ADAPT	March 22, 2011 19:00 UTC
ADAPT	March 22, 2011 21:00 UTC
ADAPT	March 22, 2011 23:00 UTC
ADAPT	March 23, 2011 00:00 UTC
ADAPT	March 23, 2011 02:00 UTC
ADAPT	March 23, 2011 04:00 UTC
ADAPT	March 23, 2011 06:00 UTC
ADAPT	March 23, 2011 08:00 UTC
ADAPT	March 23, 2011 10:00 UTC
ADAPT	March 23, 2011 12:00 UTC
ADAPT	March 23, 2011 14:00 UTC
ADAPT	March 23, 2011 16:00 UTC
ADAPT	March 23, 2011 18:00 UTC
ADAPT	March 23, 2011 20:00 UTC
ADAPT	March 23, 2011 22:00 UTC
ADAPT	March 24, 2011 00:00 UTC
ADAPT	March 24, 2011 02:00 UTC
ADAPT	March 24, 2011 04:00 UTC
ADAPT	March 24, 2011 06:00 UTC
ADAPT	March 24, 2011 08:00 UTC
ADAPT	March 24, 2011 10:00 UTC
ADAPT	March 24, 2011 12:00 UTC
ADAPT	March 24, 2011 14:00 UTC
ADAPT	March 24, 2011 16:00 UTC
ADAPT	March 24, 2011 18:00 UTC
ADAPT	March 24, 2011 20:00 UTC
ADAPT	March 24, 2011 22:00 UTC
ADAPT	March 25, 2011 00:00 UTC
ADAPT	March 25, 2011 02:00 UTC

Gridded Met

Source	Obs Time
ADAPT	March 25, 2011 04:00 UTC
ADAPT	March 25, 2011 06:00 UTC
ADAPT	March 25, 2011 08:00 UTC
ADAPT	March 25, 2011 10:00 UTC
ADAPT	March 25, 2011 12:00 UTC
ADAPT	March 25, 2011 14:00 UTC
ADAPT	March 25, 2011 16:00 UTC
ADAPT	March 25, 2011 18:00 UTC
ADAPT	March 25, 2011 20:00 UTC
ADAPT	March 25, 2011 22:00 UTC
ADAPT	March 26, 2011 00:00 UTC
ADAPT	March 26, 2011 02:00 UTC
ADAPT	March 26, 2011 04:00 UTC
ADAPT	March 26, 2011 06:00 UTC

No precipitation is included in this calculation

ASSUMPTIONS:

Unless otherwise stated ICRP60 series DCF's were used for dose plots.

CONTACT INFORMATION:

Calculation requested on March 25, 2011 04:00 UTC by:

none none, DOE NIT
202-586-8100

Approved by: NARAC Operations
Approver organization: NARAC
Phone: 925-422-9100

Email: narac@llnl.gov
Approved on: March 25, 2011 04:14 UTC

Classification: ~~Official Use Only - Not Approved for Further Distribution~~

DISCLAIMER:

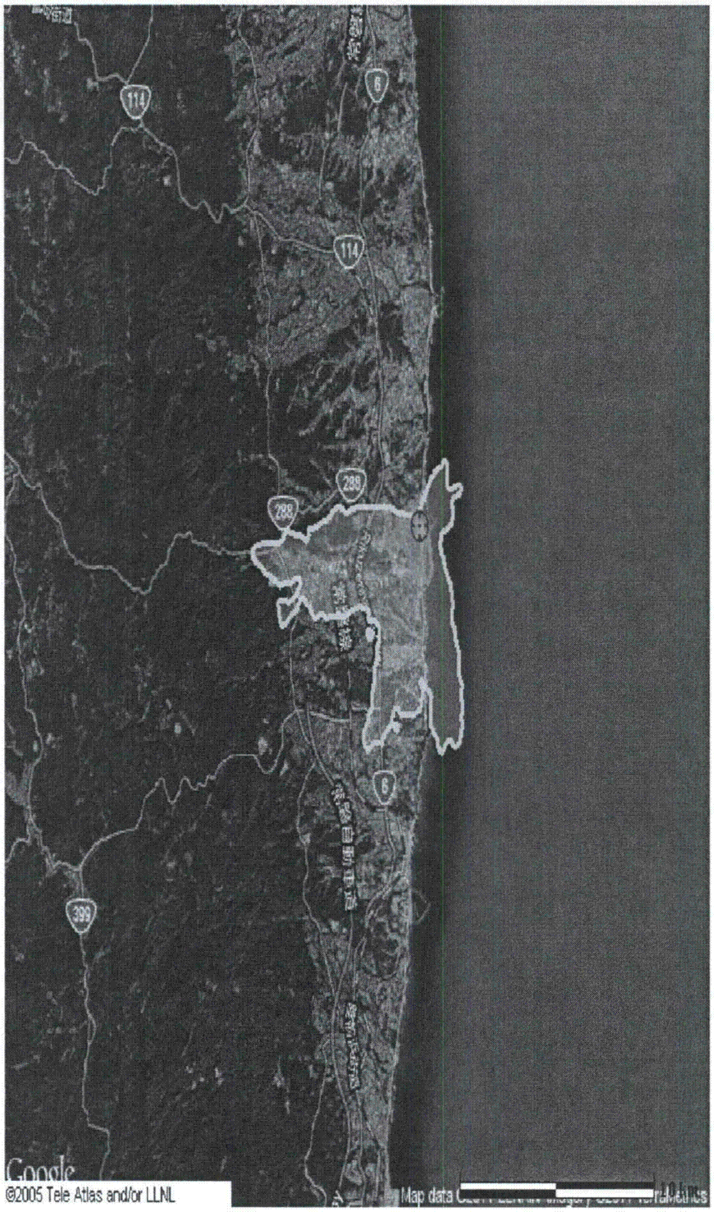
These model predictions are intended to be guidance, and are not final recommendations. The accuracy of any prediction will be limited by the accuracy of the input data, such as estimates of the amount of material that becomes airborne and the available meteorological data for the area and time of the incident. Plume predictions may be for a limited time period, and may change at later times if new input data becomes available. Predictions should be confirmed and refined using field measurements. Air and ground concentration may be higher than predicted by this plume model simulation due the limited resolution of this particular simulation. For actual incidents or exercises, consult incident command and subject matter experts from the appropriate coordinating agency before making any decisions based on this model prediction.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

NARAC
National Atmospheric Release Advisory Center

Early Phase Dose (0-4d)
(Total Effective Dose)

Japan Impacts - NRC Plausible Realistic
Case V3 (U1Exp)
NARAC Report - Potential Release



Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

Actions and Long-Term Effects

	Description	(rem) Extent Area	Population
	Exceeds 5 rem total effective dose.	>5 1.8 km 2.3 km2	2,380
	Exceeds 1 rem total effective dose.	>1 8.6 km 41.2 km2	10,200

Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination from March 12, 2011 06:25 UTC to March 16, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133

Generated On: March 25, 2011 03:51 UTC

Model: LODI

Comments:

Doses shown are total accumulated from the beginning of release.

Plausible Realistic Scenario

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465

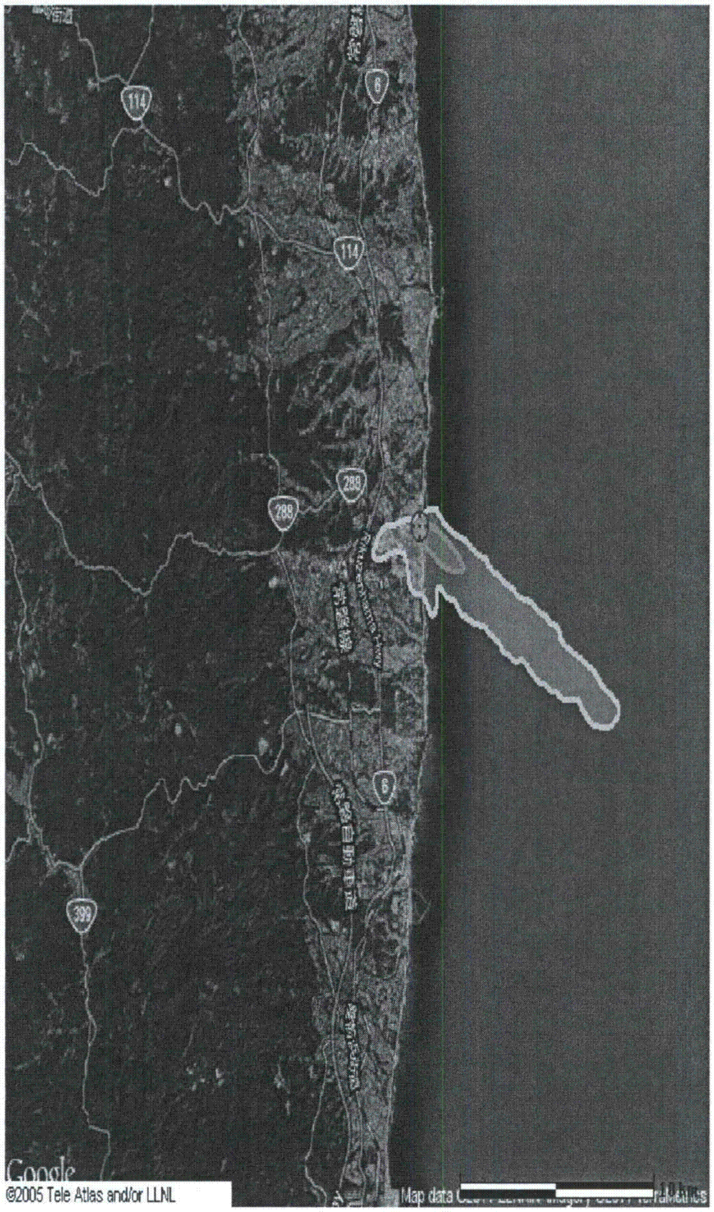
Requested by: {none none; DOE NIT; 202-586-8100}

Approved by: {NARAC Operations; NARAC; 925-422-9100}

APPROVED PRODUCT NARAC National Atmospheric Release Advisory Center

Early Phase Dose (4-8d)
(Total Effective Dose)

Japan Impacts - NRC Plausible Realistic Case V3 (U1Exp)
NARAC Report - Potential Release



Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

Actions and Long-Term Effects

	Description	(rem) Extent Area	Population
	Exceeds 5 rem total effective dose.	>5 2.6 km 1.7 km2	730
	Exceeds 1 rem total effective dose.	>1 11.6 km 21.6 km2	3,080

Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination from March 16, 2011 06:25 UTC to March 20, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133

Generated On: March 25, 2011 03:52 UTC

Model: LODI

Comments:

Doses shown are accrued after 03/16/2011 06:25:00 UTC and can be avoided by protective actions

Plausible Realistic Scenario

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465

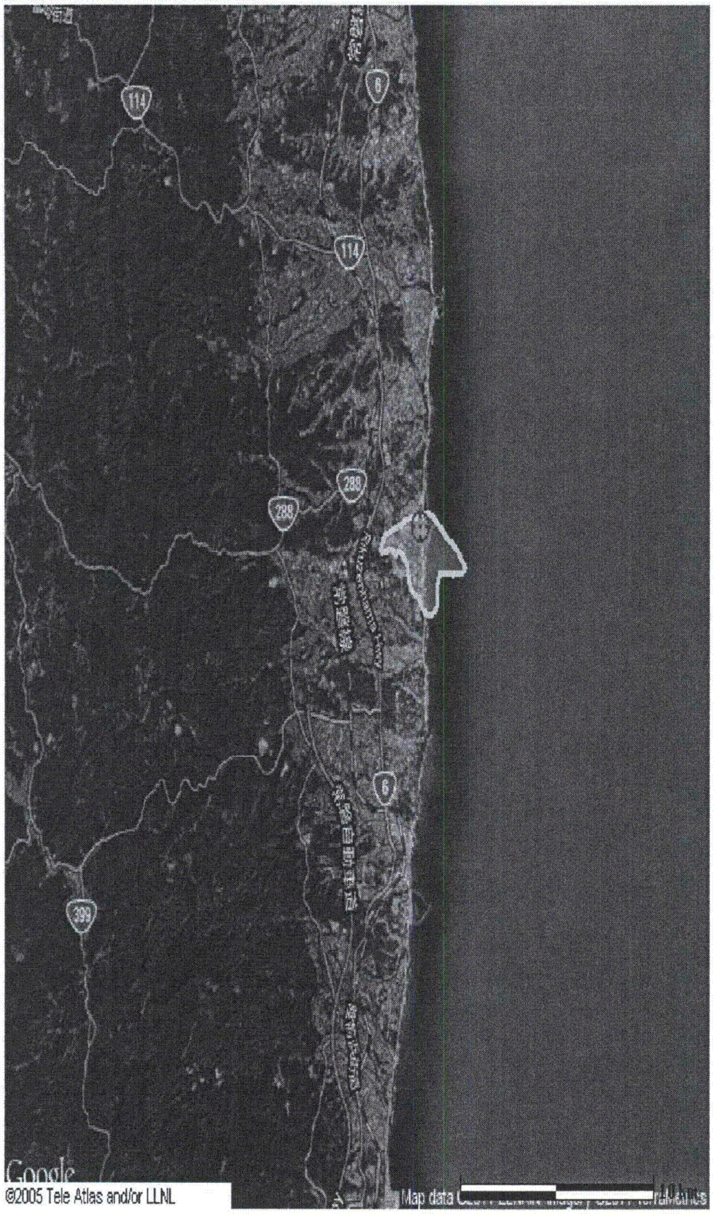
Requested by: {none none; DOE NIT; 202-586-8100}

Approved by: {NARAC Operations; NARAC; 925-422-9100}

APPROVED PRODUCT
NARAC
National Atmospheric Release Advisory Center

Early Phase Dose (8-12d)
(Total Effective Dose)

Japan Impacts - NRC Plausible Realistic Case V3 (U1Exp)
NARAC Report - Potential Release



Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

Actions and Long-Term Effects

	Description	(rem) Extent Area	Population
	Exceeds 5 rem total effective dose.	>5 0.5 km 0.4 km2	540
	Exceeds 1 rem total effective dose.	>1 2.7 km 6.0 km2	2,970
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.			

Effects or contamination from March 20, 2011 06:25 UTC to March 24, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133

Generated On: March 25, 2011 03:52 UTC

Model: LODI

Comments:

Doses shown are accrued after 03/20/2011 06:25:00 UTC and can be avoided by protective actions

Plausible Realistic Scenario

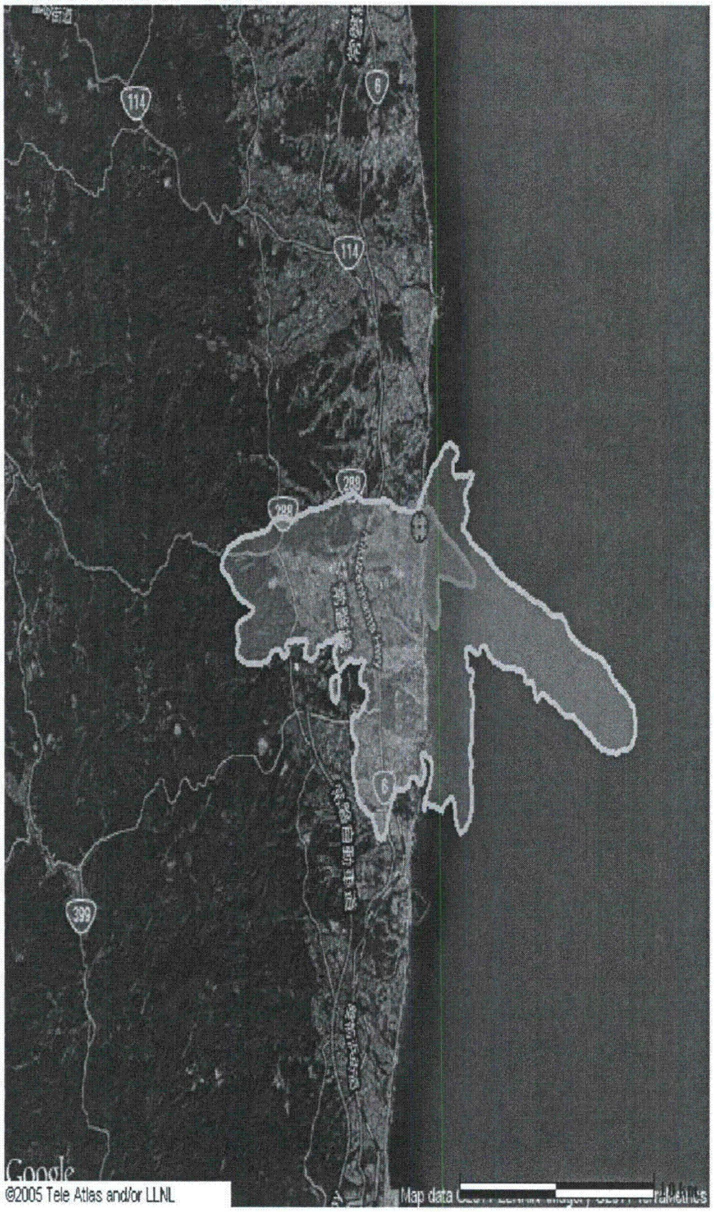
NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465

Requested by: {none none; DOE NIT; 202-586-8100}

Approved by: {NARAC Operations; NARAC; 925-422-9100}

Early Phase Dose (0-14d)
(Total Effective Dose)

Japan Impacts - NRC Plausible Realistic
Case V3 (U1Exp)
NARAC Report - Potential Release



Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

Actions and Long-Term Effects			
	Description	**(rem) Extent Area**	**Population**
	Exceeds 5 rem total effective dose.	>5 3.2 km 8.5 km2	3,220
	Exceeds 1 rem total effective dose.	>1 12.6 km 98.2 km2	14,900
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.			

Effects or contamination from March 12, 2011 06:25 UTC to March 26, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133

Generated On: March 25, 2011 03:52 UTC

Model: LODI

Comments:

Doses shown are total accumulated from the beginning of release.

Plausible Realistic Scenario

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465

Requested by: {none none; DOE NIT; 202-586-8100}

Approved by: {NARAC Operations; NARAC; 925-422-9100}

Early Phase Guidance (Radioiodine) (0-14 d)
(KI Administration based on Thyroid Radioiodine Dose)

Japan Impacts - NRC Plausible Realistic Case V3 (U1Exp)
NARAC Report - Potential Release

Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

Effects and Actions			
	Description	(rem) Extent Area	Population
	Adult thyroid Committed Equivalent Dose - Early Phase FDA Guidance for KI administration to adults	>10 8.4 km 34.7 km2	8,580
	Child thyroid Committed Equivalent Dose - Early Phase PAG for KI administration to children.	>5 17.8 km 252 km2	27,800
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.			

Effects or contamination from March 12, 2011 06:25 UTC to March 26, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: I-131 + I-132 + TE-132 + I-133 + TE-129M

Generated On: March 25, 2011 03:52 UTC

Model: LODI

Comments:

Doses shown are total accumulated from the beginning of release.

Plausible Realistic Scenario

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465

Requested by: {none none; DOE NIT; 202-586-8100}

Approved by: {NARAC Operations; NARAC; 925-422-9100}

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Worker Protection Dose Rate at 4 d
(Groundshine Dose Rate at 03/16/2011 15:25:00 JST)

Japan Impacts - NRC Plausible Realistic Case V3 (U1Exp)
NARAC Report - Potential Release

Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

Acute (Short-Term) Effects			
	Description	**(mrem/hr) Extent Area**	**Population**
	Limit for all occupational exposures exceeded by exposure for 50 hours or less.	>100 0.2 km 0.02 km2	50
	U.S. NCRP radiological control boundary.	>10 3.5 km 7.1 km2	3,120
	U.S. NRC public exclusion zone	>2 10.2 km 76.3 km2	13,600
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.			

Effects or contamination at March 16, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

Generated On: March 25, 2011 03:52 UTC

Model: LODI

Comments:

Plausible Realistic Scenario

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465

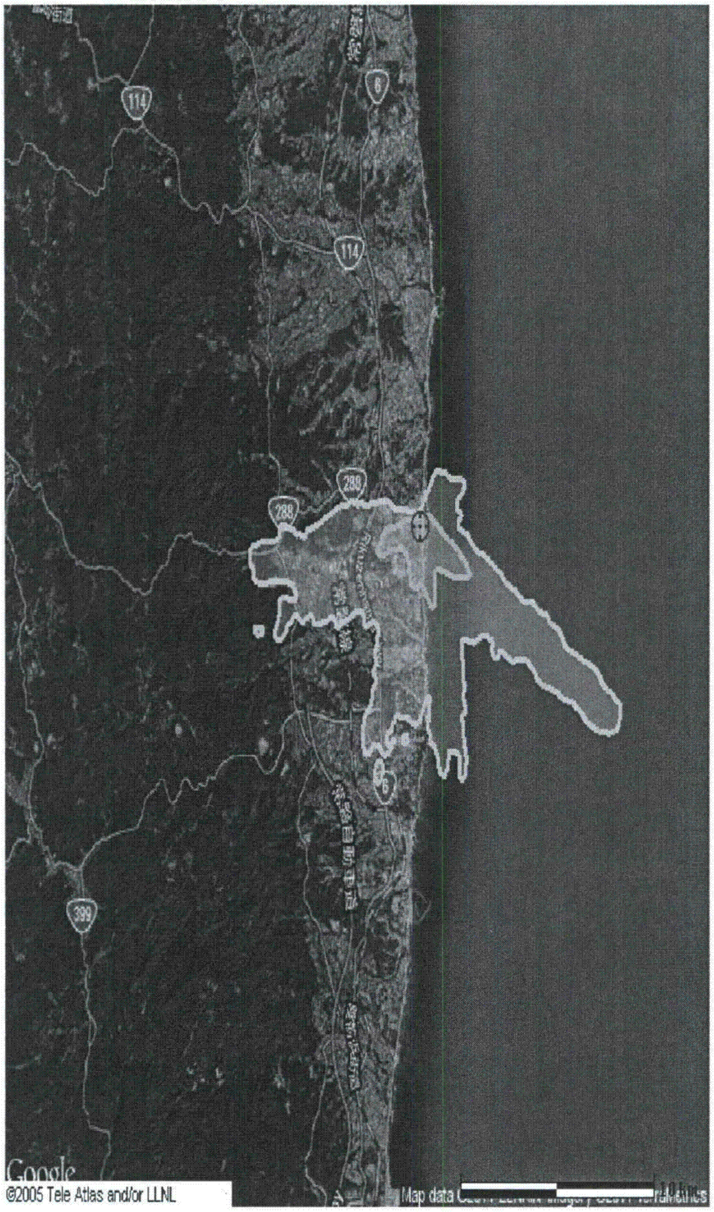
Requested by: {none none; DOE NIT; 202-586-8100}

Approved by: {NARAC Operations; NARAC; 925-422-9100}

APPROVED PRODUCT NARAC National Atmospheric Release Advisory Center

Worker Protection Dose Rate at 8 d
(Groundshine Dose Rate at 03/20/2011 15:25:00 JST)

Japan Impacts - NRC Plausible Realistic Case V3 (U1Exp)
NARAC Report - Potential Release



Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

Acute (Short-Term) Effects			
	Description	**(mrem/hr) Extent Area**	**Population**
	U.S. NCRP radiological control boundary.	>10 2.9 km 5.5 km2	2,910
	U.S. NRC public exclusion zone	>2 11.9 km 64.7 km2	10,800
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.			

Effects or contamination at March 20, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

Generated On: March 25, 2011 03:52 UTC

Model: LODI

Comments:

Plausible Realistic Scenario

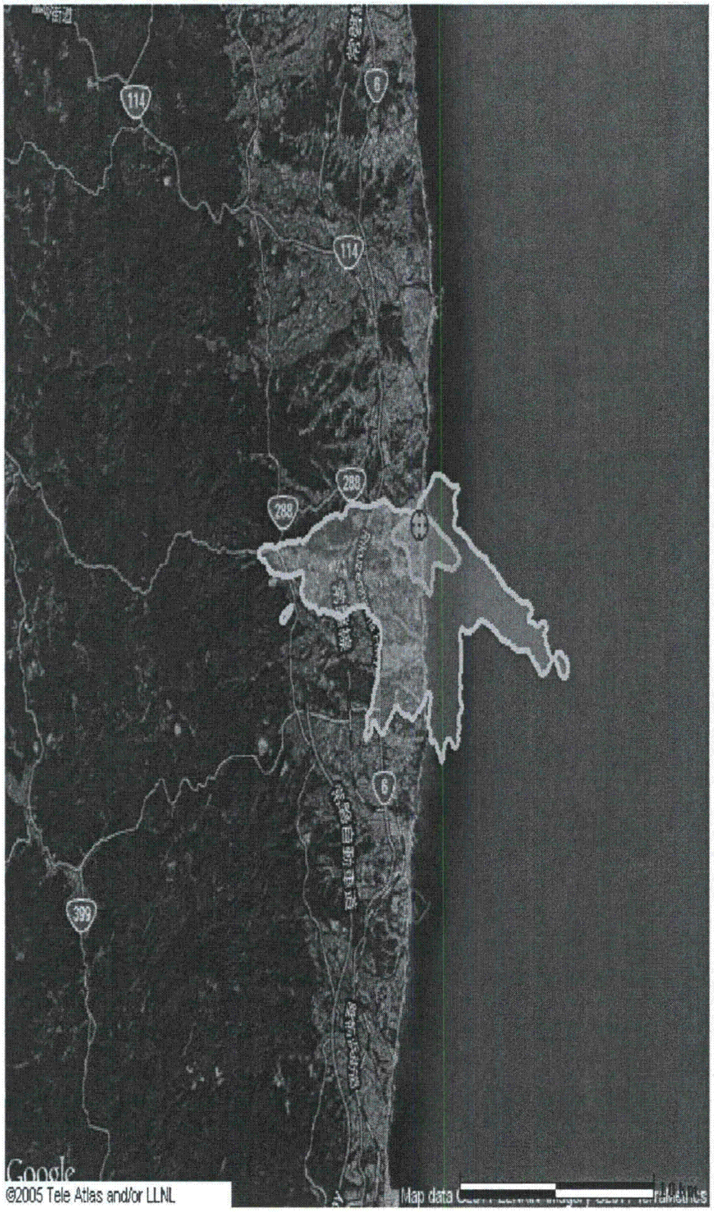
NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465

Requested by: {none none; DOE NIT; 202-586-8100}

Approved by: {NARAC Operations; NARAC; 925-422-9100}

Worker Protection Dose Rate at 12 d
(Groundshine Dose Rate at 03/24/2011 15:25:00 JST)

Japan Impacts - NRC Plausible Realistic Case V3 (U1Exp)
NARAC Report - Potential Release



Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

Acute (Short-Term) Effects			
	Description	**(mrem/hr) Extent Area**	**Population**
	U.S. NCRP radiological control boundary.	>10 2.3 km 3.9 km2	2,560
	U.S. NRC public exclusion zone	>2 8.8 km 48.7 km2	10,100
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.			

Effects or contamination at March 24, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

Generated On: March 25, 2011 03:52 UTC

Model: LODI

Comments:

Plausible Realistic Scenario

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465

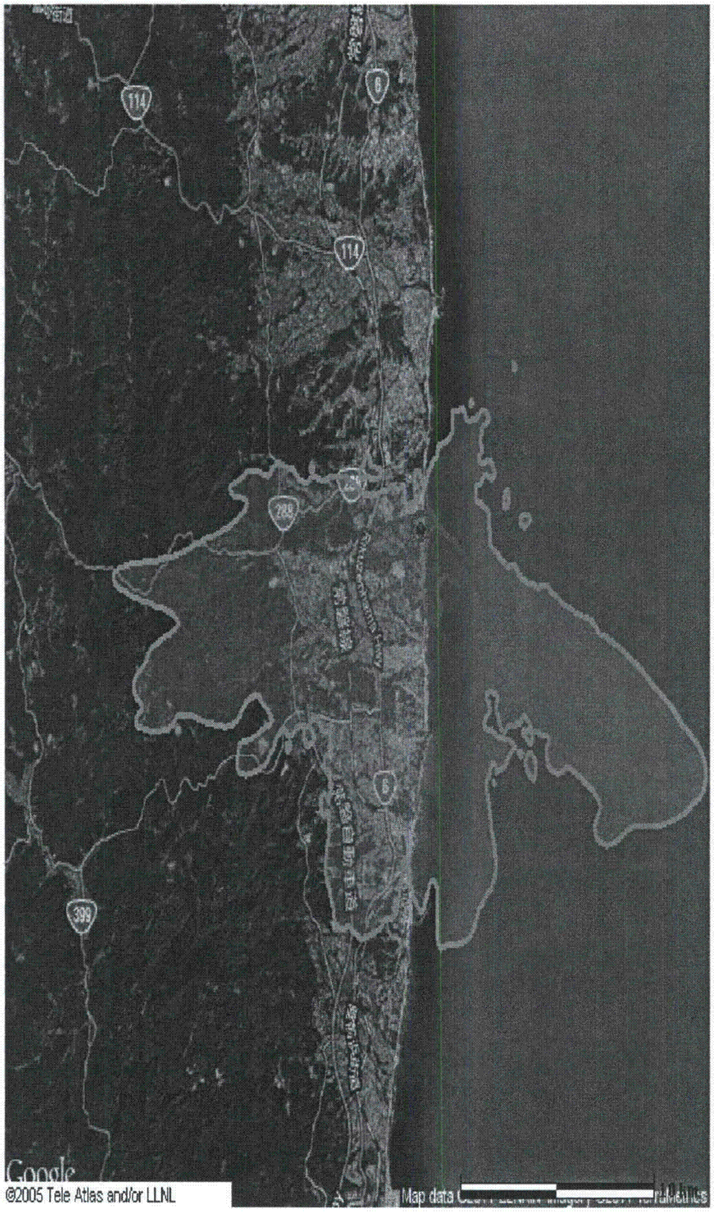
Requested by: {none none; DOE NIT; 202-586-8100}

Approved by: {NARAC Operations; NARAC; 925-422-9100}

APPROVED PRODUCT
NARAC
National Atmospheric Release Advisory Center

Deposition at 14 d
(Surface Contamination from Deposited Radionuclides)

Japan Impacts - NRC Plausible Realistic Case V3 (U1Exp)
NARAC Report - Potential Release



Map Size: 36.4 km by 36.4 km **Id:** Production3.rcE12815.rcC1

Effects and Actions

	Description	(Ci/m2) Extent Area	Population
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>0.01 0.2 km 0.07 km2	120
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>0.0010 3.5 km 8.3 km2	3,150
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>0.0001 16.4 km 217 km2	25,800

Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination at March 26, 2011 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

Generated On: March 25, 2011 03:52 UTC

Model: LODI

Comments:

Plausible Realistic Scenario

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465

Requested by: {none none; DOE NIT; 202-586-8100}

Approved by: {NARAC Operations; NARAC; 925-422-9100}

Consequence Report

Issued: March 30, 2011 00:30 UTC

Japan Impacts - NRC PRC V3 - Relocation

NARAC Report - Potential Release

SUMMARY:

This report describes the health effect consequences associated with a hypothetical unknown release to the atmosphere from a radiological source. This is an initial, automated NARAC product, not a final recommendation. Initial predictions are for a limited time period and areas affected may change at later times. Please consult NARAC staff (925-422-7627) for refined, quality assured predictions. Predictions should be confirmed and refined using measurements.

PRODUCTS:

Intermediate Phase Relocation PAGs : (Relocation based on Avoidable Groundshine and Resuspension Dose)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

The following figure illustrates the model-predicted regions in which individuals are projected to have an elevated risk of developing fatal and non-fatal cancers due to radiation exposure over a period of many years from the radioactive material that has been deposited on the surface. There are two primary pathways by which individuals will continue to receive a radiological dose while they remain in these areas. Individuals in these regions will be exposed to radiation by direct exposure from radioactive material on surfaces and by exposure from material that has been resuspended into the air and subsequently inhaled. The U.S. Environmental Protection Agency (EPA) and Department of Homeland Security (DHS) have proposed or accepted similar sets of Protective Action Guides (PAGs) to indicate when relocation (long-term removal) of individuals should be considered. These Guides are primarily based on an assessment of the risk in developing cancer over an exposed individual's lifetime, and thus the health effects produced by the doses may develop over a period of several years. Note that the PAGs were developed based on avoidable dose (i.e. the dose that will be avoided once protective actions have been implemented). These model predictions are based on the conservative assumption that individuals are unsheltered and remain in the area during the time period specified in the figure's legend. If protective actions have not been implemented by the beginning of this exposure period, the avoidable dose will be less than that shown for the unsheltered population, and accumulated dose will continue to rise at an undiminished rate. Health effects could be significantly different for sheltered individuals or for those exposed in these areas for different time periods. The contours that may be displayed include the first-year relocation contour where individuals are projected to receive a dose in excess of 2 rem over the remainder of the first year following the release, and the second-year relocation contour where individuals are projected to receive a dose in excess of 0.5 rem during the second year following the release. (Doses received over each of the subsequent years are normally less than those received during the second-year.)

SOURCE INFORMATION:

Release Start Time:	March 12, 2011 06:25 UTC
Release Stop Time:	March 26, 2011 06:25 UTC
Release Location:	(37.421389, 141.0325) Fukushima 1
Source Material and Amount:	138969 Ci of BA-140 (100% respirable) over 1036800 sec
	3162.34 Ci of CE-144 (100% respirable) over 1036800 sec
	40.1641 Ci of CM-242 (100% respirable) over 1036800 sec

	177591 Ci of CS-134 (100% respirable) over 1036800 sec
	61424.6 Ci of CS-136 (100% respirable) over 1036800 sec
	129073 Ci of CS-137 (100% respirable) over 1036800 sec
	1.1998e+06 Ci of I-131 (100% respirable) over 1036800 sec
	743463 Ci of I-132 (100% respirable) over 1036800 sec
	312127 Ci of I-133 (100% respirable) over 1036800 sec
	305.666 Ci of PU-241 (100% respirable) over 1036800 sec
	2277.81 Ci of RB-86 (100% respirable) over 1036800 sec
	18478.1 Ci of RU-103 (100% respirable) over 1036800 sec
	5395.12 Ci of RU-106 (100% respirable) over 1036800 sec
	12057.3 Ci of SB-127 (100% respirable) over 1036800 sec
	83562.2 Ci of SR-89 (100% respirable) over 1036800 sec
	6698.63 Ci of SR-90 (100% respirable) over 1036800 sec
	3537.12 Ci of TE-127M (100% respirable) over 1036800 sec
	14672.2 Ci of TE-129M (100% respirable) over 1036800 sec
	177062 Ci of TE-132 (100% respirable) over 1036800 sec
Source Geometry:	gaussian cloud top at 200 m
Particle Size Distribution:	All particulate is in the respirable range from 0.1 to 10 microns

METEOROLOGY:

ADAPT Gridded Metdata from 03/11/2011 21:00:00 JST to 03/26/2011 15:00:00 JST at 2 hr intervals were used in this calculation

Gridded Met Source	Obs Time
ADAPT	March 11, 2011 12:00 UTC
ADAPT	March 11, 2011 14:00 UTC
ADAPT	March 11, 2011 16:00 UTC
ADAPT	March 11, 2011 18:00 UTC
ADAPT	March 11, 2011 20:00 UTC
ADAPT	March 11, 2011 22:00 UTC
ADAPT	March 12, 2011 00:00 UTC
ADAPT	March 12, 2011 02:00 UTC
ADAPT	March 12, 2011 04:00 UTC
ADAPT	March 12, 2011 06:00 UTC

Gridded Met

Source	Obs Time
ADAPT	March 12, 2011 08:00 UTC
ADAPT	March 12, 2011 10:00 UTC
ADAPT	March 12, 2011 12:00 UTC
ADAPT	March 12, 2011 13:00 UTC
ADAPT	March 12, 2011 15:00 UTC
ADAPT	March 12, 2011 16:00 UTC
ADAPT	March 12, 2011 18:00 UTC
ADAPT	March 12, 2011 20:00 UTC
ADAPT	March 12, 2011 22:00 UTC
ADAPT	March 13, 2011 00:00 UTC
ADAPT	March 13, 2011 02:00 UTC
ADAPT	March 13, 2011 04:00 UTC
ADAPT	March 13, 2011 06:00 UTC
ADAPT	March 13, 2011 08:00 UTC
ADAPT	March 13, 2011 10:00 UTC
ADAPT	March 13, 2011 12:00 UTC
ADAPT	March 13, 2011 14:00 UTC
ADAPT	March 13, 2011 16:00 UTC
ADAPT	March 13, 2011 18:00 UTC
ADAPT	March 13, 2011 19:00 UTC
ADAPT	March 13, 2011 22:00 UTC
ADAPT	March 14, 2011 00:00 UTC
ADAPT	March 14, 2011 02:00 UTC
ADAPT	March 14, 2011 04:00 UTC
ADAPT	March 14, 2011 06:00 UTC
ADAPT	March 14, 2011 08:00 UTC
ADAPT	March 14, 2011 10:00 UTC
ADAPT	March 14, 2011 12:00 UTC
ADAPT	March 14, 2011 14:00 UTC
ADAPT	March 14, 2011 16:00 UTC

Gridded Met

Source	Obs Time
ADAPT	March 14, 2011 18:00 UTC
ADAPT	March 14, 2011 20:00 UTC
ADAPT	March 14, 2011 22:00 UTC
ADAPT	March 15, 2011 00:00 UTC
ADAPT	March 15, 2011 02:00 UTC
ADAPT	March 15, 2011 04:00 UTC
ADAPT	March 15, 2011 06:00 UTC
ADAPT	March 15, 2011 08:00 UTC
ADAPT	March 15, 2011 10:00 UTC
ADAPT	March 15, 2011 12:00 UTC
ADAPT	March 15, 2011 14:00 UTC
ADAPT	March 15, 2011 16:00 UTC
ADAPT	March 15, 2011 18:00 UTC
ADAPT	March 15, 2011 20:00 UTC
ADAPT	March 15, 2011 22:00 UTC
ADAPT	March 16, 2011 00:00 UTC
ADAPT	March 16, 2011 02:00 UTC
ADAPT	March 16, 2011 04:00 UTC
ADAPT	March 16, 2011 06:00 UTC
ADAPT	March 16, 2011 08:00 UTC
ADAPT	March 16, 2011 10:00 UTC
ADAPT	March 16, 2011 12:00 UTC
ADAPT	March 16, 2011 14:00 UTC
ADAPT	March 16, 2011 16:00 UTC
ADAPT	March 16, 2011 18:00 UTC
ADAPT	March 16, 2011 20:00 UTC
ADAPT	March 16, 2011 22:00 UTC
ADAPT	March 17, 2011 00:00 UTC
ADAPT	March 17, 2011 02:00 UTC
ADAPT	March 17, 2011 04:00 UTC

Gridded Met

Source	Obs Time
ADAPT	March 17, 2011 06:00 UTC
ADAPT	March 17, 2011 08:00 UTC
ADAPT	March 17, 2011 10:00 UTC
ADAPT	March 17, 2011 12:00 UTC
ADAPT	March 17, 2011 14:00 UTC
ADAPT	March 17, 2011 16:00 UTC
ADAPT	March 17, 2011 18:00 UTC
ADAPT	March 17, 2011 20:00 UTC
ADAPT	March 17, 2011 22:00 UTC
ADAPT	March 18, 2011 00:00 UTC
ADAPT	March 18, 2011 02:00 UTC
ADAPT	March 18, 2011 04:00 UTC
ADAPT	March 18, 2011 06:00 UTC
ADAPT	March 18, 2011 08:00 UTC
ADAPT	March 18, 2011 10:00 UTC
ADAPT	March 18, 2011 12:00 UTC
ADAPT	March 18, 2011 14:00 UTC
ADAPT	March 18, 2011 16:00 UTC
ADAPT	March 18, 2011 21:00 UTC
ADAPT	March 18, 2011 23:00 UTC
ADAPT	March 19, 2011 01:00 UTC
ADAPT	March 19, 2011 03:00 UTC
ADAPT	March 19, 2011 05:00 UTC
ADAPT	March 19, 2011 07:00 UTC
ADAPT	March 19, 2011 10:00 UTC
ADAPT	March 19, 2011 12:00 UTC
ADAPT	March 19, 2011 14:00 UTC
ADAPT	March 19, 2011 16:00 UTC
ADAPT	March 19, 2011 17:00 UTC
ADAPT	March 19, 2011 21:00 UTC

Gridded Met

Source	**Obs Time**
ADAPT	March 19, 2011 23:00 UTC
ADAPT	March 20, 2011 01:00 UTC
ADAPT	March 20, 2011 03:00 UTC
ADAPT	March 20, 2011 05:00 UTC
ADAPT	March 20, 2011 07:00 UTC
ADAPT	March 20, 2011 09:00 UTC
ADAPT	March 20, 2011 11:00 UTC
ADAPT	March 20, 2011 13:00 UTC
ADAPT	March 20, 2011 15:00 UTC
ADAPT	March 20, 2011 17:00 UTC
ADAPT	March 20, 2011 19:00 UTC
ADAPT	March 20, 2011 21:00 UTC
ADAPT	March 20, 2011 23:00 UTC
ADAPT	March 21, 2011 01:00 UTC
ADAPT	March 21, 2011 03:00 UTC
ADAPT	March 21, 2011 05:00 UTC
ADAPT	March 21, 2011 07:00 UTC
ADAPT	March 21, 2011 09:00 UTC
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ADAPT	March 21, 2011 13:00 UTC
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ADAPT	March 21, 2011 19:00 UTC
ADAPT	March 21, 2011 21:00 UTC
ADAPT	March 21, 2011 23:00 UTC
ADAPT	March 22, 2011 01:00 UTC
ADAPT	March 22, 2011 03:00 UTC
ADAPT	March 22, 2011 05:00 UTC
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ADAPT	March 22, 2011 09:00 UTC

Gridded Met

Source	Obs Time
ADAPT	March 22, 2011 11:00 UTC
ADAPT	March 22, 2011 13:00 UTC
ADAPT	March 22, 2011 15:00 UTC
ADAPT	March 22, 2011 17:00 UTC
ADAPT	March 22, 2011 19:00 UTC
ADAPT	March 22, 2011 21:00 UTC
ADAPT	March 22, 2011 23:00 UTC
ADAPT	March 23, 2011 00:00 UTC
ADAPT	March 23, 2011 02:00 UTC
ADAPT	March 23, 2011 04:00 UTC
ADAPT	March 23, 2011 06:00 UTC
ADAPT	March 23, 2011 08:00 UTC
ADAPT	March 23, 2011 10:00 UTC
ADAPT	March 23, 2011 12:00 UTC
ADAPT	March 23, 2011 14:00 UTC
ADAPT	March 23, 2011 16:00 UTC
ADAPT	March 23, 2011 18:00 UTC
ADAPT	March 23, 2011 20:00 UTC
ADAPT	March 23, 2011 22:00 UTC
ADAPT	March 24, 2011 00:00 UTC
ADAPT	March 24, 2011 02:00 UTC
ADAPT	March 24, 2011 04:00 UTC
ADAPT	March 24, 2011 06:00 UTC
ADAPT	March 24, 2011 08:00 UTC
ADAPT	March 24, 2011 10:00 UTC
ADAPT	March 24, 2011 12:00 UTC
ADAPT	March 24, 2011 14:00 UTC
ADAPT	March 24, 2011 16:00 UTC
ADAPT	March 24, 2011 18:00 UTC
ADAPT	March 24, 2011 20:00 UTC

Gridded Met

Source	Obs Time
ADAPT	March 24, 2011 22:00 UTC
ADAPT	March 25, 2011 00:00 UTC
ADAPT	March 25, 2011 02:00 UTC
ADAPT	March 25, 2011 04:00 UTC
ADAPT	March 25, 2011 06:00 UTC
ADAPT	March 25, 2011 08:00 UTC
ADAPT	March 25, 2011 10:00 UTC
ADAPT	March 25, 2011 12:00 UTC
ADAPT	March 25, 2011 14:00 UTC
ADAPT	March 25, 2011 16:00 UTC
ADAPT	March 25, 2011 18:00 UTC
ADAPT	March 25, 2011 20:00 UTC
ADAPT	March 25, 2011 22:00 UTC
ADAPT	March 26, 2011 00:00 UTC
ADAPT	March 26, 2011 02:00 UTC
ADAPT	March 26, 2011 04:00 UTC
ADAPT	March 26, 2011 06:00 UTC

No precipitation is included in this calculation

ASSUMPTIONS:

Unless otherwise stated ICRP60 series DCF's were used for dose plots.

CONTACT INFORMATION:

Calculation requested on March 26, 2011 00:28 UTC by:

none none, DOE NIT
202-586-8100

Approved by: NARAC Operations
Approver organization: NARAC
Phone: 925-422-9100
Email: narac@llnl.gov
Approved on: March 26, 2011 02:24 UTC

Classification: ~~Official Use Only - Not Approved for Further Distribution~~

DISCLAIMER:

These model predictions are intended to be guidance, and are not final recommendations. The accuracy of any prediction will be limited by the accuracy of the input data, such as estimates of the amount of material that becomes airborne and the available meteorological data for the area and time of the incident. Plume predictions may be for a limited time period, and may change at later times if new input data becomes available. Predictions should be confirmed and refined using field measurements. Air and ground concentration may be higher than predicted by this plume model simulation due the limited resolution of this particular simulation. For actual incidents or exercises, consult incident command and subject matter experts from the appropriate coordinating agency before making any decisions based on this model prediction.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

Intermediate Phase Relocation PAGs
(Relocation based on Avoidable Groundshine and Resuspension Dose)

Japan Impacts - NRC PRC V3 - Relocation
NARAC Report - Potential Release

Map Size: 72.9 km by 72.9 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

Actions and Long-Term Effects

	Description	(rem) Extent Area	Population
	Exceeds first-year relocation PAG (5 d to 1 yr 5 d).	>2 15.2 km 149 km2	19,300
	Exceeds second-year relocation PAG.	>0.5 32.0 km 553 km2	36,700

Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination from March 17, 2011 06:25 UTC to March 17, 2012 06:25 UTC at or near ground level.

Release Location: 37.421389 N, 141.032500 E

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

Generated On: March 26, 2011 00:27 UTC

Model: LODI

Comments:

Doses shown are accrued after 03/17/2011 06:25:00 UTC and can be avoided by protective actions

Tokyo Supercore 63 nuclides for U2 U3 U4a U4b

From: Hoc, PMT12
Sent: Tuesday, March 29, 2011 8:40 PM
To: PMT02 Hoc; PMT09 Hoc; PMT11 Hoc
Subject: FW: RFI continued
Attachments: TokyoSupercore-U2-RealWinds-2ndYrReloc-NARACReport-Draft.pdf; TokyoModifiedSuperCore-U34-RealWinds-EarlyIodineWorker-NARACreport-Draft.pdf

-----Original Message-----
From: Bertram, William (CONTR) [mailto:William.Bertram@nnsa.doe.gov]
Sent: Tuesday, March 29, 2011 8:28 PM
To: Hoc, PMT12
Subject: RFI continued

Here is the rest of the data that was requested.

Nuclear Incident Team (NIT)
Office of Emergency Response (NA-42)
National Nuclear Security Administration U.S. Department of Energy nitops@nnsa.doe.gov nit@doe.sgov.gov 202-586-8100

APPROVED PRODUCT NARAC National Atmospheric Release Advisory Center

Consequence Report
Tokyo Supercore U3, U4 no Iodine - Early Phase - Real Winds
NARAC Report - Potential Release

Issued: March 29, 2011 14:07 UTC

SUMMARY:

This report describes the health effect consequences associated with a hypothetical unknown release to the atmosphere from a radiological source. This is an initial, automated NARAC product, not a final recommendation. Initial predictions are for a limited time period and areas affected may change at later times. Please consult NARAC staff (925-422-7627) for refined, quality assured predictions. Predictions should be confirmed and refined using measurements.

PRODUCTS:

Early Phase Dose (0-96 Hrs) : (Total Effective Dose Including Plume Passage)
Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133
This product identifies areas that could exceed doses of 5 and 1 rem over a 4-day exposure period, which begins at the start of the release. If used to project doses from a potential future release, these levels correspond to the EPA/DHS guidelines for the Early Phase based on the dose that may be avoided if shelter and evacuation guidance can be implemented prior to the beginning of the release. These Protective Action Guideline (PAG) limits are based on an assessment of the long-term risk of developing cancer in exposed individuals over their lifetime or producing genetic disorders in subsequent generations. These risks result from the projected combined dose caused by radiation from the material deposited onto the surface, radiation from the material as it is carried in the air, and radiation from the material that has been inhaled and retained by the body. Upon request, estimates of the total number of people exposed, and (after accounting for estimated deaths from acute, short-term effects) the number of expected subsequent fatal cancers and combined number of expected subsequent fatal and non-fatal cancers may be displayed. These are computer model estimates assuming unprotected exposure and no mitigating action (such as evacuation or sheltering) for the entire time period of this prediction, and therefore may be over-estimates of the actual effects.

Early Phase Guidance (Radioiodine) : (KI Administration based on Thyroid Radioiodine Dose)
Material: I-131 + I-132 + TE-132 + TE-129M
The U.S. Environmental Protection Agency (EPA) and Department of Homeland Security (DHS) have proposed or accepted similar sets of Protective Action Guides (PAGs) to indicate when protective actions should be considered/implemented to protect the population. These Guides correspond to specific dose levels and are primarily based on an assessment of the risk in developing cancer over an exposed individual's lifetime. Thus the health effects produced by these doses may develop over a period of years. In the event radioiodines are released into the atmosphere, the PAG level is based on the projected dose to a child's thyroid which may be avoided by the administering of potassium iodide. Additional levels based on guidance from the U.S. Food and Drug Administration for adults may also be shown. (Note that the PAG level for potassium iodide administration to pregnant women is 5 rem to the adult thyroid.) These model predictions are based on the effects of radiation from the material inhaled and retained by the body, and use the conservative assumption that individuals are unsheltered and remain in the area during the time period specified in the figure's legend. Health effects could be significantly different for sheltered individuals or for those exposed in these areas for different time periods. Estimates of the number of exposed individuals expected to experience these effects may be given in the legend. If so, the counts given for all illnesses include those leading to pre-mature death. Note that the counts and area covered by each contour are cumulative such that outer contours include the counts and areas of all inner contours. NOTE: This release scenario has not produced radiation doses which reach the originally requested threshold levels.

Worker Protection Dose Rate at 96 hrs (Far Field) : (Groundshine Dose Rate at 03/19/2011 03:00:00 JST)
Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M
This product identifies the locations where the Federal Radiation Protection Guidance occupational upper limit dose may be exceeded for various exposure periods by unprotected workers performing emergency services. The results

are based on the risk of workers developing cancer over their lifetimes, and ensure that exposures will not result in detrimental acute or early health effects. Although these doses may be expressed in terms of the EPA Response Worker Guidelines, these contours may also be used to estimate the ongoing dose received by the unsheltered general population. NCRP and NRC administrative control areas are also shown. Note: EPA and NRC guidelines are based on a total dose limit. These contoured dose rate values, if constant over the indicated exposure period, will deliver the equivalent limiting dose. For rapidly-decaying dose rates, these predictions will be conservative. The dose associated with potential inhalation of resuspended material is not included in these estimates. The relative importance of any committed inhalation dose from resuspended material is dependent on a variety of factors (e.g. weather, radionuclides, etc.). Note that the population count and area covered by each contour are cumulative such that outer contours include the counts and areas of all inner contours.

Deposition at 96 hrs : (Surface Contamination from Deposited Radionuclides)
Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M
This product identifies the more highly contaminated areas due to fallout and deposition of the radioactive material. This material, depending upon the type of radiation emitted, may continue to give significant doses to individuals in these areas through inhalation of resuspended radioactive material or from direct external radiation. These levels of deposited radioactivity should be confirmed by monitoring surverys.

SOURCE INFORMATION:

Release Start Time:	March 14, 2011 18:00 UTC
Release Stop Time:	March 15, 2011 18:00 UTC
Release Location:	(37.421389, 141.0325) Fukushima 1
Source Material and Amount:	Early Phase Dose (0-96 Hrs)
	20300 Ci of BA-140 (100% respirable)
	399 Ci of CE-144 (100% respirable)
	10.7 Ci of CM-242 (100% respirable)
	1.45e+07 Ci of CS-134 (100% respirable)
	336000 Ci of CS-136 (100% respirable)
	1.6e+07 Ci of CS-137 (100% respirable)
	1850 Ci of I-131 (100% respirable)
	0.000276 Ci of I-132 (100% respirable)
	133 Ci of PU-241 (100% respirable)
	20900 Ci of RB-86 (100% respirable)
	695 Ci of RU-103 (100% respirable)
	740 Ci of RU-106 (100% respirable)
	131 Ci of SB-127 (100% respirable)
	44900 Ci of SR-89 (100% respirable)
	23500 Ci of SR-90 (100% respirable)
	10500 Ci of TE-127M (100% respirable)
	24200 Ci of TE-129M (100% respirable)
	676 Ci of TE-132 (100% respirable)
	2.68e+06 Ci of XE-133 (100% respirable)
	Early Phase Guidance (Radioiodine)
	1850 Ci of I-131 (100% respirable)
	0.000276 Ci of I-132 (100% respirable)
	24200 Ci of TE-129M (100% respirable)
	676 Ci of TE-132 (100% respirable)
	Worker Protection Dose Rate at 96 hrs (Far Field)
	Deposition at 96 hrs
	20300 Ci of BA-140 (100% respirable)
	399 Ci of CE-144 (100% respirable)
	10.7 Ci of CM-242 (100% respirable)
	1.45e+07 Ci of CS-134 (100% respirable)

	336000 Ci of CS-136 (100% respirable)
	1.6e+07 Ci of CS-137 (100% respirable)
	1850 Ci of I-131 (100% respirable)
	0.000276 Ci of I-132 (100% respirable)
	133 Ci of PU-241 (100% respirable)
	20900 Ci of RB-86 (100% respirable)
	695 Ci of RU-103 (100% respirable)
	740 Ci of RU-106 (100% respirable)
	131 Ci of SB-127 (100% respirable)
	44900 Ci of SR-89 (100% respirable)
	23500 Ci of SR-90 (100% respirable)
	10500 Ci of TE-127M (100% respirable)
	24200 Ci of TE-129M (100% respirable)
	676 Ci of TE-132 (100% respirable)
Source Geometry:	gaussian cloud top at 200 m
Particle Size Distribution:	All particulate is in the respirable range from 0.1 to 10 microns

METEOROLOGY:

ADAPT Gridded Metdata from 03/15/2011 03:00:00 JST to 03/16/2011 19:00:00 JST at 1 hr intervals were used in this calculation

Gridded Met Source	Obs Time
ADAPT	March 14, 2011 18:00 UTC
ADAPT	March 14, 2011 19:00 UTC
ADAPT	March 14, 2011 20:00 UTC
ADAPT	March 14, 2011 21:00 UTC
ADAPT	March 14, 2011 22:00 UTC
ADAPT	March 14, 2011 23:00 UTC
ADAPT	March 15, 2011 00:00 UTC
ADAPT	March 15, 2011 01:00 UTC
ADAPT	March 15, 2011 02:00 UTC
ADAPT	March 15, 2011 03:00 UTC
ADAPT	March 15, 2011 04:00 UTC
ADAPT	March 15, 2011 05:00 UTC
ADAPT	March 15, 2011 06:00 UTC
ADAPT	March 15, 2011 07:00 UTC
ADAPT	March 15, 2011 08:00 UTC
ADAPT	March 15, 2011 09:00 UTC
ADAPT	March 15, 2011 10:00 UTC
ADAPT	March 15, 2011 11:00 UTC
ADAPT	March 15, 2011 12:00 UTC
ADAPT	March 15, 2011 13:00 UTC
ADAPT	March 15, 2011 14:00 UTC
ADAPT	March 15, 2011 15:00 UTC
ADAPT	March 15, 2011 16:00 UTC
ADAPT	March 15, 2011 17:00 UTC
ADAPT	March 15, 2011 18:00 UTC

Gridded Met Source	Obs Time
ADAPT	March 15, 2011 19:00 UTC
ADAPT	March 15, 2011 20:00 UTC
ADAPT	March 15, 2011 21:00 UTC
ADAPT	March 15, 2011 22:00 UTC
ADAPT	March 15, 2011 23:00 UTC
ADAPT	March 16, 2011 00:00 UTC
ADAPT	March 16, 2011 01:00 UTC
ADAPT	March 16, 2011 02:00 UTC
ADAPT	March 16, 2011 03:00 UTC
ADAPT	March 16, 2011 04:00 UTC
ADAPT	March 16, 2011 05:00 UTC
ADAPT	March 16, 2011 06:00 UTC
ADAPT	March 16, 2011 07:00 UTC
ADAPT	March 16, 2011 08:00 UTC
ADAPT	March 16, 2011 09:00 UTC
ADAPT	March 16, 2011 10:00 UTC

No precipitation is included in this calculation

ASSUMPTIONS:

Unless otherwise stated ICRP60 series DCF's were used for dose plots.

CONTACT INFORMATION:

Calculation requested on March 29, 2011 13:52 UTC by:

none none, DOE NIT
202-586-8100

Approved by: NARAC Operations
Approver organization: NARAC
Phone: 925-422-9100
Email: narac@llnl.gov
Approved on: March 29, 2011 14:04 UTC

Classification: ~~Draft-Official Use Only-Not Approved for Further Distribution~~

DISCLAIMER:

These model predictions are intended to be guidance, and are not final recommendations. The accuracy of any prediction will be limited by the accuracy of the input data, such as estimates of the amount of material that becomes airborne and the available meteorological data for the area and time of the incident. Plume predictions may be for a limited time period, and may change at later times if new input data becomes available. Predictions should be confirmed and refined using field measurements. Air and ground concentration may be higher than predicted by this plume model simulation due the limited resolution of this particular simulation. For actual incidents or exercises, consult incident command and subject matter experts from the appropriate coordinating agency before making any decisions based on this model prediction.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

APPROVED PRODUCT
NARAC
National Atmospheric Release Advisory Center

Early Phase Dose (0-96 Hrs)
(Total Effective Dose Including Plume Passage)

Tokyo Supercore U3, U4 no Iodine - Early Phase - Real WInds
NARAC Report - Potential Release

Actions and Long-Term Effects					
	Description	**Level (rem)**	**Extent**	**Area**	**Population**
	Exceeds 5 rem total effective dose.	>5	51.3km	1,602 km2	332,000
	Exceeds 1 rem total effective dose.	>1	108km	7,000 km2	1.22E6
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.					

Effects or contamination from March 14, 2011 18:00 UTC to March 18, 2011 18:00 UTC at or near ground level.
Release Location: 37.421389 N, 141.032500 E **Material:** BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133
Generated On: March 29, 2011 13:37 UTC
Model: LODI
Comments:
Doses shown are total accumulated from the beginning of release.
20 nuclides (U3, U4 with no iodine), using real meteorological conditions.

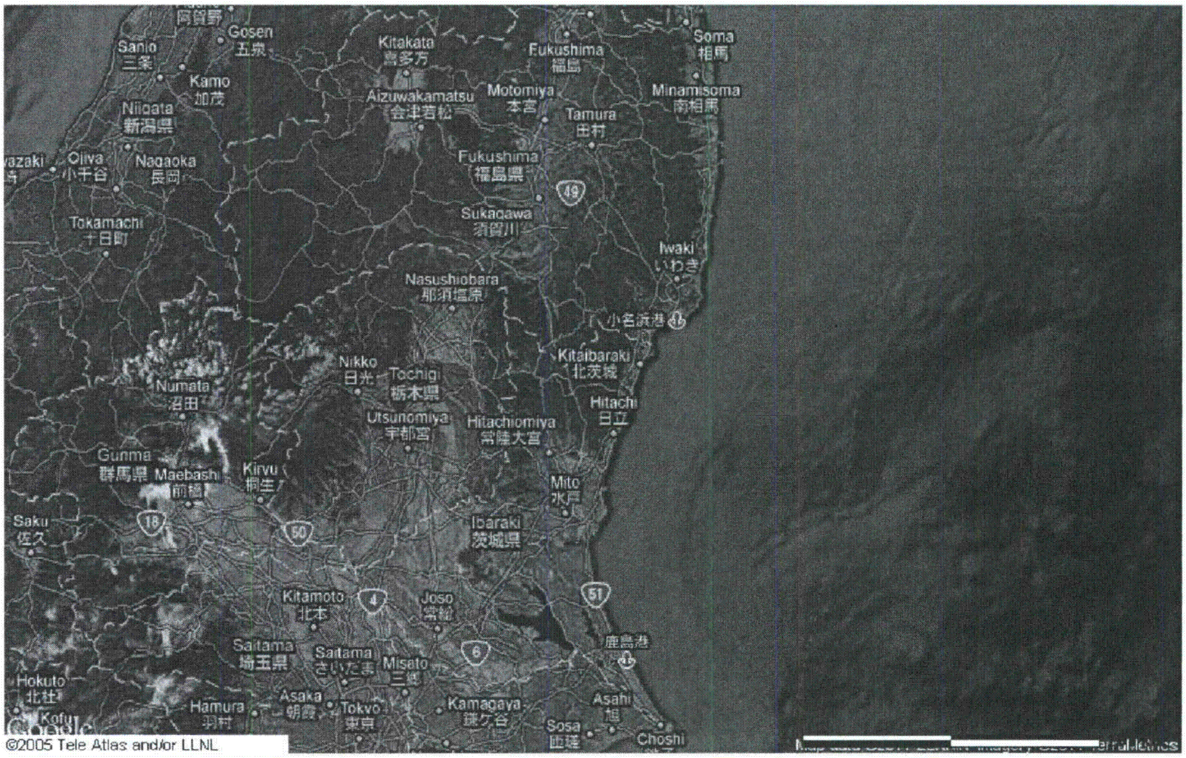
Map Size: 392 km by 245 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

APPROVED PRODUCT
NARAC
National Atmospheric Release Advisory Center

Early Phase Guidance (Radioiodine)
(KI Administration based on Thyroid Radioiodine Dose)

Tokyo Supercore U3, U4 no Iodine - Early Phase - Real WInds
NARAC Report - Potential Release



Effects and Actions					
	Description	Level (rem)	Extent	Area	Population
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.					

Effects or contamination from March 14, 2011 18:00 UTC to March 18, 2011 18:00 UTC at or near ground level.
Release Location: 37.421389 N, 141.032500 E **Material:** I-131 + I-132 + TE-132 + TE-129M
Generated On: March 29, 2011 13:37 UTC
Model: LODI
Comments:
Doses shown are total accumulated from the beginning of release.
20 nuclides (U3, U4 with no iodine), using real meteorological conditions.

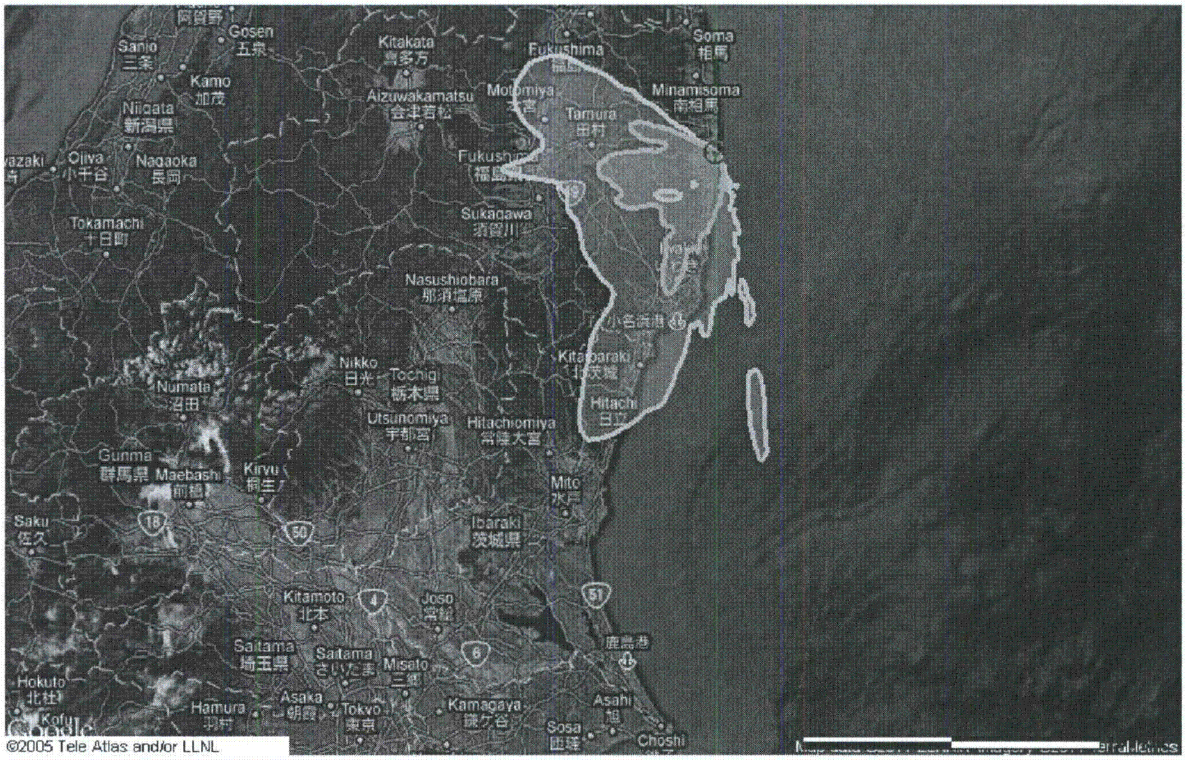
Map Size: 392 km by 245 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

APPROVED PRODUCT NARAC National Atmospheric Release Advisory Center

Worker Protection Dose Rate at 96 hrs (Far Field)
(Groundshine Dose Rate at 03/19/2011 03:00:00 JST)

Tokyo Supercore U3, U4 no Iodine - Early Phase - Real WInds
NARAC Report - Potential Release



Acute (Short-Term) Effects					
	Description	Level (mrem/hr)	Extent	Area	Population
	Limit for all occupational exposures exceeded by exposure for 5 hours or less.	>1,000	1.1km	0.6 km2	1,100
	Limit for all occupational exposures exceeded by exposure for 50 hours or less.	>100	9.9km	37.2 km2	11,600
	NCRP radiological control boundary.	>10	48.6km	986 km2	170,000
	Limit for NRC public exclusion zone exceeded by exposure for 1 hour or less.	>2	103km	4,934 km2	1.09E6
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.					

Effects or contamination at March 18, 2011 18:00 UTC at or near ground level.
Release Location: 37.421389 N, 141.032500 E **Material:** BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M
Generated On: March 29, 2011 13:37 UTC
Model: LODI
Comments:
20 nuclides (U3, U4 with no iodine), using real meteorological conditions.

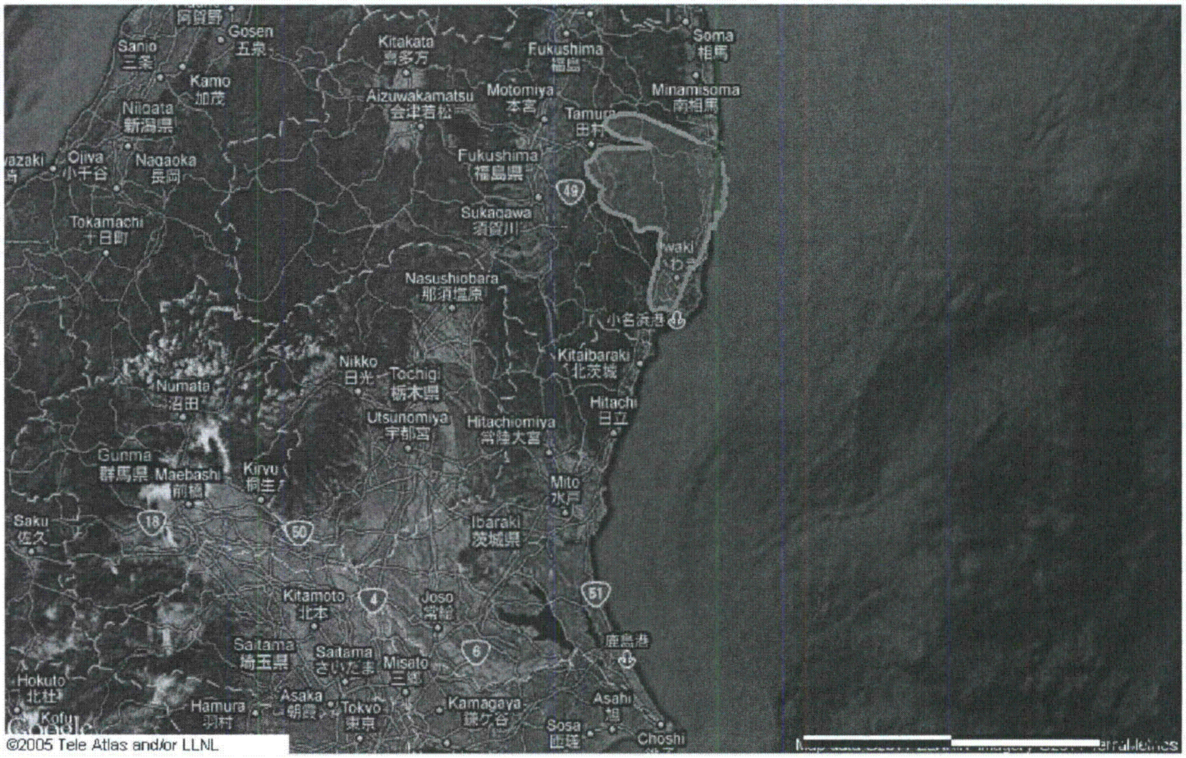
Map Size: 392 km by 245 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

APPROVED PRODUCT
NARAC
National Atmospheric Release Advisory Center

Deposition at 96 hrs
(Surface Contamination from Deposited Radionuclides)

Tokyo Supercore U3, U4 no Iodine - Early Phase - Real WInds
NARAC Report - Potential Release



Effects and Actions					
	Description	Level (Ci/m2)	Extent	Area	Population
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>0.10	1.5km	1.0 km2	1,610
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>0.01	11.8km	53.8 km2	16,900
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>0.0010	54.8km	1,460 km2	284,000
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.					

Effects or contamination at March 18, 2011 18:00 UTC at or near ground level.
Release Location: 37.421389 N, 141.032500 E **Material:** BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M
Generated On: March 29, 2011 13:37 UTC
Model: LODI
Comments:
20 nuclides (U3, U4 with no iodine), using real meteorological conditions.

Map Size: 392 km by 245 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

APPROVED PRODUCT

NARAC
National Atmospheric Release Advisory Center

Consequence Report Issued: March 29, 2011 13:32 UTC

Tokyo Supercore U2 - Real Winds - 2nd Year

Automated Report - Potential Release

SUMMARY:

This report describes the health effect consequences associated with a hypothetical unknown release to the atmosphere from a radiological source. This is an initial, automated NARAC product, not a final recommendation. Initial predictions are for a limited time period and areas affected may change at later times. Please consult NARAC staff (925-422-7627) for refined, quality assured predictions. Predictions should be confirmed and refined using measurements.

PRODUCTS:

Second Year Intermediate Phase Relocation PAG : (Relocation based on Avoidable Groundshine and Resuspension Dose)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

The following figure illustrates the model-predicted regions in which individuals are projected to have an elevated risk of developing fatal and non-fatal cancers due to radiation exposure over a period of many years from the radioactive material that has been deposited on the surface. There are two primary pathways by which individuals will continue to receive a radiological dose while they remain in these areas. Individuals in these regions will be exposed to radiation by direct exposure from radioactive material on surfaces and by exposure from material that has been resuspended into the air and subsequently inhaled. The U.S. Environmental Protection Agency (EPA) and Department of Homeland Security (DHS) have proposed or accepted similar sets of Protective Action Guides (PAGs) to indicate when relocation (long-term removal) of individuals should be considered. These Guides are primarily based on an assessment of the risk in developing cancer over an exposed individual's lifetime, and thus the health effects produced by the doses may develop over a period of several years. Note that the PAGs were developed based on avoidable dose (i.e. the dose that will be avoided once protective actions have been implemented). These model predictions are based on the conservative assumption that individuals are unsheltered and remain in the area during the time period specified in the figure's legend. If protective actions have not been implemented by the beginning of this exposure period, the avoidable dose will be less than that shown for the unsheltered population, and accumulated dose will continue to rise at an undiminished rate. Health effects could be significantly different for sheltered individuals or for those exposed in these areas for different time periods. The contours that may be displayed include the first-year relocation contour where individuals are projected to receive a dose in excess of 2 rem over the remainder of the first year following the release, and the second-year relocation contour where individuals are projected to receive a dose in excess of 0.5 rem during the second year following the release. (Doses received over each of the subsequent years are normally less than those received during the second-year.)

SOURCE INFORMATION:

Release Start Time:	March 14, 2011 18:00 UTC
Release Stop Time:	March 15, 2011 18:00 UTC
Release Location:	(37.421389, 141.0325) Fukushima 1
Source Material and Amount:	263049 Ci of BA-140 (100% respirable) 5923.59 Ci of CE-144 (100% respirable) 74.5882 Ci of CM-242 (100% respirable) 426145 Ci of CS-134 (100% respirable) 143525 Ci of CS-136 (100% respirable) 295793 Ci of CS-137 (100% respirable) 2.68694e+06 Ci of I-131 (100% respirable)

	2.23019e+06 Ci of I-132 (100% respirable)
	386233 Ci of I-133 (100% respirable)
	559.408 Ci of PU-241 (100% respirable)
	5416.64 Ci of RB-86 (100% respirable)
	34373.8 Ci of RU-103 (100% respirable)
	10100.2 Ci of RU-106 (100% respirable)
	20815.7 Ci of SB-127 (100% respirable)
	154734 Ci of SR-89 (100% respirable)
	12549.8 Ci of SR-90 (100% respirable)
	6672.18 Ci of TE-127M (100% respirable)
	26470 Ci of TE-129M (100% respirable)
	294734 Ci of TE-132 (100% respirable)
Source Geometry:	gaussian cloud top at 200 m
Particle Size Distribution:	All particulate is in the respirable range from 0.1 to 10 microns

METEOROLOGY:

ADAPT Gridded Metdata from 03/15/2011 03:00:00 JST to 03/16/2011 19:00:00 JST at 1 hr intervals were used in this calculation

Gridded Met Source	Obs Time
ADAPT	March 14, 2011 18:00 UTC
ADAPT	March 14, 2011 19:00 UTC
ADAPT	March 14, 2011 20:00 UTC
ADAPT	March 14, 2011 21:00 UTC
ADAPT	March 14, 2011 22:00 UTC
ADAPT	March 14, 2011 23:00 UTC
ADAPT	March 15, 2011 00:00 UTC
ADAPT	March 15, 2011 01:00 UTC
ADAPT	March 15, 2011 02:00 UTC
ADAPT	March 15, 2011 03:00 UTC
ADAPT	March 15, 2011 04:00 UTC
ADAPT	March 15, 2011 05:00 UTC
ADAPT	March 15, 2011 06:00 UTC
ADAPT	March 15, 2011 07:00 UTC
ADAPT	March 15, 2011 08:00 UTC
ADAPT	March 15, 2011 09:00 UTC
ADAPT	March 15, 2011 10:00 UTC
ADAPT	March 15, 2011 11:00 UTC
ADAPT	March 15, 2011 12:00 UTC
ADAPT	March 15, 2011 13:00 UTC
ADAPT	March 15, 2011 14:00 UTC
ADAPT	March 15, 2011 15:00 UTC
ADAPT	March 15, 2011 16:00 UTC
ADAPT	March 15, 2011 17:00 UTC
ADAPT	March 15, 2011 18:00 UTC
ADAPT	March 15, 2011 19:00 UTC
ADAPT	March 15, 2011 20:00 UTC

Gridded Met Source	Obs Time
ADAPT	March 15, 2011 21:00 UTC
ADAPT	March 15, 2011 22:00 UTC
ADAPT	March 15, 2011 23:00 UTC
ADAPT	March 16, 2011 00:00 UTC
ADAPT	March 16, 2011 01:00 UTC
ADAPT	March 16, 2011 02:00 UTC
ADAPT	March 16, 2011 03:00 UTC
ADAPT	March 16, 2011 04:00 UTC
ADAPT	March 16, 2011 05:00 UTC
ADAPT	March 16, 2011 06:00 UTC
ADAPT	March 16, 2011 07:00 UTC
ADAPT	March 16, 2011 08:00 UTC
ADAPT	March 16, 2011 09:00 UTC
ADAPT	March 16, 2011 10:00 UTC

No precipitation is included in this calculation

ASSUMPTIONS:

Unless otherwise stated ICRP60 series DCF's were used for dose plots.

CONTACT INFORMATION:

Calculation requested on March 29, 2011 06:06 UTC by:

none none, DOE NIT
202-586-8100

Approved by: NARAC Operations
Approver organization: NARAC
Phone: 925-422-9100
Email: narac@llnl.gov
Approved on: March 29, 2011 13:32 UTC

Classification: ~~Draft-Official Use Only - Not Approved for Further Distribution~~

DISCLAIMER:

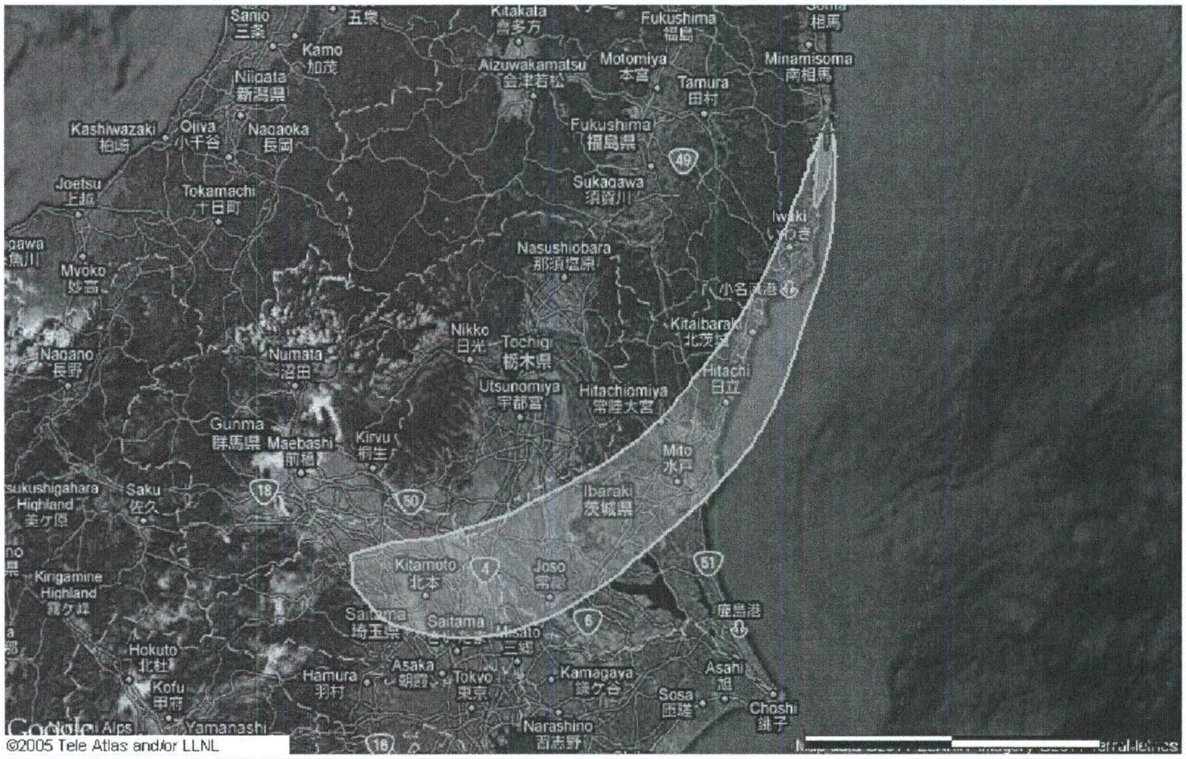
These model predictions are intended to be guidance, and are not final recommendations. The accuracy of any prediction will be limited by the accuracy of the input data, such as estimates of the amount of material that becomes airborne and the available meteorological data for the area and time of the incident. Plume predictions may be for a limited time period, and may change at later times if new input data becomes available. Predictions should be confirmed and refined using field measurements. Air and ground concentration may be higher than predicted by this plume model simulation due the limited resolution of this particular simulation. For actual incidents or exercises, consult incident command and subject matter experts from the appropriate coordinating agency before making any decisions based on this model prediction.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

APPROVED PRODUCT
NARAC
National Atmospheric Release Advisory Center

Second Year Intermediate Phase Relocation PAG
(Relocation based on Avoidable Groundshine and Resuspension Dose)

Tokyo Supercore U2 - Real Winds - 2nd Year Automated Report - Potential Release



Actions and Long-Term Effects					
	Description	**Level (rem)**	**Extent**	**Area**	**Population**
	>25 rem contour	>25	8.8km	10.4 km2	2,050
	>10 rem contour	>10	17.5km	38.4 km2	11,400
	>5 rem contour	>5	27.4km	84.8 km2	22,000
	Exceeds second-year relocation PAG.	>0.5	217km	5,930 km2	5.13E6
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.					

Effects or contamination from March 14, 2012 18:00 UTC to March 14, 2013 18:00 UTC at or near ground level.
Release Location: 37.421389 N, 141.032500 E **Material:** BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M
Generated On: March 29, 2011 06:04 UTC
Model: LODI
Comments:
Tokyo Supercore U2 - Real Winds
20 Nuclides

Map Size: 392 km by 245 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

CV 70 of 3058

From: Hoc, PMT12
Sent: Tuesday, March 29, 2011 8:27 PM
To: PMT09 Hoc; PMT02 Hoc; PMT11 Hoc
Subject: FW: NARAC Supercore Real Winds
Attachments: TokyoSupercoreImpacts_20NuclideU4SPFModNoI_2011Mar29_1230Z.DOCX; TokyoSupercore-U2-RealWinds-2ndYrReloc-NARACReport-Draft.pdf; TokyoSupercore-U2-RealWinds-1stYrReloc-NARACReport-Draft.pdf; TokyoModifiedSupercore-U3U4-RealWinds-2ndYrReloc-NARACReport-Draft.pdf; TokyoModifiedSupercore-U3U4-RealWinds-1stYrReloc-NARACReport-Draft.pdf; TokyoSupercore-U2-RealWinds-EarlyIodineWorker-NARACReport-Draft.pdf

-----Original Message-----
From: NITOPS [mailto:NITOPS@nnsa.doe.gov]
Sent: Tuesday, March 29, 2011 8:26 PM
To: Hoc, PMT12
Subject: FW: NARAC Supercore Real Winds

Here is part of the information that was requested during our evening turnover. Due to size of the attachments the rest of the information will follow in a separate email.

Nuclear Incident Team (NIT)
Office of Emergency Response (NA-42)
National Nuclear Security Administration U.S. Department of Energy nitops@nnsa.doe.gov nit@doe.sgov.gov 202-586-8100

-----Original Message-----
From: NITOPS
Sent: Tuesday, March 29, 2011 12:51 PM
To: Steve Fetter; (b)(6); Aoki, Steven
Cc: NITOPS; DL-Policy Working Group
Subject: NARAC Supercore Real Winds

Attached are the results of the NARAC modeling you requested yesterday afternoon.

If you have any questions, please contact NITOPS.

Nuclear Incident Team (NIT)
Office of Emergency Response (NA-42)
National Nuclear Security Administration U.S. Department of Energy nitops@nnsa.doe.gov nit@doe.sgov.gov 202-586-8100

APPROVED PRODUCT

NARAC National Atmospheric Release Advisory Center

Consequence Report

Issued: March 29, 2011 13:12 UTC

Tokyo Supercore U3, U4 no Iodine - Real Winds - 1st Year

NARAC Report - Potential Release

SUMMARY:

This report describes the health effect consequences associated with a hypothetical unknown release to the atmosphere from a radiological source. This is an initial, automated NARAC product, not a final recommendation. Initial predictions are for a limited time period and areas affected may change at later times. Please consult NARAC staff (925-422-7627) for refined, quality assured predictions. Predictions should be confirmed and refined using measurements.

PRODUCTS:

First Year Intermediate Phase Relocation PAGs : (Relocation based on Avoidable Groundshine and Resuspension Dose)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

The following figure illustrates the model-predicted regions in which individuals are projected to have an elevated risk of developing fatal and non-fatal cancers due to radiation exposure over a period of many years from the radioactive material that has been deposited on the surface. There are two primary pathways by which individuals will continue to receive a radiological dose while they remain in these areas. Individuals in these regions will be exposed to radiation by direct exposure from radioactive material on surfaces and by exposure from material that has been resuspended into the air and subsequently inhaled. The U.S. Environmental Protection Agency (EPA) and Department of Homeland Security (DHS) have proposed or accepted similar sets of Protective Action Guides (PAGs) to indicate when relocation (long-term removal) of individuals should be considered. These Guides are primarily based on an assessment of the risk in developing cancer over an exposed individual's lifetime, and thus the health effects produced by the doses may develop over a period of several years. Note that the PAGs were developed based on avoidable dose (i.e. the dose that will be avoided once protective actions have been implemented). These model predictions are based on the conservative assumption that individuals are unsheltered and remain in the area during the time period specified in the figure's legend. If protective actions have not been implemented by the beginning of this exposure period, the avoidable dose will be less than that shown for the unsheltered population, and accumulated dose will continue to rise at an undiminished rate. Health effects could be significantly different for sheltered individuals or for those exposed in these areas for different time periods. The contours that may be displayed include the first-year relocation contour where individuals are projected to receive a dose in excess of 2 rem over the remainder of the first year following the release, and the second-year relocation contour where individuals are projected to receive a dose in excess of 0.5 rem during the second year following the release. (Doses received over each of the subsequent years are normally less than those received during the second-year.)

SOURCE INFORMATION:

Release Start Time:	March 14, 2011 18:00 UTC
Release Stop Time:	March 15, 2011 18:00 UTC
Release Location:	(37.421389, 141.0325) Fukushima 1
Source Material and Amount:	Tokyo Supercore Modified U3U4aU4b - Real Winds
Source Geometry:	gaussian cloud top at 200 m
Particle Size Distribution:	All particulate is in the respirable range from 0.1 to 10 microns

METEOROLOGY:

ADAPT Gridded Metdata from 03/15/2011 03:00:00 JST to 03/16/2011 19:00:00 JST at 1 hr intervals were used in this calculation

Gridded Met Source	Obs Time
ADAPT	March 14, 2011 18:00 UTC
ADAPT	March 14, 2011 19:00 UTC
ADAPT	March 14, 2011 20:00 UTC
ADAPT	March 14, 2011 21:00 UTC
ADAPT	March 14, 2011 22:00 UTC
ADAPT	March 14, 2011 23:00 UTC
ADAPT	March 15, 2011 00:00 UTC
ADAPT	March 15, 2011 01:00 UTC
ADAPT	March 15, 2011 02:00 UTC
ADAPT	March 15, 2011 03:00 UTC
ADAPT	March 15, 2011 04:00 UTC
ADAPT	March 15, 2011 05:00 UTC
ADAPT	March 15, 2011 06:00 UTC
ADAPT	March 15, 2011 07:00 UTC
ADAPT	March 15, 2011 08:00 UTC
ADAPT	March 15, 2011 09:00 UTC
ADAPT	March 15, 2011 10:00 UTC
ADAPT	March 15, 2011 11:00 UTC
ADAPT	March 15, 2011 12:00 UTC
ADAPT	March 15, 2011 13:00 UTC
ADAPT	March 15, 2011 14:00 UTC
ADAPT	March 15, 2011 15:00 UTC
ADAPT	March 15, 2011 16:00 UTC
ADAPT	March 15, 2011 17:00 UTC
ADAPT	March 15, 2011 18:00 UTC
ADAPT	March 15, 2011 19:00 UTC
ADAPT	March 15, 2011 20:00 UTC
ADAPT	March 15, 2011 21:00 UTC
ADAPT	March 15, 2011 22:00 UTC
ADAPT	March 15, 2011 23:00 UTC
ADAPT	March 16, 2011 00:00 UTC
ADAPT	March 16, 2011 01:00 UTC
ADAPT	March 16, 2011 02:00 UTC
ADAPT	March 16, 2011 03:00 UTC
ADAPT	March 16, 2011 04:00 UTC
ADAPT	March 16, 2011 05:00 UTC
ADAPT	March 16, 2011 06:00 UTC
ADAPT	March 16, 2011 07:00 UTC
ADAPT	March 16, 2011 08:00 UTC
ADAPT	March 16, 2011 09:00 UTC
ADAPT	March 16, 2011 10:00 UTC

No precipitation is included in this calculation

ASSUMPTIONS:

Unless otherwise stated ICRP60 series DCF's were used for dose plots.

CONTACT INFORMATION:

Calculation requested on March 29, 2011 06:09 UTC by:

none none, DOE NIT
202-586-8100

Approved by: NARAC Operations
Approver organization: NARAC
Phone: 925-422-9100
Email: narac@llnl.gov
Approved on: March 29, 2011 13:10 UTC

Classification: ~~Draft-Official Use Only-Not Approved for Further Distribution~~

DISCLAIMER:

These model predictions are intended to be guidance, and are not final recommendations. The accuracy of any prediction will be limited by the accuracy of the input data, such as estimates of the amount of material that becomes airborne and the available meteorological data for the area and time of the incident. Plume predictions may be for a limited time period, and may change at later times if new input data becomes available. Predictions should be confirmed and refined using field measurements. Air and ground concentration may be higher than predicted by this plume model simulation due the limited resolution of this particular simulation. For actual incidents or exercises, consult incident command and subject matter experts from the appropriate coordinating agency before making any decisions based on this model prediction.

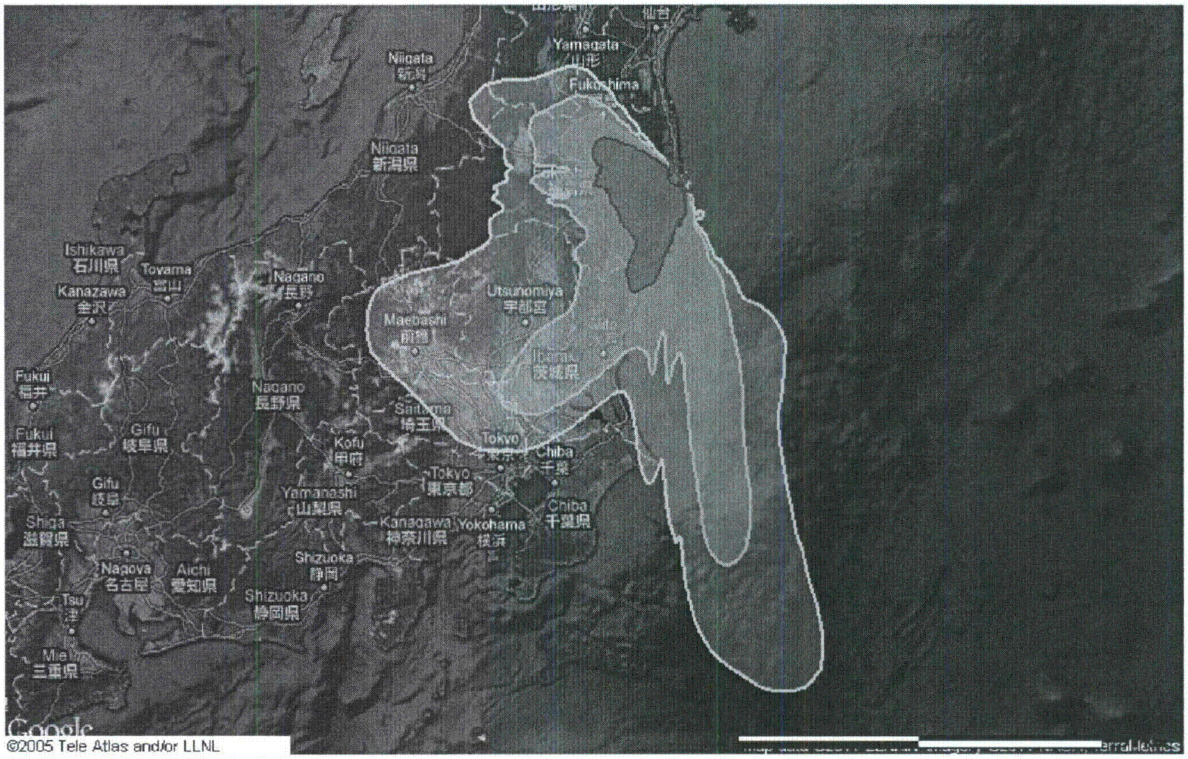
This document was prepared as an account of work sponsored by an agency of the United States government. Neither the United States government nor Lawrence Livermore National Security, LLC, nor Lockheed Martin, nor Sandia Corporation, nor any of their employees makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or Lawrence Livermore National Security, LLC. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or Lawrence Livermore National Security, LLC, and shall not be used for advertising or product endorsement purposes.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

APPROVED PRODUCT
NARAC
National Atmospheric Release Advisory Center

First Year Intermediate Phase Relocation PAGs
(Relocation based on Avoidable Groundshine and Resuspension Dose)

Tokyo Supercore U3, U4 no Iodine - Real Winds - 1st Year
NARAC Report - Potential Release



Actions and Long-Term Effects					
	Description	Level (rem)	Extent	Area	Population
	>25 rem contour	>25	81.2km	3,196 km2	629,000
	>10 rem contour	>10	142km	8,591 km2	1.60E6
	>5 rem contour	>5	255km	20,587 km2	3.73E6
	Exceeds first-year relocation PAG, (5d to 1 yr 5 d)	>2	344km	52,776 km2	1.54E7
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.					

Effects or contamination from March 19, 2011 18:00 UTC to March 19, 2012 18:00 UTC at or near ground level.
Release Location: 37.421389 N, 141.032500 E **Material:** BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M
Generated On: March 29, 2011 05:54 UTC
Model: LODI
Comments:
Tokyo Supercore Modified U3U4aU4b - Real Winds
20 Nuclides

Map Size: 789 km by 493 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

APPROVED PRODUCT

NARAC
National Atmospheric Release Advisory Center

Consequence Report

Issued: March 29, 2011 13:18 UTC

Tokyo Supercore U3, U4 no Iodine - Real Winds - 2nd Year

NARAC Report - Potential Release

SUMMARY:

This report describes the health effect consequences associated with a hypothetical unknown release to the atmosphere from a radiological source. This is an initial, automated NARAC product, not a final recommendation. Initial predictions are for a limited time period and areas affected may change at later times. Please consult NARAC staff (925-422-7627) for refined, quality assured predictions. Predictions should be confirmed and refined using measurements.

PRODUCTS:

Second Year Intermediate Phase Relocation PAGs : (Relocation based on Avoidable Groundshine and Resuspension Dose)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

The following figure illustrates the model-predicted regions in which individuals are projected to have an elevated risk of developing fatal and non-fatal cancers due to radiation exposure over a period of many years from the radioactive material that has been deposited on the surface. There are two primary pathways by which individuals will continue to receive a radiological dose while they remain in these areas. Individuals in these regions will be exposed to radiation by direct exposure from radioactive material on surfaces and by exposure from material that has been resuspended into the air and subsequently inhaled. The U.S. Environmental Protection Agency (EPA) and Department of Homeland Security (DHS) have proposed or accepted similar sets of Protective Action Guides (PAGs) to indicate when relocation (long-term removal) of individuals should be considered. These Guides are primarily based on an assessment of the risk in developing cancer over an exposed individual's lifetime, and thus the health effects produced by the doses may develop over a period of several years. Note that the PAGs were developed based on avoidable dose (i.e. the dose that will be avoided once protective actions have been implemented). These model predictions are based on the conservative assumption that individuals are unsheltered and remain in the area during the time period specified in the figure's legend. If protective actions have not been implemented by the beginning of this exposure period, the avoidable dose will be less than that shown for the unsheltered population, and accumulated dose will continue to rise at an undiminished rate. Health effects could be significantly different for sheltered individuals or for those exposed in these areas for different time periods. The contours that may be displayed include the first-year relocation contour where individuals are projected to receive a dose in excess of 2 rem over the remainder of the first year following the release, and the second-year relocation contour where individuals are projected to receive a dose in excess of 0.5 rem during the second year following the release. (Doses received over each of the subsequent years are normally less than those received during the second-year.)

SOURCE INFORMATION:

Release Start Time:	March 14, 2011 18:00 UTC
Release Stop Time:	March 15, 2011 18:00 UTC
Release Location:	(37.421389, 141.0325) Fukushima 1
Source Material and Amount:	Tokyo Supercore Modified U3U4aU4b - Real Winds
Source Geometry:	gaussian cloud top at 200 m
Particle Size Distribution:	All particulate is in the respirable range from 0.1 to 10 microns

METEOROLOGY:

ADAPT Gridded Metdata from 03/15/2011 03:00:00 JST to 03/16/2011 19:00:00 JST at 1 hr intervals were used in this calculation

Gridded Met Source	Obs Time
ADAPT	March 14, 2011 18:00 UTC
ADAPT	March 14, 2011 19:00 UTC
ADAPT	March 14, 2011 20:00 UTC
ADAPT	March 14, 2011 21:00 UTC
ADAPT	March 14, 2011 22:00 UTC
ADAPT	March 14, 2011 23:00 UTC
ADAPT	March 15, 2011 00:00 UTC
ADAPT	March 15, 2011 01:00 UTC
ADAPT	March 15, 2011 02:00 UTC
ADAPT	March 15, 2011 03:00 UTC
ADAPT	March 15, 2011 04:00 UTC
ADAPT	March 15, 2011 05:00 UTC
ADAPT	March 15, 2011 06:00 UTC
ADAPT	March 15, 2011 07:00 UTC
ADAPT	March 15, 2011 08:00 UTC
ADAPT	March 15, 2011 09:00 UTC
ADAPT	March 15, 2011 10:00 UTC
ADAPT	March 15, 2011 11:00 UTC
ADAPT	March 15, 2011 12:00 UTC
ADAPT	March 15, 2011 13:00 UTC
ADAPT	March 15, 2011 14:00 UTC
ADAPT	March 15, 2011 15:00 UTC
ADAPT	March 15, 2011 16:00 UTC
ADAPT	March 15, 2011 17:00 UTC
ADAPT	March 15, 2011 18:00 UTC
ADAPT	March 15, 2011 19:00 UTC
ADAPT	March 15, 2011 20:00 UTC
ADAPT	March 15, 2011 21:00 UTC
ADAPT	March 15, 2011 22:00 UTC
ADAPT	March 15, 2011 23:00 UTC
ADAPT	March 16, 2011 00:00 UTC
ADAPT	March 16, 2011 01:00 UTC
ADAPT	March 16, 2011 02:00 UTC
ADAPT	March 16, 2011 03:00 UTC
ADAPT	March 16, 2011 04:00 UTC
ADAPT	March 16, 2011 05:00 UTC
ADAPT	March 16, 2011 06:00 UTC
ADAPT	March 16, 2011 07:00 UTC
ADAPT	March 16, 2011 08:00 UTC
ADAPT	March 16, 2011 09:00 UTC
ADAPT	March 16, 2011 10:00 UTC

No precipitation is included in this calculation

ASSUMPTIONS:

Unless otherwise stated ICRP60 series DCF's were used for dose plots.

CONTACT INFORMATION:

Calculation requested on March 29, 2011 06:09 UTC by:

none none, DOE NIT
202-586-8100

Approved by: NARAC Operations
Approver organization: NARAC
Phone: 925-422-9100
Email: narac@llnl.gov
Approved on: March 29, 2011 13:17 UTC

Classification: ~~Draft-Official Use Only - Not Approved for Further Distribution~~

DISCLAIMER:

These model predictions are intended to be guidance, and are not final recommendations. The accuracy of any prediction will be limited by the accuracy of the input data, such as estimates of the amount of material that becomes airborne and the available meteorological data for the area and time of the incident. Plume predictions may be for a limited time period, and may change at later times if new input data becomes available. Predictions should be confirmed and refined using field measurements. Air and ground concentration may be higher than predicted by this plume model simulation due the limited resolution of this particular simulation. For actual incidents or exercises, consult incident command and subject matter experts from the appropriate coordinating agency before making any decisions based on this model prediction.

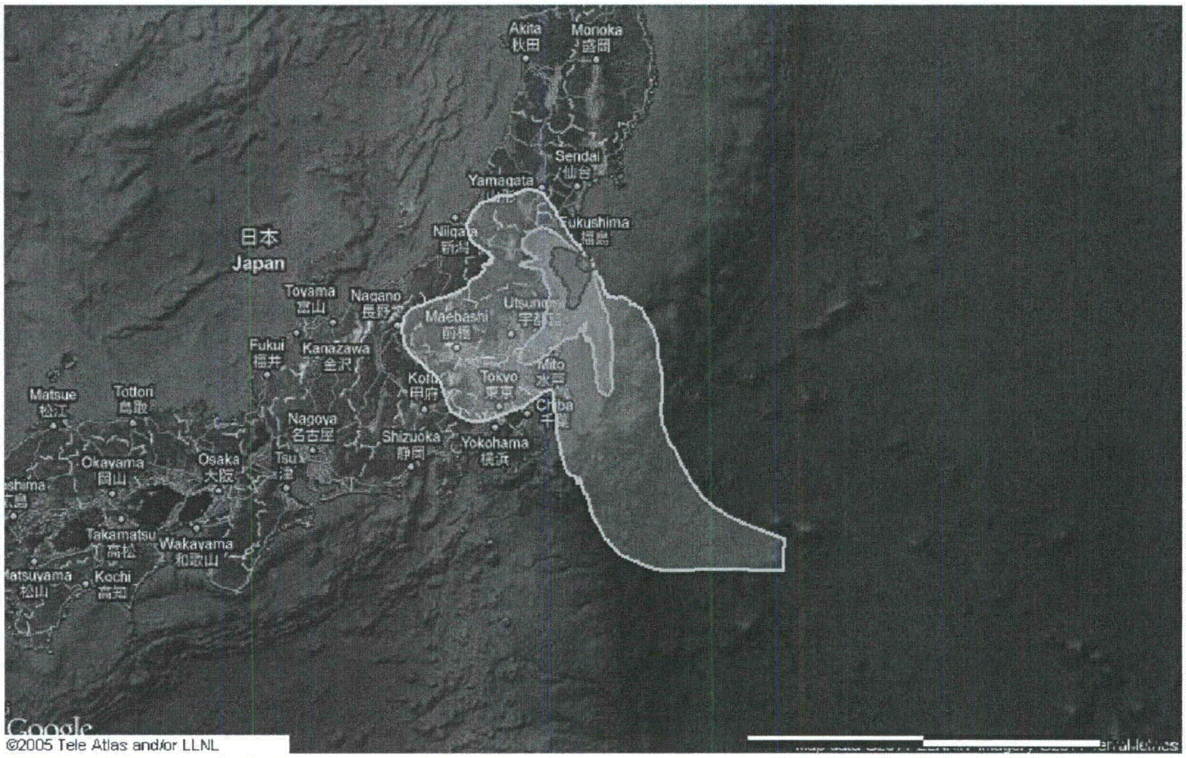
This document was prepared as an account of work sponsored by an agency of the United States government. Neither the United States government nor Lawrence Livermore National Security, LLC, nor Lockheed Martin, nor Sandia Corporation, nor any of their employees makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or Lawrence Livermore National Security, LLC. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or Lawrence Livermore National Security, LLC, and shall not be used for advertising or product endorsement purposes.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

APPROVED PRODUCT NARAC National Atmospheric Release Advisory Center

Second Year Intermediate Phase Relocation PAGs
(Relocation based on Avoidable Groundshine and Resuspension Dose)

Tokyo Supercore U3, U4 no Iodine - Real Winds - 2nd Year
NARAC Report - Potential Release



Actions and Long-Term Effects					
	Description	Level (rem)	Extent	Area	Population
	>25 rem contour	>25	68.2km	2,339 km2	473,000
	>10 rem contour	>10	103km	5,078 km2	1.10E6
	>5 rem contour	>5	178km	12,372 km2	2.36E6
	Exceeds second-year relocation PAG	>0.5	479km	98,291 km2	3.32E7
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.					

Effects or contamination from March 14, 2012 18:00 UTC to March 14, 2013 18:00 UTC at or near ground level.
Release Location: 37.421389 N, 141.032500 E **Material:** BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M
Generated On: March 29, 2011 06:04 UTC
Model: LODI
Comments:
Tokyo Supercore Modified U3U4aU4b - Real Winds
20 Nuclides

Map Size: 1,583 km by 989 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

APPROVED PRODUCT

NARAC

National Atmospheric Release Advisory Center

Consequence Report

Tokyo Supercore U2 - Real Winds - 1st Year

Automated Report - Potential Release

Issued: March 29, 2011 13:30 UTC

SUMMARY:

This report describes the health effect consequences associated with a hypothetical unknown release to the atmosphere from a radiological source. This is an initial, automated NARAC product, not a final recommendation. Initial predictions are for a limited time period and areas affected may change at later times. Please consult NARAC staff (925-422-7627) for refined, quality assured predictions. Predictions should be confirmed and refined using measurements.

PRODUCTS:

First Year Intermediate Phase Relocation PAG : (Relocation based on Avoidable Groundshine and Resuspension Dose)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

The following figure illustrates the model-predicted regions in which individuals are projected to have an elevated risk of developing fatal and non-fatal cancers due to radiation exposure over a period of many years from the radioactive material that has been deposited on the surface. There are two primary pathways by which individuals will continue to receive a radiological dose while they remain in these areas. Individuals in these regions will be exposed to radiation by direct exposure from radioactive material on surfaces and by exposure from material that has been resuspended into the air and subsequently inhaled. The U.S. Environmental Protection Agency (EPA) and Department of Homeland Security (DHS) have proposed or accepted similar sets of Protective Action Guides (PAGs) to indicate when relocation (long-term removal) of individuals should be considered. These Guides are primarily based on an assessment of the risk in developing cancer over an exposed individual's lifetime, and thus the health effects produced by the doses may develop over a period of several years. Note that the PAGs were developed based on avoidable dose (i.e. the dose that will be avoided once protective actions have been implemented). These model predictions are based on the conservative assumption that individuals are unsheltered and remain in the area during the time period specified in the figure's legend. If protective actions have not been implemented by the beginning of this exposure period, the avoidable dose will be less than that shown for the unsheltered population, and accumulated dose will continue to rise at an undiminished rate. Health effects could be significantly different for sheltered individuals or for those exposed in these areas for different time periods. The contours that may be displayed include the first-year relocation contour where individuals are projected to receive a dose in excess of 2 rem over the remainder of the first year following the release, and the second-year relocation contour where individuals are projected to receive a dose in excess of 0.5 rem during the second year following the release. (Doses received over each of the subsequent years are normally less than those received during the second-year.)

SOURCE INFORMATION:

Release Start Time:	March 14, 2011 18:00 UTC
Release Stop Time:	March 15, 2011 18:00 UTC
Release Location:	(37.421389, 141.0325) Fukushima 1
Source Material and Amount:	263049 Ci of BA-140 (100% respirable)
	5923.59 Ci of CE-144 (100% respirable)
	74.5882 Ci of CM-242 (100% respirable)
	426145 Ci of CS-134 (100% respirable)
	143525 Ci of CS-136 (100% respirable)
	295793 Ci of CS-137 (100% respirable)
	2.68694e+06 Ci of I-131 (100% respirable)

	2.23019e+06 Ci of I-132 (100% respirable)
	386233 Ci of I-133 (100% respirable)
	559.408 Ci of PU-241 (100% respirable)
	5416.64 Ci of RB-86 (100% respirable)
	34373.8 Ci of RU-103 (100% respirable)
	10100.2 Ci of RU-106 (100% respirable)
	20815.7 Ci of SB-127 (100% respirable)
	154734 Ci of SR-89 (100% respirable)
	12549.8 Ci of SR-90 (100% respirable)
	6672.18 Ci of TE-127M (100% respirable)
	26470 Ci of TE-129M (100% respirable)
	294734 Ci of TE-132 (100% respirable)
Source Geometry:	gaussian cloud top at 200 m
Particle Size Distribution:	All particulate is in the respirable range from 0.1 to 10 microns

METEOROLOGY:

ADAPT Gridded Metdata from 03/15/2011 03:00:00 JST to 03/16/2011 19:00:00 JST at 1 hr intervals were used in this calculation

Gridded Met Source	Obs Time
ADAPT	March 14, 2011 18:00 UTC
ADAPT	March 14, 2011 19:00 UTC
ADAPT	March 14, 2011 20:00 UTC
ADAPT	March 14, 2011 21:00 UTC
ADAPT	March 14, 2011 22:00 UTC
ADAPT	March 14, 2011 23:00 UTC
ADAPT	March 15, 2011 00:00 UTC
ADAPT	March 15, 2011 01:00 UTC
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ADAPT	March 15, 2011 03:00 UTC
ADAPT	March 15, 2011 04:00 UTC
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ADAPT	March 15, 2011 06:00 UTC
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ADAPT	March 15, 2011 11:00 UTC
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ADAPT	March 15, 2011 13:00 UTC
ADAPT	March 15, 2011 14:00 UTC
ADAPT	March 15, 2011 15:00 UTC
ADAPT	March 15, 2011 16:00 UTC
ADAPT	March 15, 2011 17:00 UTC
ADAPT	March 15, 2011 18:00 UTC
ADAPT	March 15, 2011 19:00 UTC
ADAPT	March 15, 2011 20:00 UTC

Gridded Met Source	Obs Time
ADAPT	March 15, 2011 21:00 UTC
ADAPT	March 15, 2011 22:00 UTC
ADAPT	March 15, 2011 23:00 UTC
ADAPT	March 16, 2011 00:00 UTC
ADAPT	March 16, 2011 01:00 UTC
ADAPT	March 16, 2011 02:00 UTC
ADAPT	March 16, 2011 03:00 UTC
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ADAPT	March 16, 2011 07:00 UTC
ADAPT	March 16, 2011 08:00 UTC
ADAPT	March 16, 2011 09:00 UTC
ADAPT	March 16, 2011 10:00 UTC

No precipitation is included in this calculation

ASSUMPTIONS:

Unless otherwise stated ICRP60 series DCF's were used for dose plots.

CONTACT INFORMATION:

Calculation requested on March 29, 2011 06:09 UTC by:

none none, DOE NIT
202-586-8100

Approved by: NARAC Operations
Approver organization: NARAC
Phone: 925-422-9100
Email: narac@llnl.gov
Approved on: March 29, 2011 13:26 UTC

Classification: ~~Draft-Official Use Only - Not Approved for Further Distribution~~

DISCLAIMER:

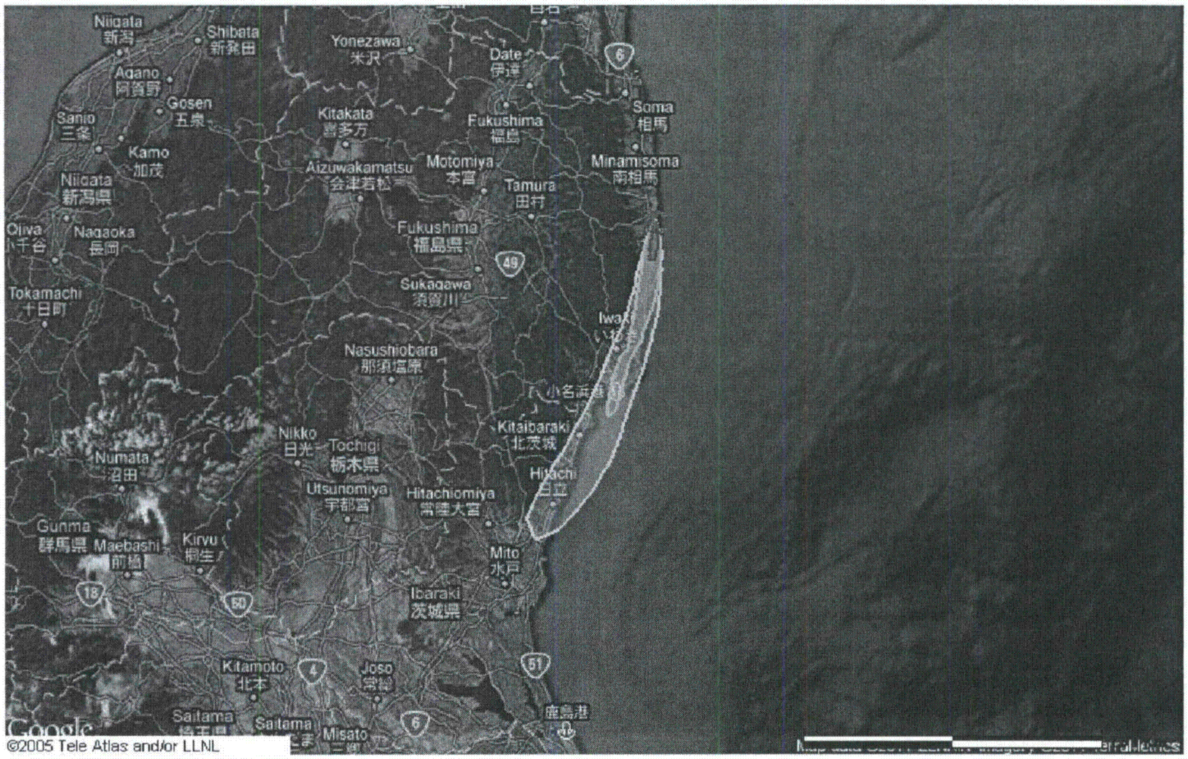
These model predictions are intended to be guidance, and are not final recommendations. The accuracy of any prediction will be limited by the accuracy of the input data, such as estimates of the amount of material that becomes airborne and the available meteorological data for the area and time of the incident. Plume predictions may be for a limited time period, and may change at later times if new input data becomes available. Predictions should be confirmed and refined using field measurements. Air and ground concentration may be higher than predicted by this plume model simulation due the limited resolution of this particular simulation. For actual incidents or exercises, consult incident command and subject matter experts from the appropriate coordinating agency before making any decisions based on this model prediction.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

APPROVED PRODUCT NARAC National Atmospheric Release Advisory Center

First Year Intermediate Phase Relocation PAG
(Relocation based on Avoidable Groundshine and Resuspension Dose)

Tokyo Supercore U2 - Real Winds - 1st Year Automated Report - Potential Release



Actions and Long-Term Effects					
	Description	Level (rem)	Extent	Area	Population
	>25 rem contour	>25	12.1km	21.7 km2	7,550
	>10 rem contour	>10	24.7km	72.3 km2	20,700
	>5 rem contour	>5	63.7km	258 km2	125,000
	Exceeds first-year relocation PAG (5 d to 1 yr 5 d).	>2	109km	1,181 km2	621,000
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.					

Effects or contamination from March 19, 2011 18:00 UTC to March 19, 2012 18:00 UTC at or near ground level.
Release Location: 37.421389 N, 141.032500 E **Material:** BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M
Generated On: March 29, 2011 05:53 UTC
Model: LODI
Comments:
Tokyo Supercore U2 - Real Winds
20 Nuclides

Map Size: 391 km by 244 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

APPROVED PRODUCT

NARAC

National Atmospheric Release Advisory Center

Consequence Report

Tokyo Supercore U2 - Real Winds - 2nd Year

Automated Report - Potential Release

Issued: March 29, 2011 13:32 UTC

SUMMARY:

This report describes the health effect consequences associated with a hypothetical unknown release to the atmosphere from a radiological source. This is an initial, automated NARAC product, not a final recommendation. Initial predictions are for a limited time period and areas affected may change at later times. Please consult NARAC staff (925-422-7627) for refined, quality assured predictions. Predictions should be confirmed and refined using measurements.

PRODUCTS:

Second Year Intermediate Phase Relocation PAG : (Relocation based on Avoidable Groundshine and Resuspension Dose)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

The following figure illustrates the model-predicted regions in which individuals are projected to have an elevated risk of developing fatal and non-fatal cancers due to radiation exposure over a period of many years from the radioactive material that has been deposited on the surface. There are two primary pathways by which individuals will continue to receive a radiological dose while they remain in these areas. Individuals in these regions will be exposed to radiation by direct exposure from radioactive material on surfaces and by exposure from material that has been resuspended into the air and subsequently inhaled. The U.S. Environmental Protection Agency (EPA) and Department of Homeland Security (DHS) have proposed or accepted similar sets of Protective Action Guides (PAGs) to indicate when relocation (long-term removal) of individuals should be considered. These Guides are primarily based on an assessment of the risk in developing cancer over an exposed individual's lifetime, and thus the health effects produced by the doses may develop over a period of several years. Note that the PAGs were developed based on avoidable dose (i.e. the dose that will be avoided once protective actions have been implemented). These model predictions are based on the conservative assumption that individuals are unsheltered and remain in the area during the time period specified in the figure's legend. If protective actions have not been implemented by the beginning of this exposure period, the avoidable dose will be less than that shown for the unsheltered population, and accumulated dose will continue to rise at an undiminished rate. Health effects could be significantly different for sheltered individuals or for those exposed in these areas for different time periods. The contours that may be displayed include the first-year relocation contour where individuals are projected to receive a dose in excess of 2 rem over the remainder of the first year following the release, and the second-year relocation contour where individuals are projected to receive a dose in excess of 0.5 rem during the second year following the release. (Doses received over each of the subsequent years are normally less than those received during the second-year.)

SOURCE INFORMATION:

Release Start Time:	March 14, 2011 18:00 UTC
Release Stop Time:	March 15, 2011 18:00 UTC
Release Location:	(37.421389, 141.0325) Fukushima 1
Source Material and Amount:	263049 Ci of BA-140 (100% respirable)
	5923.59 Ci of CE-144 (100% respirable)
	74.5882 Ci of CM-242 (100% respirable)
	426145 Ci of CS-134 (100% respirable)
	143525 Ci of CS-136 (100% respirable)
	295793 Ci of CS-137 (100% respirable)
	2.68694e+06 Ci of I-131 (100% respirable)

CV 85 of 3058

	2.23019e+06 Ci of I-132 (100% respirable)
	386233 Ci of I-133 (100% respirable)
	559.408 Ci of PU-241 (100% respirable)
	5416.64 Ci of RB-86 (100% respirable)
	34373.8 Ci of RU-103 (100% respirable)
	10100.2 Ci of RU-106 (100% respirable)
	20815.7 Ci of SB-127 (100% respirable)
	154734 Ci of SR-89 (100% respirable)
	12549.8 Ci of SR-90 (100% respirable)
	6672.18 Ci of TE-127M (100% respirable)
	26470 Ci of TE-129M (100% respirable)
	294734 Ci of TE-132 (100% respirable)
Source Geometry:	gaussian cloud top at 200 m
Particle Size Distribution:	All particulate is in the respirable range from 0.1 to 10 microns

METEOROLOGY:

ADAPT Gridded Metdata from 03/15/2011 03:00:00 JST to 03/16/2011 19:00:00 JST at 1 hr intervals were used in this calculation

Gridded Met Source	Obs Time
ADAPT	March 14, 2011 18:00 UTC
ADAPT	March 14, 2011 19:00 UTC
ADAPT	March 14, 2011 20:00 UTC
ADAPT	March 14, 2011 21:00 UTC
ADAPT	March 14, 2011 22:00 UTC
ADAPT	March 14, 2011 23:00 UTC
ADAPT	March 15, 2011 00:00 UTC
ADAPT	March 15, 2011 01:00 UTC
ADAPT	March 15, 2011 02:00 UTC
ADAPT	March 15, 2011 03:00 UTC
ADAPT	March 15, 2011 04:00 UTC
ADAPT	March 15, 2011 05:00 UTC
ADAPT	March 15, 2011 06:00 UTC
ADAPT	March 15, 2011 07:00 UTC
ADAPT	March 15, 2011 08:00 UTC
ADAPT	March 15, 2011 09:00 UTC
ADAPT	March 15, 2011 10:00 UTC
ADAPT	March 15, 2011 11:00 UTC
ADAPT	March 15, 2011 12:00 UTC
ADAPT	March 15, 2011 13:00 UTC
ADAPT	March 15, 2011 14:00 UTC
ADAPT	March 15, 2011 15:00 UTC
ADAPT	March 15, 2011 16:00 UTC
ADAPT	March 15, 2011 17:00 UTC
ADAPT	March 15, 2011 18:00 UTC
ADAPT	March 15, 2011 19:00 UTC
ADAPT	March 15, 2011 20:00 UTC

Gridded Met Source	Obs Time
ADAPT	March 15, 2011 21:00 UTC
ADAPT	March 15, 2011 22:00 UTC
ADAPT	March 15, 2011 23:00 UTC
ADAPT	March 16, 2011 00:00 UTC
ADAPT	March 16, 2011 01:00 UTC
ADAPT	March 16, 2011 02:00 UTC
ADAPT	March 16, 2011 03:00 UTC
ADAPT	March 16, 2011 04:00 UTC
ADAPT	March 16, 2011 05:00 UTC
ADAPT	March 16, 2011 06:00 UTC
ADAPT	March 16, 2011 07:00 UTC
ADAPT	March 16, 2011 08:00 UTC
ADAPT	March 16, 2011 09:00 UTC
ADAPT	March 16, 2011 10:00 UTC

No precipitation is included in this calculation

ASSUMPTIONS:

Unless otherwise stated ICRP60 series DCF's were used for dose plots.

CONTACT INFORMATION:

Calculation requested on March 29, 2011 06:06 UTC by:

none none, DOE NIT
202-586-8100

Approved by: NARAC Operations
Approver organization: NARAC
Phone: 925-422-9100
Email: narac@llnl.gov
Approved on: March 29, 2011 13:32 UTC

Classification: ~~Draft-Official Use Only - Not Approved for Further Distribution~~

DISCLAIMER:

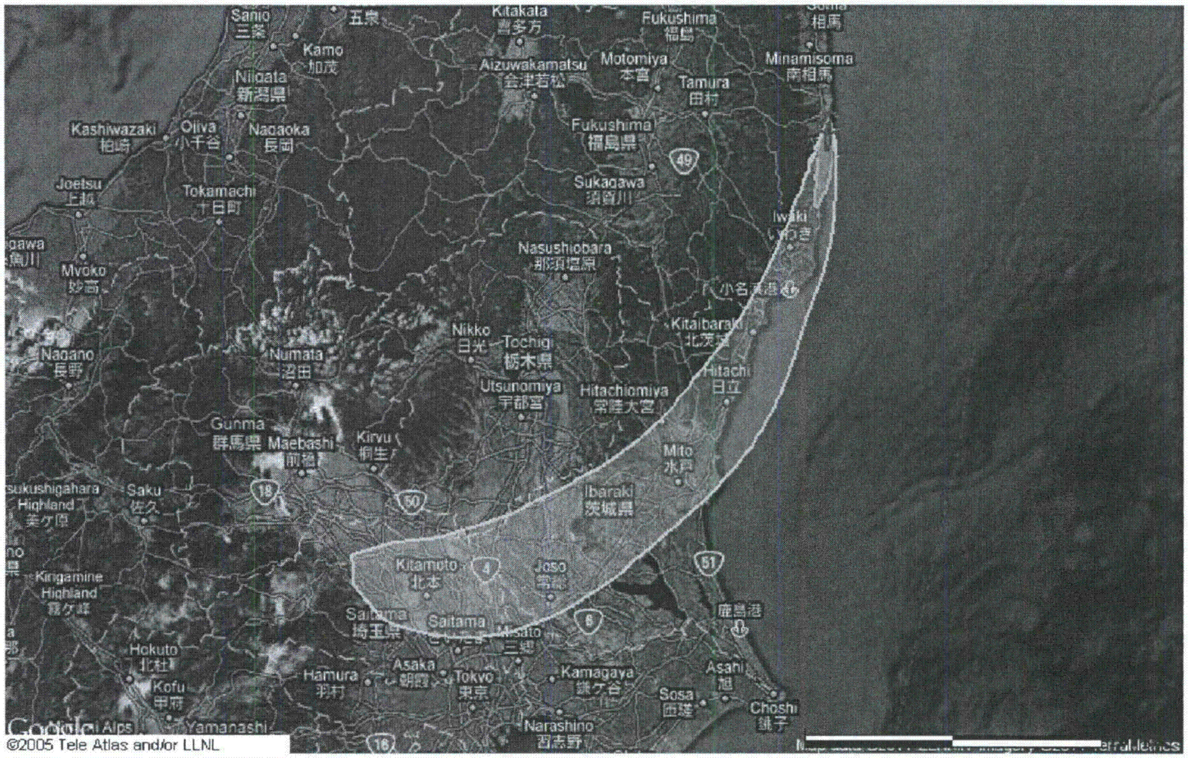
These model predictions are intended to be guidance, and are not final recommendations. The accuracy of any prediction will be limited by the accuracy of the input data, such as estimates of the amount of material that becomes airborne and the available meteorological data for the area and time of the incident. Plume predictions may be for a limited time period, and may change at later times if new input data becomes available. Predictions should be confirmed and refined using field measurements. Air and ground concentration may be higher than predicted by this plume model simulation due the limited resolution of this particular simulation. For actual incidents or exercises, consult incident command and subject matter experts from the appropriate coordinating agency before making any decisions based on this model prediction.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

APPROVED PRODUCT NARAC National Atmospheric Release Advisory Center

Second Year Intermediate Phase Relocation PAG
(Relocation based on Avoidable Groundshine and Resuspension Dose)

Tokyo Supercore U2 - Real Winds - 2nd Year Automated Report - Potential Release



Actions and Long-Term Effects

	Description	Level (rem)	Extent	Area	Population
	>25 rem contour	>25	8.8km	10.4 km2	2,050
	>10 rem contour	>10	17.5km	38.4 km2	11,400
	>5 rem contour	>5	27.4km	84.8 km2	22,000
	Exceeds second-year relocation PAG.	>0.5	217km	5,930 km2	5.13E6

Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination from March 14, 2012 18:00 UTC to March 14, 2013 18:00 UTC at or near ground level.
Release Location: 37.421389 N, 141.032500 E **Material:** BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M
Generated On: March 29, 2011 06:04 UTC
Model: LODI
Comments:
Tokyo Supercore U2 - Real Winds
20 Nuclides

Map Size: 392 km by 245 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

APPROVED PRODUCT

NARAC

National Atmospheric Release Advisory Center

Consequence Report

Tokyo Supercore U2 - Early-Iodine-Worker- Real Winds

Automated Report - Potential Release

Issued: March 29, 2011 14:28 UTC

SUMMARY:

This report describes the health effect consequences associated with a hypothetical unknown release to the atmosphere from a radiological source. This is an initial, automated NARAC product, not a final recommendation. Initial predictions are for a limited time period and areas affected may change at later times. Please consult NARAC staff (925-422-7627) for refined, quality assured predictions. Predictions should be confirmed and refined using measurements.

PRODUCTS:

Early Phase Dose (0-96 Hrs) : (Total Effective Dose Including Plume Passage)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133

This product identifies areas that could exceed doses of 5 and 1 rem over a 4-day exposure period, which begins at the start of the release. If used to project doses from a potential future release, these levels correspond to the EPA/DHS guidelines for the Early Phase based on the dose that may be avoided if shelter and evacuation guidance can be implemented prior to the beginning of the release. These Protective Action Guideline (PAG) limits are based on an assessment of the long-term risk of developing cancer in exposed individuals over their lifetime or producing genetic disorders in subsequent generations. These risks result from the projected combined dose caused by radiation from the material deposited onto the surface, radiation from the material as it is carried in the air, and radiation from the material that has been inhaled and retained by the body. Upon request, estimates of the total number of people exposed, and (after accounting for estimated deaths from acute, short-term effects) the number of expected subsequent fatal cancers and combined number of expected subsequent fatal and non-fatal cancers may be displayed. These are computer model estimates assuming unprotected exposure and no mitigating action (such as evacuation or sheltering) for the entire time period of this prediction, and therefore may be over-estimates of the actual effects.

Early Phase Guidance (Radioiodine) : (KI Administration based on Thyroid Radioiodine Dose)

Material: I-131 + I-132 + TE-132 + I-133 + TE-129M

The U.S. Environmental Protection Agency (EPA) and Department of Homeland Security (DHS) have proposed or accepted similar sets of Protective Action Guides (PAGs) to indicate when protective actions should be considered/implemented to protect the population. These Guides correspond to specific dose levels and are primarily based on an assessment of the risk in developing cancer over an exposed individual's lifetime. Thus the health effects produced by these doses may develop over a period of years. In the event radioiodines are released into the atmosphere, the PAG level is based on the projected dose to a child's thyroid which may be avoided by the administering of potassium iodide. Additional levels based on guidance from the U.S. Food and Drug Administration for adults may also be shown. (Note that the PAG level for potassium iodide administration to pregnant women is 5 rem to the adult thyroid.) These model predictions are based on the effects of radiation from the material inhaled and retained by the body, and use the conservative assumption that individuals are unsheltered and remain in the area during the time period specified in the figure's legend. Health effects could be significantly different for sheltered individuals or for those exposed in these areas for different time periods. Estimates of the number of exposed individuals expected to experience these effects may be given in the legend. If so, the counts given for all illnesses include those leading to pre-mature death. Note that the counts and area covered by each contour are cumulative such that outer contours include the counts and areas of all inner contours.

Worker Protection Dose Rate at 96 hrs (Far Field) : (Groundshine Dose Rate at 03/19/2011 03:00:00 JST)

Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M

This product identifies the locations where the Federal Radiation Protection Guidance occupational upper limit dose may be exceeded for various exposure periods by unprotected workers performing emergency services. The limits are based on the risk of workers developing cancer over their lifetimes, and ensure that exposures will not result in detrimental acute or early health effects. Although these doses may be expressed in terms of the EPA Response Worker Guidelines, these contours may also be used to estimate the ongoing dose received by the unsheltered general population. NCRP and NRC administrative control areas are also shown. Note: EPA and NRC guidelines are based on a total dose limit. These contoured dose rate values, if constant over the indicated exposure period, will deliver the equivalent limiting dose. For rapidly-decaying dose rates, these predictions will be conservative. The dose associated with potential inhalation of resuspended material is not included in these estimates. The relative importance of any committed inhalation dose from resuspended material is dependent on a variety of factors (e.g. weather, radionuclides, etc.). Note that the population count and area covered by each contour are cumulative such that outer contours include the counts and areas of all inner contours.

Deposition at 96 hrs : (Surface Contamination from Deposited Radionuclides)
Material: BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M
This product identifies the more highly contaminated areas due to fallout and deposition of the radioactive material. This material, depending upon the type of radiation emitted, may continue to give significant doses to individuals in these areas through inhalation of resuspended radioactive material or from direct external radiation. These levels of deposited radioactivity should be confirmed by monitoring surverys.

SOURCE INFORMATION:

Release Start Time:	March 14, 2011 18:00 UTC
Release Stop Time:	March 15, 2011 18:00 UTC
Release Location:	(37.421389, 141.0325) Fukushima 1
Source Material and Amount:	Early Phase Dose (0-96 Hrs)
	263049 Ci of BA-140 (100% respirable)
	5923.59 Ci of CE-144 (100% respirable)
	74.5882 Ci of CM-242 (100% respirable)
	426145 Ci of CS-134 (100% respirable)
	143525 Ci of CS-136 (100% respirable)
	295793 Ci of CS-137 (100% respirable)
	2.68694e+06 Ci of I-131 (100% respirable)
	2.23019e+06 Ci of I-132 (100% respirable)
	386233 Ci of I-133 (100% respirable)
	559.408 Ci of PU-241 (100% respirable)
	5416.64 Ci of RB-86 (100% respirable)
	34373.8 Ci of RU-103 (100% respirable)
	10100.2 Ci of RU-106 (100% respirable)
	20815.7 Ci of SB-127 (100% respirable)
	154734 Ci of SR-89 (100% respirable)
	12549.8 Ci of SR-90 (100% respirable)
	6672.18 Ci of TE-127M (100% respirable)
	26470 Ci of TE-129M (100% respirable)
	294734 Ci of TE-132 (100% respirable)
	2.90702e+07 Ci of XE-133 (100% respirable)
	Early Phase Guidance (Radioiodine)
	2.68694e+06 Ci of I-131 (100% respirable)
	2.23019e+06 Ci of I-132 (100% respirable)
	386233 Ci of I-133 (100% respirable)
	26470 Ci of TE-129M (100% respirable)
	294734 Ci of TE-132 (100% respirable)
	Worker Protection Dose Rate at 96 hrs (Far Field)
	Deposition at 96 hrs
	263049 Ci of BA-140 (100% respirable)
	5923.59 Ci of CE-144 (100% respirable)

74.5882 Ci of CM-242 (100% respirable)
426145 Ci of CS-134 (100% respirable)
143525 Ci of CS-136 (100% respirable)
295793 Ci of CS-137 (100% respirable)
2.68694e+06 Ci of I-131 (100% respirable)
2.23019e+06 Ci of I-132 (100% respirable)
386233 Ci of I-133 (100% respirable)
559.408 Ci of PU-241 (100% respirable)
5416.64 Ci of RB-86 (100% respirable)
34373.8 Ci of RU-103 (100% respirable)
10100.2 Ci of RU-106 (100% respirable)
20815.7 Ci of SB-127 (100% respirable)
154734 Ci of SR-89 (100% respirable)
12549.8 Ci of SR-90 (100% respirable)
6672.18 Ci of TE-127M (100% respirable)
26470 Ci of TE-129M (100% respirable)
294734 Ci of TE-132 (100% respirable)

Source Geometry: gaussian cloud top at 200 m

Particle Size Distribution: All particulate is in the respirable range from 0.1 to 10 microns

METEOROLOGY:

ADAPT Gridded Metdata from 03/15/2011 03:00:00 JST to 03/16/2011 19:00:00 JST at 1 hr intervals were used in this calculation

Gridded Met Source	Obs Time
ADAPT	March 14, 2011 18:00 UTC
ADAPT	March 14, 2011 19:00 UTC
ADAPT	March 14, 2011 20:00 UTC
ADAPT	March 14, 2011 21:00 UTC
ADAPT	March 14, 2011 22:00 UTC
ADAPT	March 14, 2011 23:00 UTC
ADAPT	March 15, 2011 00:00 UTC
ADAPT	March 15, 2011 01:00 UTC
ADAPT	March 15, 2011 02:00 UTC
ADAPT	March 15, 2011 03:00 UTC
ADAPT	March 15, 2011 04:00 UTC
ADAPT	March 15, 2011 05:00 UTC
ADAPT	March 15, 2011 06:00 UTC
ADAPT	March 15, 2011 07:00 UTC
ADAPT	March 15, 2011 08:00 UTC
ADAPT	March 15, 2011 09:00 UTC
ADAPT	March 15, 2011 10:00 UTC
ADAPT	March 15, 2011 11:00 UTC
ADAPT	March 15, 2011 12:00 UTC
ADAPT	March 15, 2011 13:00 UTC
ADAPT	March 15, 2011 14:00 UTC
ADAPT	March 15, 2011 15:00 UTC
ADAPT	March 15, 2011 16:00 UTC

Gridded Met Source	Obs Time
ADAPT	March 15, 2011 17:00 UTC
ADAPT	March 15, 2011 18:00 UTC
ADAPT	March 15, 2011 19:00 UTC
ADAPT	March 15, 2011 20:00 UTC
ADAPT	March 15, 2011 21:00 UTC
ADAPT	March 15, 2011 22:00 UTC
ADAPT	March 15, 2011 23:00 UTC
ADAPT	March 16, 2011 00:00 UTC
ADAPT	March 16, 2011 01:00 UTC
ADAPT	March 16, 2011 02:00 UTC
ADAPT	March 16, 2011 03:00 UTC
ADAPT	March 16, 2011 04:00 UTC
ADAPT	March 16, 2011 05:00 UTC
ADAPT	March 16, 2011 06:00 UTC
ADAPT	March 16, 2011 07:00 UTC
ADAPT	March 16, 2011 08:00 UTC
ADAPT	March 16, 2011 09:00 UTC
ADAPT	March 16, 2011 10:00 UTC

No precipitation is included in this calculation

ASSUMPTIONS:

Unless otherwise stated ICRP60 series DCF's were used for dose plots.

CONTACT INFORMATION:

Calculation requested on March 29, 2011 14:23 UTC by:

none none, DOE NIT
202-586-8100

Approved by: NARAC Operations
Approver organization: NARAC
Phone: 925-422-9100
Email: narac@llnl.gov
Approved on: March 29, 2011 14:28 UTC

Classification: ~~DRAFT-Official Use Only-Not Approved for Further Distribution~~

DISCLAIMER:

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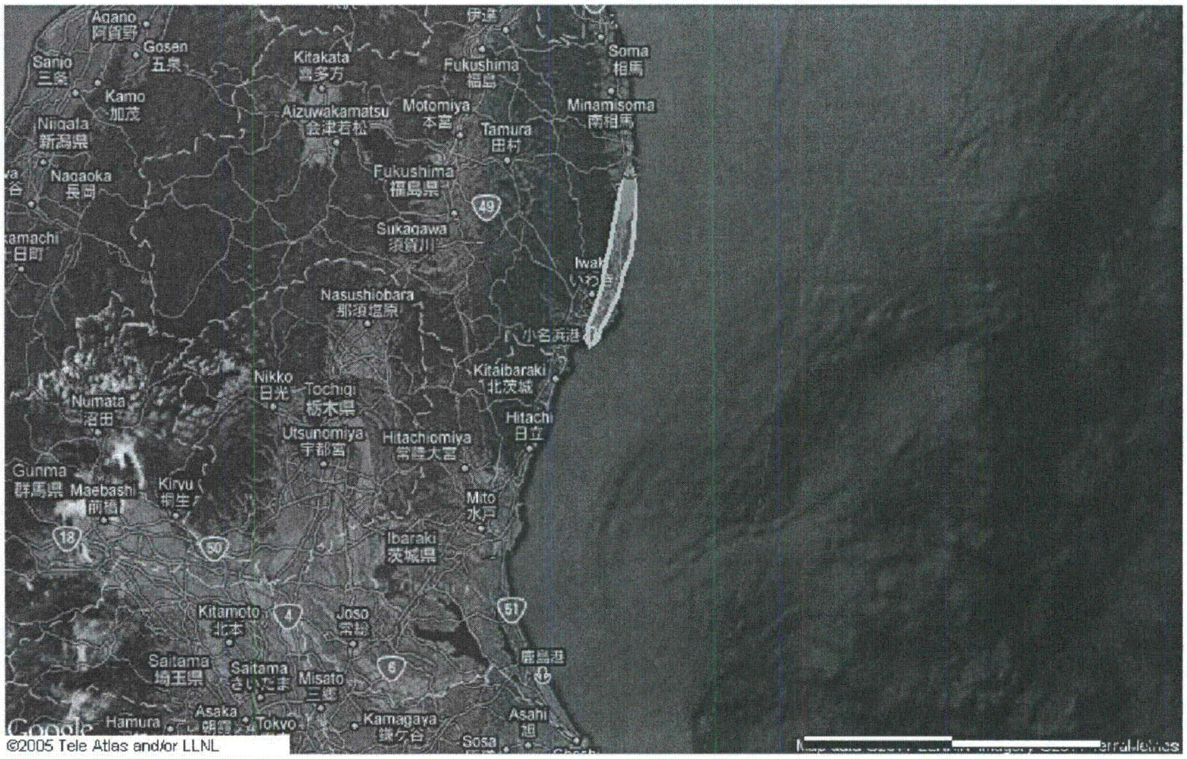
This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

APPROVED PRODUCT
NARAC
National Atmospheric Release Advisory Center

Early Phase Dose (0-96 Hrs) (Total Effective Dose Including Plume Passage)

Tokyo Supercore U2 - Early-Iodine-Worker- Real Winds Automated Report - Potential Release



Actions and Long-Term Effects					
	Description	Level (rem)	Extent	Area	Population
	Exceeds 5 rem total effective dose.	>5	16.6km	35.3 km2	10,800
	Exceeds 1 rem total effective dose.	>1	59.0km	301 km2	118,000
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.					

Effects or contamination from March 14, 2011 18:00 UTC to March 18, 2011 18:00 UTC at or near ground level.
Release Location: 37.421389 N, 141.032500 E **Material:** BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M + XE-133
Generated On: March 29, 2011 14:22 UTC
Model: LODI
Comments:
Doses shown are total accumulated from the beginning of release.
Hypothetical release of 20 nuclides. Based on real meteorological conditions.

Map Size: 392 km by 245 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

APPROVED PRODUCT
NARAC
National Atmospheric Release Advisory Center

Early Phase Guidance (Radioiodine)
(KI Administration based on Thyroid Radioiodine Dose)

Tokyo Supercore U2 - Early-Iodine-Worker- Real Winds Automated Report - Potential Release

Effects and Actions

	Description	Level (rem)	Extent	Area	Population
	Adult thyroid Committed Equivalent Dose - Early Phase FDA Guidance for KI administration to adults over 40.	>500	1.1km	0.3 km2	330
	Adult thyroid Committed Equivalent Dose - Early Phase FDA Guidance for KI administration to adults under 40.	>10	34.0km	126 km2	25,200
	Child thyroid Committed Equivalent Dose - Early Phase PAG for KI administration to children under 18.	>5	87.6km	804 km2	320,000

Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination from March 14, 2011 18:00 UTC to March 18, 2011 18:00 UTC at or near ground level.
Release Location: 37.421389 N, 141.032500 E **Material:** I-131 + I-132 + TE-132 + I-133 + TE-129M
Generated On: March 29, 2011 14:22 UTC
Model: LODI
Comments:
Doses shown are total accumulated from the beginning of release.
Hypothetical release of 20 nuclides. Based on real meteorological conditions.

Map Size: 392 km by 245 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

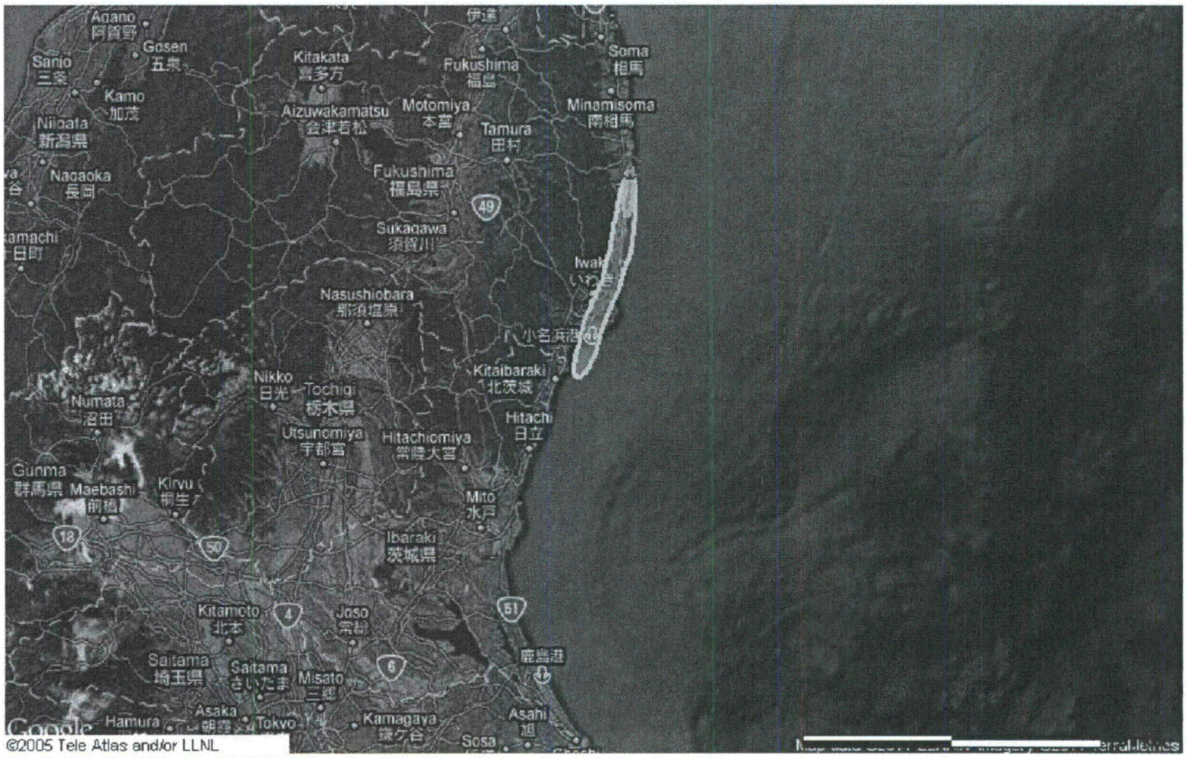
APPROVED PRODUCT

NARAC

National Atmospheric Release Advisory Center

Worker Protection Dose Rate at 96 hrs (Far Field)
(Groundshine Dose Rate at 03/19/2011 03:00:00 JST)

Tokyo Supercore U2 - Early-Iodine-Worker- Real Winds Automated Report - Potential Release



Acute (Short-Term) Effects

	Description	Level (mrem/hr)	Extent	Area	Population
	Limit for all occupational exposures exceeded by exposure for 50 hours or less.	>100	2.4km	0.9 km2	600
	NCRP radiological control boundary.	>10	15.5km	32.1 km2	10,100
	Limit for NRC public exclusion zone exceeded by exposure for 1 hour or less.	>2	70.2km	388 km2	178,000

Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.

Effects or contamination at March 18, 2011 18:00 UTC at or near ground level.
Release Location: 37.421389 N, 141.032500 E **Material:** BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M
Generated On: March 29, 2011 14:22 UTC
Model: LODI
Comments:
Hypothetical release of 20 nuclides. Based on real meteorological conditions.

Map Size: 392 km by 245 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

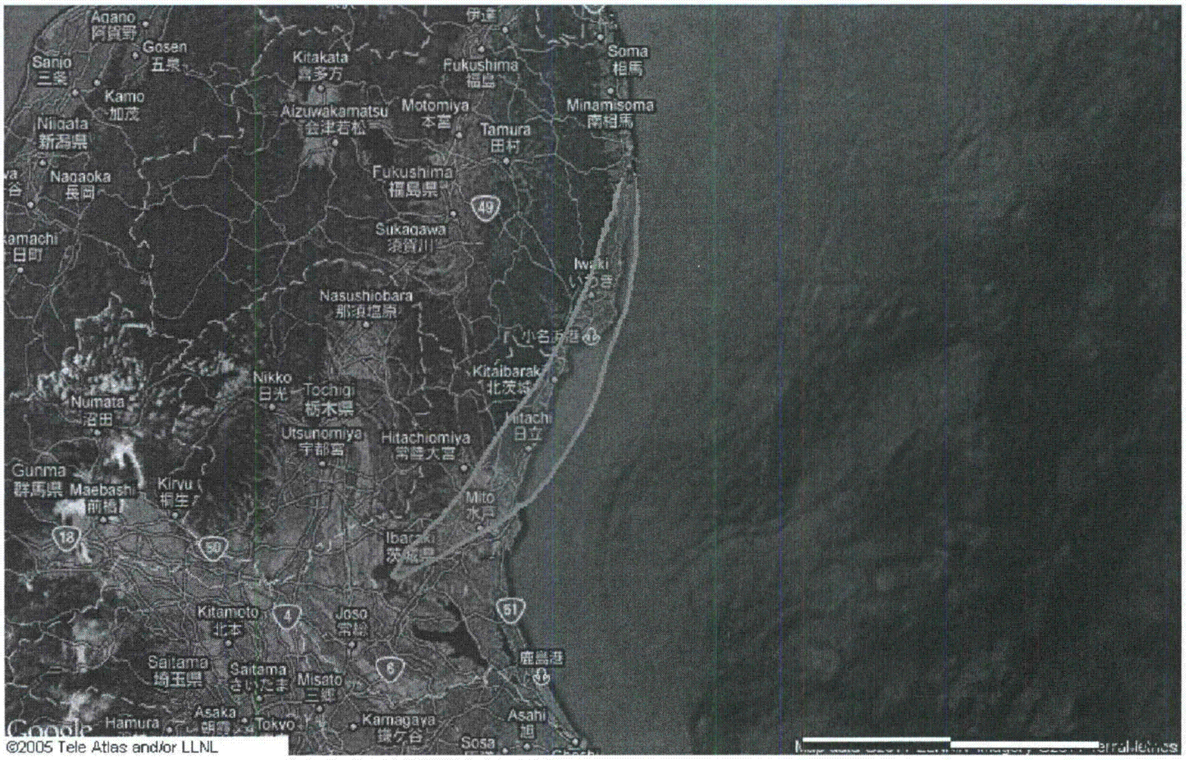
APPROVED PRODUCT

NARAC

National Atmospheric Release Advisory Center

Deposition at 96 hrs
(Surface Contamination from Deposited Radionuclides)

Tokyo Supercore U2 - Early-Iodine-Worker- Real Winds Automated Report - Potential Release



Effects and Actions					
	Description	Level (Ci/m2)	Extent	Area	Population
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>0.01	4.2km	2.6 km2	1,030
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>0.0010	22.9km	67.2 km2	18,700
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>0.0001	152km	2,194 km2	1.19E6
Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.					

Effects or contamination at March 18, 2011 18:00 UTC at or near ground level.
Release Location: 37.421389 N, 141.032500 E **Material:** BA-140 + CE-144 + CM-242 + CS-134 + CS-136 + CS-137 + I-131 + I-132 + TE-132 + I-133 + PU-241 + RB-86 + RU-103 + RU-106 + SB-127 + TE-127M + SR-89 + SR-90 + TE-129M
Generated On: March 29, 2011 14:22 UTC
Model: LODI
Comments:
Hypothetical release of 20 nuclides. Based on real meteorological conditions.

Map Size: 392 km by 245 km **Id:** Production3.rcE12815.rcC1

NARAC Operations: (onDuty Assessor); narac@llnl.gov; 925-424-6465
Requested by: {none none; DOE NIT; 202-586-8100}
Approved by: {NARAC Operations; NARAC; 925-422-9100}

From: Hoc, PMT12
Sent: Tuesday, March 29, 2011 8:26 PM
To: PMT02 Hoc; PMT09 Hoc
Subject: FW: Plutonium Detected In Fukushima 'Not Significant': U.S. Official

-----Original Message-----
From: Jackson, Todd
Sent: Tuesday, March 29, 2011 8:25 PM
To: Hoc, PMT12
Subject: FW: Plutonium Detected In Fukushima 'Not Significant': U.S. Official

FYI
Todd

-----Original Message-----
From: Sano, Mikako [mailto:SanoMX@state.gov]
Sent: Tuesday, March 29, 2011 8:18 PM
To: Coleman, Norman (NIH/NCI) [E]; Howard, E. Bruce; tbowman@cdc.gov; Jackson, Todd; Nicholas, Richard A (MED); Miller, Marie; Telfer, Jana L. (CDC/ONDIEH/NCEH); Simon, Steve (NIH/NCI) [E]; Petrie, Ronald C
Subject: Plutonium Detected In Fukushima 'Not Significant': U.S. Official

FYI: Wednesday, March 30, 2011

Plutonium Detected In Fukushima 'Not Significant': U.S. Official WASHINGTON (Kyodo)--A senior U.S. Energy Department official said Tuesday the level of plutonium detected in soil at the crippled Fukushima Daiichi nuclear power plant in Japan is "not significant."

"Certainly it would be a concern if it were in significant levels ... It was not significant at this point," Peter Lyons, acting assistant secretary of the department's Office of Nuclear Energy, said in a hearing of the Senate Energy and Natural Resources Committee.

He also noted finding plutonium that was derived from either the operating reactors or the spent fuel pools "would not be regarded as a major surprise."

Tokyo Electric Power Co., the operator of the stricken reactors, said Monday that plutonium has been detected in soil at five locations at the Fukushima Daiichi nuclear power plant.

In the Senate panel, Lyons said, "Current information suggests that the plants are in a slow recovery from the accident."

Although long-term cooling of the troubled reactors at Fukushima Daiichi Nuclear Power Station is essential, "it has not been adequately restored to date," he added.

Lyons revealed the United States plans to provide Japan with radiation-hardened robotics to assist the country's efforts to deal with the nuclear crisis.

The official also suggested that the nuclear accident in Japan will not alter U.S. energy policy, saying, "We view nuclear energy as a very important component to the overall portfolio we are trying to build a clean-energy future."

President Barack Obama is scheduled to deliver a speech on U.S. energy security in Washington on Wednesday and may touch on the Japan's nuclear disaster and its implications for the U.S. policy.

From: Huffert, Anthony
Sent: Tuesday, March 29, 2011 3:40 PM
To: PMT11 Hoc; PMT02 Hoc; PMT09 Hoc
Subject: Anthropogenic plutonium in japaneese soil
Attachments: japanplu.pdf

4.31 Isotope ratios of $^{240}Pu/^{239}Pu$ in soil samples from different areas

Yasuyuki Muramatsu[1], Satoshi Yoshida[1] and Shinnosuke Yamazaki[2]

[1]National Institute of Radiological Sciences: Anagawa 4-9-1, Inage, Chiba, 263-8555 Japan
[2]Tokyo Nuclear Service Inc.: Ueno 7-6-5, Taito-ku, Tokyo, 110-0005 Japan

ABSTRACT

Plutonium concentrations and $^{240}Pu/^{239}Pu$ atom ratios in soil samples from Japan and other areas in the world (including IAEA standard reference materials) were determined by ICP-MS. The range of $^{240}Pu/^{239}Pu$ atom ratios observed in 21 Japanese soil samples was 0.155 - 0.194 and the average was 0.180 ± 0.011, which is comparable to the global fallout value. A low ratio of about 0.05, which is derived from Pu-bomb, was found in samples from Nishiyama (Nagasaki) and Mururoa Atoll (IAEA-368), while a high ratio of about 0.31 was found in a sample from Bikini Atoll (Marshall Islands). The ratio for Irish Sea sediment (IAEA-135) was 0.21, which was higher than the global fallout value, suggesting the influence by the contamination from the Sellafield facility. The $^{240}Pu/^{239}Pu$ atom ratios in soils from the Chernobyl area were determined, and the ratio was found to be very high (about 0.4), indicating the high burn-up grade of the reactor fuel. These results show that the $^{240}Pu/^{239}Pu$ ratio can be used as a finger print to identify the source of the contamination.

Keywords
Plutonium, ICP-MS analysis, isotope ratio, soil, different areas

1. INTRODUCTION

Plutonium is one of the most important radionuclides in the field of radioecology. There are different anthropogenic sources of Pu in the environment [1]. Atomic weapons testing introduced the major deposited fraction of Pu to the global environment. High Pu levels are known for the nuclear weapons testing sites such as in the Marshall Islands, Mururoa Atoll, Nevada and Semipalatinsk. In the Nishiyama area (Nagasaki/Japan) elevated Pu concentrations were observed [2]. Plutonium has also been released into the environment through operation or accidents at nuclear facilities such as Sellafield/UK, Kyshtym/Russia, Chernobyl/Ukraine, etc. The deep-sea disposal of packaged waste around the Farallon Islands (California/USA) and in the North Atlantic would be potential contamination sources in the marine environment. Accidental burn-up of the SNAP9A satellite in 1964 also released Pu, which was used for the battery, into the atmosphere.

However, there is only a limited volume of quality data available on the isotope compositions of Pu (specifically, $^{240}Pu/^{239}Pu$ ratio). This is mainly due to the fact that ^{239}Pu and ^{240}Pu have similar alpha energies and cannot be easily resolved by alpha spectrometry. We have developed a reliable method for the determination of ^{239}Pu and ^{240}Pu by ICP-MS (Inductively Coupled Plasma Mass Spectrometry) [3].

In this paper, we report the analytical methods for Pu by ICP-MS, $^{240}Pu/^{239}Pu$ ratio in soil (or sediments) samples from different areas (e.g. Japan, Chernobyl, the Marshall Islands) and the differences in the $^{240}Pu/^{239}Pu$ ratios according to the soil profile.

2. MATERIALS AND METHOD

Analytical procedures used were based on the method reported previously [3, 4]. Only a brief description is given here. Samples (1-10 g, depending on the concentration level) were mixed with a known amount of ^{242}Pu tracer (CRM 130, New Brunswick Laboratory) in a Pyrex beaker and treated with 8 M HNO_3 (more than 8 times the sample weight). Special attention should be paid to the high production of CO_2 bubbles during the acid dissolution step to avoid loss of sample. The beaker was covered with a watchglass and boiled on a hot plate (180-200°C) for about 5 hours. The warm supernatant (leachate) was then filtered through a glass fiber filter. The residue in the beaker was treated again with 8 M HNO_3 for about 30 minutes, then filtered. This leaching procedure was usually repeated at least twice. The filtrates were collected in a beaker, and heated on a hot plate until a thick wet paste was obtained. The paste was then dissolved in HNO_3, and diluted with deionized water to adjust the solution to 8 M HNO_3. Chemical form of plutonium was converted to tetravalent Pu (IV), which is the only retainable form in the chromatography column, with $NaNO_2$. Sample solution was loaded onto the column containing 2 mL of Dowex 1X8 at a speed < 2 mL min^{-1}. The resin was washed with 40 mL of 8 M HNO_3, then with 40 mL of 10 M HCl. Finally, plutonium was eluted from the column using 40 mL of NH_4I (5%)-10 M HCl solution which reducing Pu (IV) to Pu (III). In order to remove iodine, the eluant was treated with 4 mL of HNO_3 and 1 mL of H_2O_2, and the solution heated to dryness. The residue was then dissolved in 4% HNO_3 and plutonium isotopes measured by ICP-MS using a quadrupole-type mass spectrometer (Q-ICP-MS; Yokogawa PMS-2000) and also high resolution-type (HR-ICP-MS; Finnigan Element).

Concentrations of ^{239}Pu and ^{240}Pu were calculated from the results using isotope dilution methods. Three separate measurements of each solution digest were performed—normally the internal precision of these measurements was around ± 5%. A plutonium isotopic standard (NIST-947) with a known $^{240}Pu/^{239}Pu$ ratio was also used to check the accuracy of the isotopic ratio measurements, and to correct for any mass bias.

3. RESULTS AND DISCUSSIONS

3.1 $^{240}Pu/^{239}Pu$ ratios in Japanese soil samples

Analytical results for 21 Japanese soil samples collected from different places showed that the concentrations of Pu ($^{239+240}Pu$) ranged from 0.15 – 4.3 Bq/kg (dry weight basis). The concentrations in surface soils collected from forests were higher than those from agricultural fields. The range of $^{240}Pu/^{239}Pu$ atom ratios observed in the Japanese soil samples was 0.155 - 0.194 (excluding

Nishiyama/Nagasaki sample) and the average was 0.180 ± 0.011. These values were comparable to the global fallout value of 0.176 ± 0.014 reported by Krey [5], which was based on the mass-spectrometric measurements of various soils (about 60) collected world-wide. Variation between the lowest to highest ratio might be due to the influence of different fallout events, since a variety of nuclear weapons has been tested world-wide. Differentiation of the $^{240}Pu/^{239}Pu$ ratio might also occur during the migration of Pu in the environment (e.g. in soil), because chemical species of Pu would depend on individual fallout.

In order to know the vertical distribution of Pu in soil, samples were collected at 4 different depths (0-2cm, 2-5cm, 10-20cm and 20-30cm) at the same point in a pine forest in Aomori Prefecture. It was observed that Pu concentration was markedly higher in the surface soil layer (specifically in the 0-5 cm depth) than in deeper layers (see Table 1). This suggested that the migration of Pu into lower soil layers was very slow and most of Pu is still retained in the surface soil for more than 30 years after the fallout peak (around 1963). A tendency was observed for the $^{240}Pu/^{239}Pu$ ratio to increase with depth, although the differences were not so large. If these differences had been statistically significant, there could be a possibility that species having a higher $^{240}Pu/^{239}Pu$ ratio migrated in the soil faster than those having a lower ratio. However, it is necessary to analyze more samples from different areas, before we can confirm this hypothesis. There was also a possibility that the difference of the isotope ratios and the Pu chemical forms were related to the different origin of the fallout, which were influenced by the type and scale of the explosion.

Table 1 Concentrations of ^{239}Pu and ^{240}Pu and their atom ratios in soils from a forest in Aomori Prefecture (on a dry weight basis).

Depth (cm)	^{239}Pu (Bq/kg)	SD	^{240}Pu (Bq/kg)	SD	$^{239+240}Pu$ (Bq/kg)	SD	$^{240}Pu/^{239}Pu$ (atom ratio)	SD
0-2	1.88	± 0.020	1.14	± 0.012	3.02	± 0.023	0.166	± 0.001
2-5	1.62	± 0.015	1.01	± 0.019	2.62	± 0.024	0.170	± 0.004
10-20	0.45	± 0.008	0.29	± 0.003	0.74	± 0.008	0.174	± 0.002
20-30	0.09	± 0.001	0.06	± 0.002	0.15	± 0.002	0.194	± 0.005

3.2 Comparison of the $^{240}Pu/^{239}Pu$ ratios from different areas

The $^{240}Pu/^{239}Pu$ atom ratios analyzed by us for samples originating from several different areas (including IAEA standard reference materials) are summarized in Figure 1. Details on the samples from the Chernobyl area and from the Marshall Islands were published elsewhere [6, 7].

The value for surface soil collected from Austria (IAEA-SOIL-6) was 0.191 ± 0.005, which was somewhat larger than the Japanese soil, but within the range of the global fallout value of 0.176 ± 0.014 reported by Krey [5].

Ocean sediment from Mururoa Atoll (IAEA-368) had a value of 0.04 ± 0.008. This suggested that Pu was derived from the testing of a Pu-bomb in which ^{239}Pu was enriched. However, the $^{240}Pu/^{239}Pu$

atom ratio for samples from the Marshall Islands (IAEA-367) showed a high value of about 0.30, although the concentration of $^{239+240}$Pu in these two marine sediments was similar. The high ^{240}Pu/^{239}Pu atom ratio for samples found for the Marshall Islands sample was similar to the ratio reported by Komura *et al.* [8] measured in two samples of Hemp-palm leaves (0.338±0.051 and 0.318±0.033) used in the Japanese fishing boat, No. 5 Fukuryu-Maru (Lucky Dragon), which was directly contaminated in a thermonuclear bomb test at Bikini Atoll. The difference of the atom ratio observed in Mururoa Atoll and the Marshall Islands may be due to the type of the weapons tested. Since several different tests were probably carried out in both islands, we could not conclude that the values mentioned here were representative for these areas; they are just for examples based on our analytical results in standard reference materials.

The ratio obtained for the Irish Sea sediment sample (IAEA-135) of 0.211 was higher than the global fallout value. The higher value would be influenced by the contamination from the Sellafield facility. Our value was comparable to the ratio (0.20) reported by Yamamoto *et al.* [9] in a sediment sample originating from the Sellafield area. Fish flesh from the Irish Sea (IAEA-134) showed a similar value of 0.200 to the Irish Sea sediment sample, suggesting that the origin of the contamination seemed to be the same.

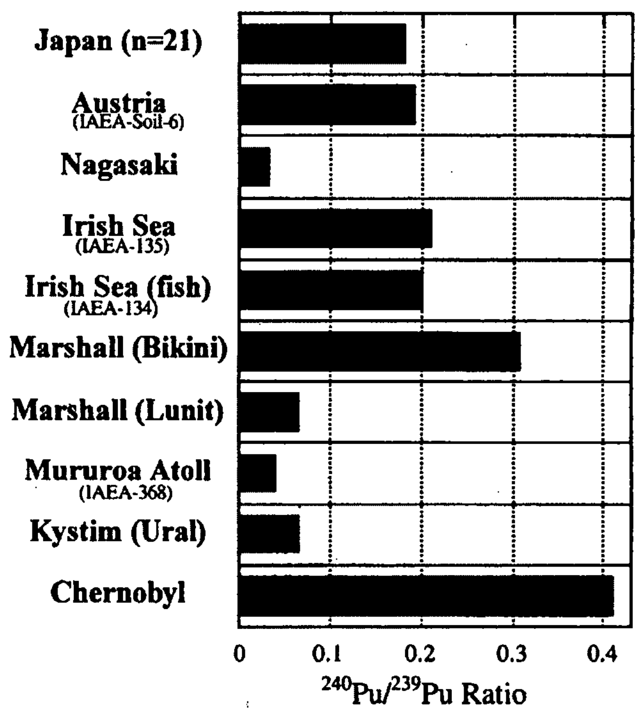


Fig. 1 ^{240}Pu/^{239}Pu atom ratio in samples from different areas

The very low value of the ^{240}Pu/^{239}Pu atom ratio (0.04) observed in the sample collected from Nishiyama/Nagasaki indicated the influence of Pu from the bomb dropped in August 1945. The low ratio observed in a sample from Kyshtym of about 0.07 indicated the Pu was related to the contamination due to the release of nuclear materials from the nearby military facility.

Analytical results for surface soil samples collected from the 30 Km zone of the Chernobyl reactor showed very high $^{240}Pu/^{239}Pu$ atom ratios of about 0.41 [6]. There were almost no differences in the $^{240}Pu/^{239}Pu$ ratios between the samples analyzed in our study, although the $^{239+240}Pu$ levels varied very widely, i.e. 6.3 - 1430 Bq kg^{-1}, depending on the distances from the reactor and also on the soil layers. The ratio observed in the Chernobyl area was much higher than that attributed to weapons fallout. This high ratio should be related to the high burn-up grade of the reactor fuel. The $^{240}Pu/^{239}Pu$ ratio observed might be used in identifying the distribution of the Chernobyl-derived Pu in the environment.

As already mentioned that the average $^{240}Pu/^{239}Pu$ atom ratio in global fallout was around 0.18; it is interesting to consider which significant sources (nuclear weapons types, etc.) contributed to this ratio. In our previous study [7] on Pu analysis in soil samples from the Marshall Islands, we saw there was a large variation of $^{240}Pu/^{239}Pu$ ratios, depending on the type of devices having tested. For example, samples from Bikini Island (Bikini Atoll) had a high $^{240}Pu/^{239}Pu$ ratio of 0.302-0.306. This Island received direct contamination from the fallout originating from the Castle-BRAVO thermonuclear test (15 Mt) at Namu Island (Bikini Atoll) in March 1954. On the other hand, the very low $^{240}Pu/^{239}Pu$ ratio of 0.065 with a high Pu concentration (1420 Bq kg^{-1}) was observed in a sample from Runit Island (Enewetak Atoll), in which Pu bombs were tested. As mentioned above, one $^{240}Pu/^{239}Pu$ ratio found in Nishiyama/Nagasaki was also very low, 0.037, due to the influence of Pu bomb fallout. If we consider the mixture of Pu isotopes from the above-mentioned two major sources, Pu bombs and thermonuclear bombs, the mean $^{240}Pu/^{239}Pu$ atom ratio might be similar to the average ratio found in global fallout. However, data are still lacking on source specific $^{240}Pu/^{239}Pu$ ratios from different nuclear weapons tests, including thermonuclear tests other than the BRAVO bomb.

The determination of the Pu isotope ratio is important in understanding the source of the nuclide and the ratio can be used as a finger print in the environmental monitoring of Pu.

Acknowledgements

We thank Prof. M. Yamamoto (Kanazawa University) and Dr. Y. Igarashi (Meteorological Research Institute) for their helpful comments and Mr. A. Tanaka (Kaken Co.) and Mrs. H. Murayama (NIRS) for their technical assistance.

REFERENCES

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3. Muramatsu Y., Uchida S., Tagami K., Yoshida S., and Fujikawa T., Determination of plutonium concentration and its isotopic ratio in environmental materials by ICP-MS after separation using ion-exchange and extraction chromatography, *J. Anal At Spectrom.* **14**, 859 (1999).

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5. Krey, P. W., Hardy, E. P., Pachucki, C., Rourke, F., Coluzza, J., and Benson, W. K., Mass isotopic composition of global fall-out plutonium in soil, *Proceedings of a Symposium on Transuranium Nuclides in the Environment*, IAEA-SM-199-39, p671 (1976).
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7. Muramatsu, Y., Hamilton, T., Uchida, S., Tagami, K., and Yoshida, S., Measurement of ^{240}Pu/^{239}Pu isotopic ratios in soils from the Marshall Islands using ICP-MS, *The Science of the Total Environment* **278**, 151 (2001).
8. Komura, K., Sakanoue, M., and Yamamoto, M., Determination of ^{240}Pu/^{239}Pu ratio in environmental samples based on the measurement of Lx/α-ray activity ratio, *Health Phys.* **46**, 1213 (1984).
9. Yamamoto M., Tsumura A., Katayama Y., Tsukatani T., Plutonium isotopic composition in soil from the former semipalatinsk nuclear test site, Radiochimica Acta **72**, 209 (1996).

From: Jones, Cynthia
Sent: Friday, April 01, 2011 1:05 PM
To: Jonathan Medalia
Subject: RE: your phone message on CRS draft document
Attachments: image001.jpg

Pleasure-

Let us know when it goes out and is available to the public-

Cyndi

From: Jonathan Medalia [mailto:JMEDALIA@crs.loc.gov]
Sent: Friday, April 01, 2011 12:01 PM
To: Jones, Cynthia
Subject: RE: your phone message on CRS draft document

I'm updating the report to add an appendix with useful links, and of course have included a couple from NRC. Thanks again for your good work.
Jon

>>> "Jones, Cynthia" <Cynthia.Jones@nrc.gov> 4/1/2011 11:59 AM >>>
Thanks Jon

From: Jonathan Medalia [mailto:JMEDALIA@crs.loc.gov]
Sent: Thursday, March 31, 2011 6:31 PM
To: Jones, Cynthia
Cc: Sun, Casper; LIA06 Hoc; Hoc, PMT12
Subject: Re: your phone message on CRS draft document

Hi Cyndi, Casper, et al.,
Thanks for your comments on my report, Cyndi. I have worked through them and now have the report in good shape. I'll be in touch if I have further questions, but for now I think I'm ok. I've attached the report. You will notice that I acknowledge assistance from NRC, which I greatly appreciate. I will update the report from time to time, so let me know if you have any thoughts, esp. things to add.
Best,
Jon

Jonathan Medalia, Ph.D.
Specialist in Nuclear Weapons Policy
Congressional Research Service
202-707-7632
jmedalia@crs.loc.gov

>>> "Jones, Cynthia" <Cynthia.Jones@nrc.gov> 3/29/2011 3:09 PM >>>
Hi Jonathan-

I have been working in the Ops Center on swing shift the past week and got your phone message regarding the comments that NRC provided on your draft CRS document. I did not see the comments that NRC passed on to you, however, I am ccing the Protective Measures Team Director and Dr. Casper Sun, who was in the PMT that provided the mark-ups on your document.

PMT and/or Casper- Can you please call Jonathan back at 202-707-7632 to go over the comments provided?

Thanks
Cyndi

Cynthia G. Jones, Ph.D.,
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Office of Nuclear Security & Incident Response
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cynthia.jones@nrc.gov
cgj@nrc.sgov.gov
Work: 301-415-0298
Blackberry (b)(6)

The Best Places to Work
IN THE FEDERAL GOVERNMENT

From: Hoc, PMT12
Sent: Tuesday, March 29, 2011 2:00 AM
To: PMT09 Hoc
Subject: FW: Fukuchima Nuclear slides
Attachments: Fukuchima_eng_20110320.pps

From: Wiggins, Jim
Sent: Monday, March 28, 2011 11:40 PM
To: RST01 Hoc; Hoc, PMT12
Cc: FOIA Response.hoc Resource
Subject: FW: Fukuchima Nuclear slides

Fyi...decent graphics.

From: Salley, MarkHenry
Sent: Monday, March 28, 2011 3:53 PM
To: Sheron, Brian; Wiggins, Jim
Subject: FW: Fukuchima Nuclear slides

Areva's take on Fukushima Dai ichi accident

From: Deg Priest [mailto: (b)(6)
Sent: Monday, March 28, 2011 1:41 PM
Subject: FW: Fukuchima Nuclear slides

--- On **Mon, 3/28/11, Khalsa, Ramdhan S** <***Ramdhan@usbr.gov***> wrote:

From: Khalsa, Ramdhan S <Ramdhan@usbr.gov>
Subject: FW: Fukuchima Nuclear slides
To: "Deg Priest" <(b)(6)>, "clay dart" <(b)(6)>
Date: Monday, March 28, 2011, 9:09 AM

Ram Dhan Khalsa, P.E.

U. S. Bureau of Reclamation

Western Colorado Area Office

2764 Compass Drive, Suite 106

Grand Junction, CO 81506

Office:970-248-0653

e-mail: ramdhan@usbr.gov

From: Pleasantp [mailto: (b)(6)]
Sent: Sunday, March 27, 2011 1:08 PM
To: ;
Subject: Fw: Fukuchima Nuclear slides

Here's a somewhat technical explanation of what happened at the Japanese Nuclear powerplant. May be too deep for some -- but it's interesting reading.

These slides came from the Nuclear Safety Monitoring at Lawrence Livermore National Laboratory. They explain how the plant is constructed, what they believe happened and what they don't yet know. Also provided are URL's to websites for more up to date information.

From: Burnell, Scott
Sent: Monday, March 28, 2011 3:33 PM
To: Brian Palmer
Subject: RE: Slate Article Inquiry

Importance: High

Brian;

That's very short notice indeed, but I"ll see what I can find out. Thanks

Scott

From: Brian Palmer [mailto: (b)(6)]
Sent: Monday, March 28, 2011 3:22 PM
To: Burnell, Scott
Subject: Re: Slate Article Inquiry

Like an hour from now. I'm assuming you're not going to make it. My fault for just getting this to you.

I've been told by a number of experts now that the NRC is concerned that a sudden change to metric could create confusion and raise the risk of an accident. I feel reasonably confident that this must be correct. If you find out otherwise, please let me know.

Thanks.

Brian

On Mon, Mar 28, 2011 at 3:19 PM, Burnell, Scott <Scott.Burnell@nrc.gov> wrote:

I have to check with the experts – what's your deadline? Thanks.

From: Brian Palmer [mailto (b)(6)]
Sent: Monday, March 28, 2011 1:30 PM
To: Burnell, Scott
Subject: Slate Article Inquiry

Hi Scott,

I have to bug you with yet another question for my Slate Explainer column, although this one is relatively straightforward (I think).

Why does the NRC make facilities report radiation quantities in old units (curies, rad, and rem) rather than in the new ones (becquerel, gray, and sieverts)?

Any thoughts?

Thanks again.

Brian

Subject:	NARAC / NIT conference call on plausible and realistic modeling scenario
Location:	Call-in number 877-437-1680, pass code (b)(6) #.
Start:	Mon 3/28/2011 3:00 PM
End:	Mon 3/28/2011 3:30 PM
Recurrence:	(none)
Meeting Status:	Accepted
Organizer:	PMT03 Hoc
Required Attendees:	Hoc, PMT12; PMT07 Hoc; PMT09 Hoc

When: Monday, March 28, 2011 3:00 PM-3:30 PM (GMT-05:00) Eastern Time (US & Canada).
Where: Call-in number 877-437-1680, pass code (b)(6) #.

Note: The GMT offset above does not reflect daylight saving time adjustments.

~~*~*~*~*~*~*~*~*

NIT proposing a conference call with NARAC tomorrow (3/28/11) at 3:00pm to discuss gridded deposition output fields from plausible and realistic modeling scenario. NRC requested to participate on Conference Call

Call-in number 877-437-1680, pass code (b)(6) #.

From: Hoc, PMT12
Sent: Monday, March 28, 2011 9:14 AM
To: PMT09 Hoc
Subject: FW: Advisory Team response to FRMAC agricultural products request
Attachments: Top Crops and Status 3-18-11.xlsx; The FRMAC ag response 3-18-2011 (2).docx; Description for the NIT.docx

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From: Oldewage, Hans D [mailto:HDOLDEW@sandia.gov] **On Behalf Of** CMHT
Sent: Tuesday, March 22, 2011 9:21 AM
To: Hoc, PMT12
Subject: FW: Advisory Team response to FRMAC agricultural products request

Brian – the file titled "Description for the NIT.doc" explains the FDA Derived intervention levels (page 1-2) and the milk pathway DRL calculation specifically (page 3-4). The other word document contains the answers to several questions that were posed to the FDA regarding produce/milk/feed/etc.etc. for various locations of interest in the Trans_Pacific runs.

No questions, and therefore no answers are included regarding Wake Island. I know nothing about it, but will see what I can find out before the Melcor trans-pacific memo is done.

Hans

From: Kraus, Terrence D [mailto:tdkraus@sandia.gov]
Sent: Saturday, March 19, 2011 6:32 PM
To: cmht@nnsa.doe.gov
Subject: FW: Advisory Team response to FRMAC agricultural products request

All,

The A-Team has provided some very relevant information in the attachments for our ingestion pathway assessments.

Terry Kraus

From: Jensen, JohnT [mailto:John.Jensen@dm.usda.gov]
Sent: Friday, March 18, 2011 7:45 PM
To: 'cmht@nnsa.doe.gov'
Cc: Kraus, Terrence D; Tupin.Edward@epamail.epa.gov; 'Evans, Lynn (CDC/ONDIEH/NCEH)'; Gordon S Cleveland - APHIS; Pavek, John - Washington, DC -AGLO; 'Noska, Michael A'
Subject: Advisory Team response to FRMAC agricultural products request

The attached files provide agricultural product information for the modeling areas requested by FRMAC today. I will provide any updates or corrections as I get additional information.

Please let me know if you have any questions.

John Jensen
Director

Radiation Safety Division
Office of Homeland Security and Emergency Coordination
Departmental Management
United States Department of Agriculture
5601 Sunnyside Avenue
Beltsville, MD 20705
301-504-2441 (w)
(b)(6) (m)

Explanation of FRMAC's Ingestion Pathway Analysis

The Derived Intervention Levels (DILs) are established by the U.S. Food and Drug Administration (FDA) or are derived using the FDA's methodology. The DIL represents the amount of contamination (e.g., μCi/kg) that is expected to produce a dose equal to the FDA's protective action guide (PAG) for food consumption over a period of one year. The default FDA PAGs are 500 mrem effective (whole body) dose and 5,000 mrem equivalent dose to the most restrictive organ.

The FDA has precalculated the DIL values for the radionuclides listed in Table 4.1-1 (from the FRMAC Assessment Manual. These values must be used when evaluating the radionuclides (and groups of radionuclides) in the table unless an alternate DIL is requested by the Advisory Team or local decision makers. DIL values for radionuclides not listed in table 4.1-1 are calculated using the steps in FRMAC Assessment Method Method 4.1.2.

I-131 and Cs-137 are listed in Table 4.1-1, and therefore, FRMAC did not calculated DIL values for these radionuclides.

Table 4.1-1 FDA-Listed Ingestion DILs (FDA 1998)

Radionuclide Group	FDA DIL[a] (Bq/kg_{wet})	FDA DIL[a] ($\mu Ci/kg_{wet}$)
Principal Nuclides		
^{90}Sr	160	4.3E-03
^{131}I	170	4.6E-03
$^{134}Cs + ^{137}Cs$	1200	3.2E-02
^{134}Cs	930	2.5E-02
^{137}Cs	1360	3.7E-02
$^{238}Pu + ^{239}Pu + ^{241}Am$	2	5.4E-05
^{238}Pu	2.5	6.8E-05
^{239}Pu	2.2	6.0E-05
^{241}Am	2	5.4E-05
$^{103}Ru + ^{106}Ru$	$(^{103}Ru/6800) + (^{106}Ru/450) < 1$	$(^{103}Ru/0.18) + (^{106}Ru/1.2E\text{-}02) < 1$
^{103}Ru	6800	0.18
^{106}Ru	450	1.2E-02
Other Nuclides		
^{89}Sr	1400	3.8E-02
^{91}Y	1200	3.2E-02
^{95}Zr	4000	0.11
^{95}Nb	12000	0.32
^{132}Te	4400	0.12
^{129}I	56	1.5E-03
^{133}I	7000	0.19
^{140}Ba	6900	0.19
^{141}Ce	7200	0.19
^{144}Ce	500	1.4E-02

^{237}Np	4	1.1E-04
^{239}Np	28000	0.76
^{241}Pu	120	3.2E-03
^{242}Cm	19	5.1E-04
^{244}Cm	2	5.4E-05

[a] A food sample is considered to exceed the DIL if it meets or exceeds the DIL for any individual nuclide. Analysis results are not summed across nuclides except the combinations specifically stated (i.e., ^{134}Cs + ^{137}Cs, ^{238}Pu + ^{239}Pu + ^{241}Am, and ^{103}Ru + ^{106}Ru).

The Ingestion DRL (Ing_DRL) represents the amount of contamination on food or forage that is projected to result in the food to grown in the contaminated area to equal the FDA's contamination limits (DIL). The example below shows how the Milk_DRL is calculated. The calculation

Method 4.3.1 Ingestion DRL for Milk based on areal activity (µCi/m^2) on forage

This method calculates the areal activity level (µCi/m^2) of a radionuclide deposited over a grazing area that would result in a grazing animal's milk exceeding the DIL for the radionuclide.

Calculation

Equation 4.3-1 shows this $Milk\_DRL_{area}$ calculation.

$$Milk\_DRL_{area,A,i} = \frac{DIL_{organ,age,i} * \rho_{milk}}{\left[\frac{(CRF * AFDIR)}{Y} + \frac{ASDIR}{\rho_{soil} * d_m}\right] * FDC_F * TF_{Milk,A,i} * e^{-\lambda_i t_m}} \quad \text{(Eq. 4.3-1)}$$

$$\frac{\mu Ci}{m^2} = \frac{\frac{\mu Ci}{kg_{wet}} * \frac{kg_{wet}}{l}}{\left[\frac{\left(unitless * \frac{kg_{wet}}{d}\right)}{\frac{kg_{wet}}{m^2}} + \frac{\frac{kg_{soil}}{d}}{\frac{kg_{soil}}{m^3} * m}\right] * unitless * \frac{\mu Ci/l}{\mu Ci/d} * unitless}$$

where:

$Milk\_DRL_{area,A,i}$ = Ingestion Derived Response Level for Milk, the ground concentration, or areal activity, of radionuclide *i* that will be expected to cause the milk produced by grazing animals (*A*) to exceed the Derived Intervention Level (DIL) for that radionuclide, µCi/m^2;

$DIL_{organ, age, i}$ = Derived Intervention Level, the activity concentration level of radionuclide *i* at which the ingestion dose to the most sensitive population (age group) and target organ has the potential to exceed the applicable ingestion PAG, µCi/kg$_{wet}$;

ρ_{milk} = Milk density (default 1.04), kg$_{wet}$/l;

CRF = Crop Retention Factor, the fraction of deposited material that is retained by the edible portion of the crop (1.0 for iodine, 0.5 for other radionuclides), unitless;

$AFDIR$ = Animal Feed Daily Ingestion Rate, the daily rate at which an animal consumes feed (default 50), kg$_{wet}$/d;

Y = Crop Yield, the mass of crop grown per area of land, (default 0.7); kg$_{wet}$/m^2

$ASDIR$ = Animal Soil Daily Ingestion Rate, the daily rate at which an animal consumes soil (default 0.5), kg$_{soil}$/d;

ρ_{soil} = Soil density (default 1600), kg$_{soil}$/m^3;

d_m = Mixing Depth (default 1.0E-03), m;

FDC_F = Fraction of Diet Contaminated (feed), the fraction of the animal's diet that is from contaminated feed (default 1.0), unitless;

NOTE: If there is convincing local information that the actual *FDC* is considerably different, local authorities may decide to use a different *FDC*.

$TF_{Milk,A,i}$ = Transfer Factor for Milk, the fraction of radionuclide *i* consumed by an animal (*A*) that is transferred to the milk produced by the animal, μCi/l per μCi/d;

λ_i = Decay constant for the radionuclide *i*, d^{-1};

t_m = Time to Market, the number of days from harvest to consumption (default 2), d; and

$e^{-\lambda_i t_m}$ = Radioactive Decay adjustment for radionuclide *i* over time t_m, unitless.

EXAMPLE 1

Problem: Calculate the Cow Milk Ingestion DRL for ^{60}Co in units of areal activity (μCi/m^2)

The most conservative DIL for ^{60}Co is 0.02 μCi/kg$_{wet}$ (3 month old, whole body).

Equation 4.3-1 can be used to calculate the DRL.

$$Milk\_DRL_{area,A,i} = \frac{DIL_{organ,age,i} * \rho_{milk}}{\left[\frac{(CRF * AFDIR)}{Y} + \frac{ASDIR}{\rho_{soil} * d_m}\right] * FDC_F * TF_{Milk,A,i} * e^{-\lambda_i t_m}}$$

Assuming:

ρ_{milk} = 1.0 kg$_{wet}$/l,
CRF = 1.0 for iodine,
$AFDIR_{cow}$ = 50 kg$_{wet}$/d,
Y = 0.7 kg$_{wet}$/m^2,
$ASDIR_{cow}$ = 0.5 kg$_{soil}$/d,
ρ_{soil} = 1600 kg$_{soil}$/m^3,
d_m = 1.0E-03 m,
FDC_F = 1.0,
$TF_{Milk,cow,60Co}$ = 9E-3 μCi/l per μCi/d for I-131,
λ_{I-131} = 8.62E-2 d^{-1}, and
t_m = 2 days.

The $Milk\_DRL_{area}$ for ^{60}Co for cow milk equals:

$$Milk\_DRL_{area,cow,^{60}Co} = \frac{0.02\frac{\mu Ci}{kg_{wet}} * 1.0\frac{kg_{wet}}{l}}{\left[\left(\frac{0.5 * 50\frac{kg_{wet}}{d}}{0.7\frac{kg_{wet}}{m^2}}\right) + \frac{0.5\frac{kg_{soil}}{d}}{1600\frac{kg_{soil}}{m^3} * 1.0E\text{-}03\ m}\right] * 1 * 3.0E\text{-}04\frac{\mu Ci/l}{\mu Ci/d} * e^{-3.6E\text{-}04 d^{-1} * 2d}} = 1.85\frac{\mu Ci}{m^2}$$

Therefore cows grazing in areas with ^{60}Co contamination on the ground greater than 1.85 μCi/m^2 have the potential to produce milk that would exceed the DIL. Milk that exceeds the DIL could produce a dose that exceeds the PAG when consumed by a 3 month old.

The FRMAC's CMHT is evaluating the ingestion pathway for areas that may be impacted by the plume from the Fukushima Reactor Facility. The regions that we are interested in are:
Southern Alaska

- Hawaii
- Midway Island
- Northern California
- Southern California
- Oregon, and
- Washington State

In order to accurately evaluate the crops/foods that may become contaminated and enter the human food chain we need to know the following information for each of the areas listed above.

MILK PATHWAY:
Are dairy cows in the area which supply milk?
Are the cows feeding on pasture grass, and if so, what percent of their diet is the pasture grass.

CROPS AND PRODUCE PATHWWAY:
Are produce crops grown in the area?
Are any crops mature and ready to be harvested.
If crops are in the field and are not mature and ready for harvest, how long are they expected to continue to grow before they are ready to be harvested?

MEAT PATHWAY:
Are meat-producing animals (e.g., beef cattle, and more importantly daily or weekly % of spent dairy cattle) raised in the area that are intended to be a source of meat.
If meat-producing animals are grown in the area, how long will they continue to mature before they will be harvested.
What fraction of the meat-producing animal's diet is comprised of pasture grass?

From John P. Huntley AVIC WA and HI

Gordon S Cleveland/MD/APHIS/USDA

03/18/2011 08:49 AM

To Gary L Brickler/CA/APHIS/USDA@USDA, John P Huntley/WA/APHIS/USDA@USDA, Don E Herriott/OR/APHIS/USDA@USDA

cc Brad R LeaMaster/OR/APHIS/USDA@USDA, Bethany O'Brien/CO/APHIS/USDA@USDA, Scott A Beutelschies/CA/APHIS/USDA@USDA, Marianne B Febach/WA/APHIS/USDA@USDA, Todd L Smith/CA/APHIS/USDA@USDA, Burke L Healey/CO/APHIS/USDA@USDA, Jose R Diez/MD/APHIS/USDA@USDA, Mark E Teachman/MD/APHIS/USDA@USDA, john.jensen@da.usda.gov, Larry C Rawson/HI/APHIS/USDA@USDA, Mark L Davidson/CO/APHIS/USDA@USDA, Andrew R Wilds/MD/APHIS/USDA@USDA, Tyler H McAlpin/MD/APHIS/USDA@USDA

Subject Request for information by Dept. of Energy FRMAC

Greetings All,

As a member of the Radiological Advisory Team for Environment Food and Health, USDA works closely with the radiological subject matter experts at the DOE Federal Radiological Monitoring and Assessment Center to provide them agricultural information that helps calculate potential risk of contamination to the food chain. We have been sent a series of questions by the FRMAC Consequence Management Home Team and have been asked to reach out to all appropriate APHIS/PPQ/State resources to try to fill in some of the blanks before a potential plume reaches the US today or tomorrow. Please ask everyone to continue to update even past that time as the more information we have the better the FRMAC can inform the Advisory Team so they can make Protective Action Recommendations to Federal, State, local and tribal responders. Any help you can provide involving your state counterparts and in general, pushing this forward, would be greatly appreciated by all. This is a great opportunity for USDA (and Veterinary Services in particular) to come to the table in real time of need. For once, ***THIS IS NOT AN EXERCISE***

Thanks, and best regards,

Gordon

Gordon S. Cleveland
Radiological Program Analyst
Advisory Team for Environment Food and Health
USDA/APHIS VS NCAHEM
4700 River Rd. Unit 41
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CL (b)(6)

Obviously some of these questions are unanswerable in any detail. Please use your experiential calculus to give the best SWAG you can. The Dairy issues, including 'spent' dairy cows to slaughter, are of the highest priority.

The FRMAC's CMHT is evaluating the ingestion pathway for areas that may be impacted by the plume from the Fukushima Reactor Facility. The regions that we are interested in are:

Southern Alaska

- Hawaii
- Midway Island
- Northern California
- Southern California
- Oregon, and
- Washington State

General information RE: dairy cow culls to slaughter: Industry average is 36% per year or 0.69% per week.

Washington State

In order to accurately evaluate the crops/foods that may become contaminated and enter the human food chain we need to know the following information for each of the areas listed above.

MILK PATHWAY:

Are dairy cows in the area which supply milk? WA Yes. HI Yes

Are the cows feeding on pasture grass, and if so, what percent of their diet is the pasture grass. WA Yes. HI Yes. 50% of diet is grasses. Grasses not consumed on pasture. Stored grasses fed.

CROPS AND PRODUCE PATHWWAY:

Are produce crops grown in the area? WA Yes. HI Yes

Are any crops mature and ready to be harvested. WA No. HI Yes

If crops are in the field and are not mature and ready for harvest, how long are they expected to continue to grow before they are ready to be harvested? WA 3 months, HI: Currently harvesting

MEAT PATHWAY:

Are meat-producing animals (e.g., beef cattle) raised in the area that are intended to be a source of meat. WA Yes. HI Yes

If meat-producing animals are grown in the area, how long will they continue to mature before they will be harvested. WA and HI. This is a continuous production cycle. Animals are harvested throughout the year.

What fraction of the meat-producing animal's diet is comprised of pasture grass? 50%. Varies depending on production stage of animal.

HAWAII

MILK PATHWAY:

Are dairy cows in the area which supply milk? Yes.

Are the cows feeding on pasture grass, and if so, what percent of their diet is the pasture grass. Yes, the cows feed on grass; 100% with the exception of supplemental feed for periods of drought. One dairy produces corn silage on-site to feed its cows, in addition to grass feed. The county with dairy production is currently experiencing drought conditions.

CROPS AND PRODUCE PATHWWAY:
Are produce crops grown in the area? Yes.
Are any crops mature and ready to be harvested. Yes. Year-round production and harvest.
If crops are in the field and are not mature and ready for harvest, how long are they expected to continue to grow before they are ready to be harvested? Year-round production and harvest.

MEAT PATHWAY:
Are meat-producing animals (e.g., beef cattle) raised in the area that are intended to be a source of meat. Yes.
If meat-producing animals are grown in the area, how long will they continue to mature before they will be harvested. Year-round production and harvest.
What fraction of the meat-producing animal's diet is comprised of pasture grass? 100% with the exception of supplemental feed for periods of drought, with two counties experiencing drought conditions now.

MIDWAY ISLAND – No production of any kind is carried out.

OREGON AREA RESPONSE--18MAR11

MILK PATHWAY:

Are dairy cows in the area which supplies milk?

YES. Oregon state dairy cow inventory total: 114,000

Are the cows feeding on pasture grass, and if so, what percent of their diet is the pasture grass.

YES. Approximately 50% graze pasture at some point in the production cycle.

CROPS AND PRODUCE PATHWWAY:

Are produce crops grown in the area?

YES

Are any crops mature and ready to be harvested?

YES. Mainly greenhouse grown tomatoes and lettuce/greens at this time.

If crops are in the field and are not mature and ready for harvest, how long are they expected to continue to grow before they are ready to be harvested?

Spring produce: Harvest begins in April

Produce and vegetables: May-October

Grass hay: Late June-July

Grass seed: Late June

Alfalfa: First cutting in June

Oats, wheat, barley: Late July-August

Sweet Corn: August-September

Corn silage: September-October

Cherries: June

Strawberries: May-June

Raspberry, blueberry, marionberry, blackberry: June-August

Orchard Fruit (apple, peach, pear): August-September

Grapes (wine industry): September-October

<u>MEAT PATHWAY:</u>

Are meat-producing animals (e.g., beef cattle) raised in the areas that are intended to be a source of meat?

YES. Oregon state beef cow inventory total: 546,000

If meat-producing animals are grown in the area, how long will they continue to mature before they will be harvested?

Mother cows spend almost their entire lives on pasture or being fed hay in winter.

Market animals are commonly grazed until the last 50-60 days where they are finished in a feedlot.

Cull dairy cows commonly go directly to slaughter.

What fraction of the meat-producing animal's diet is comprised of pasture grass?

About 90%

What percentage of 'spent' dairy cattle go to slaughter on a daily or weekly basis?

About 0.5-1% on a weekly basis.

Miscellaneous information for Oregon:

Free Range Chickens. Both for meat and egg production. Grazing makes up a significant part (probably 50-60%) of their diet. Inventory is about 10,000

Total Sheep and lambs. 225,000. Grazing (and hay) makes up about 90-95% of breeding ewes. Market lambs are harvested in September.

Hogs and pigs. 17,000 Not many hogs in OR. Very few on grass.

Honey bees. 100% grazing. 55,000 colonies; 1,870,000 lbs of honey/yr.

California

CROPS AND PRODUCE PATHWWAY:
Are produce crops grown in the area? Yes.
Are any crops mature and ready to be harvested. Yes. Year-round production and harvest.
If crops are in the field and are not mature and ready for harvest, how long are they expected to continue to grow before they are ready to be harvested? Year-round production and harvest.

ALASKA

There are 5 remaining commercial herds in AK. Due to the nature of the climate, stored feed is fed most of the year. Some of the smaller herds turn cows out for grazing during the summer months, but still the major portion of feed is stored and probably purchased from Canada.

MILK PATHWAY:

Are dairy cows in the area which supply milk? Yes. 5 herds.
Are the cows feeding on pasture grass, and if so, what percent of their diet is the pasture grass.
Perhaps 20% pasture grass in summer, stored feed and forage in winter.

CROPS AND PRODUCE PATHWWAY:

Are produce crops grown in the area? Very limited.
Are any crops mature and ready to be harvested. Not at this time of year.
If crops are in the field and are not mature and ready for harvest, how long are they expected to continue to grow before they are ready to be harvested? Grass can be cut in July. Other forage crops in August at earliest.

MEAT PATHWAY:

Are meat-producing animals (e.g., beef cattle) raised in the area that are intended to be a source of meat. Yes. Limited numbers.
If meat-producing animals are grown in the area, how long will they continue to mature before they will be harvested. Beef animals harvested year round. Peak harvest in late summer and fall.
What fraction of the meat-producing animal's diet is comprised of pasture grass? Estimate of 20%

State Name	Crop Name	Estimated amount of crop	Planting timeframe	Harvest timeframe
Alaska	grass hay	20,000 acres	perennial crop	June-September
Alaska	Barley	5,000 acres	Mid-May to mid-June	August/September
Alaska	Oats	2,000 acres	Mid-May to mid-June	August/September
Alaska	potatoes	1,000 acres	May	September
Alaska	Other Vegetables	500 acres	April/May	June/July/August/September
California	Milk and Cream	39,512,000,000 lbs	year round	year round
California	Grapes	789,000 acres	n/a	Fall
California	Nursery and Greenhouse prod	$2,848,500,000 value in 2009	continuous	continuous
California	Almonds	720,000 acres	n/a	August to October
California	Cattle and Calves	2,515,930,000 lbs	continuous	continuous
California	Lettuce	217,500 acres	continuous	continuous
California	Hay	1,520,000 acres	Fall and Spring	March through October
California	Strawberries	398,000 acres	usually a two year crop	February to November
California	Tomotoes	344,000 acres	March - June	May - December
California	Rice	556,000 acres	April - June	September - November
Hawaii	Seed Crops	6,000 acres	Year Round	Year Round
Hawaii	Sugar Cane	39,300 acres	Year Round	Year Round
Hawaii	Coffee	7,800 acres	Year Round	November - March
Hawaii	Cattle	1 million acres	Year Round	Year Round
Hawaii	Macadamia Nuts	17,000 acres	Year Round	July - April
Hawaii	Tropical Fruit	19,100 acres	Year Round	Year Round
Hawaii	Vegetables	4,500 acres	Year Round	Year Round
Oregon	Alfalfa hay and grass hay	1,030,000 acres	perennial	May - October
Oregon	small grains	931,000 acres	September - June	July - September
Oregon	Alfalfa and grass seed	472,665 acres	perennial	July - August
Oregon	corn	60,000 acres	May - June	August - November
Oregon	Potatoes	37,000 acres	May - June	September - October
Oregon	Hazelnuts	28,700 acres	perennial	October - November
Oregon	Sweet Corn	24,000 acres	May - June	September
Oregon	Mint	22,900 acres	perennial	September
Oregon	onions, storage	20,300 acres	April - May	October
Oregon	Snap beans	19,000 acres	May - June	August - September
Washington	Apples	150,000 acres	Perenial	August - October

State Name	Crop Name	Estimated amount of crop	Planting timeframe	Harvest timeframe
Washington	Wheat	2,100,000 acres	September - May	July - October
Washington	Potatoes	160,000 acres	May - June	September - October
Washington	Hay All Types	800,000 acres	Perennial	June - October
Washington	Nursery / GreenHouse	8,000 acres	Continous	Continous
Washington	Cherries	75,000 acres	Perennial	July - August
Washington	Pears	50,000 acres	Perinnial	August - October
Washington	Grapes	75,000 acres	Perinnial	Autust - November
Washington	HOPS	50,000 acres	perinnial	August - October
Washington	Corn	200,000 acres	May - July	September - November

From: Brandon, Lou
Sent: Monday, March 28, 2011 4:23 AM
To: Jackson, Todd; Miller, Marie; Hoc, PMT12
Cc: PMT09 Hoc
Subject: FW: Speedi Plots

All, FYI.

From: Brandon, Lou
Sent: Saturday, March 26, 2011 7:16 AM
To: Dorman, Dan
Cc: PMT02 Hoc; PMTERDS Hoc
Subject: Speedi Plots

Dan,

I've been attempting to interpret the Speedi Plots, to help address your question. The plots come in three forms, a wind flow chart valid for one hour, an air emersion dose rate, and an iodine concentration. The activity released appears to be 1 Bq in one hour.

The Iodine Concentration in air plot appears to start with a maximum concentration of 6.76 x 10^{-10} Bq/m3 which seems to be 1 Bq dispersed through a hemisphere, of 1 km radius. The plot then highlights 5 contours of decreasing concentrations from 5 x 10^{-10} Bq/m3 to 5 x 10^{-12} Bq/m3. In essence the plot is like a smoke plot. If we were to artificially construct a RASCAL run with the same meteorological data (wind direction and speed for 1 hr) and set up some reasonable source term, then we could scale the Speedi plot to obtain a concentration downwind and compare. In Speedi, the concentration drops off by a factor of 5 from 9 km to 15 km. Setting up a similar met situation in RASCAL (F stability), we see the iodine concentration drops off from 1.5 E6 Bq/m3 at 11km to about 6.7 Bq/m3 at 16 km, roughly maybe a factor of 2.5 over the same distances. That's the kind of analysis we can do.

The Air Emersion Dose Rate plot works similarly, where the maximum dose rates starts at 2.835 E-15 uGy/h. I can't quite see how that number is arrived at, but it must be related to a Bq to dose rate conversion. The radionuclide is translated as rare gas (noble gas?) but a specific radionuclide is not identified. The dose rate drops off by a factor of 5 from about 6 km to 13 km. In RASCAL, the cloud shine drops off from 5.4 E-3 Sv/h at 4.8 km to 2.9 E-3 Sv/h at 11.3 km, roughly less than a factor of 2 over a doubling of the distance.

With the release of RASCAL 4.1, and it's new atmospheric dispersion model, we would expect greater dispersion than in the old model. With these initial comparisons, it would appear that the Speedi model has greater dispersion. My RASCAL run used one windspeed in one direction. In the Speedi runs, particularly the far reaching air immersion plot, turbulence is quite evident in the higher resolution model, so I think the greater dispersion is as expected.

This example just uses one set of Speedi data and a hypothetical RASCAL run. We're limited to how we can compare and contrast, but this case will hopefully give you perspective on what is possible and how one case compares.

Lou

From: Jones, Cynthia
Sent: Wednesday, April 20, 2011 10:12 AM
To: Hoc, PMT12; Zimmerman, Roy
Subject: FW: EPA comments on DRAFT Reentry guidance - think I found it.
Attachments: 3 27 11 Re-Entry Guidance EPA Final.docx; @3 27 11 Re-Entry Guidance EPA Final.docx

Roy, Kim-

I think I found the document you are calling "Grab-n-go" now. See notes below and attached. It was to allow for retrieval of personal property. Not for permanent reentry. This is what Julie Bentz is referring to….

Cyndi

From: PMT02 Hoc
Sent: Sunday, March 27, 2011 10:25 PM
To: Hoc, PMT12; PMT09 Hoc; Jones, Cynthia
Subject: FW: EPA comments on DRAFT Reentry guidance

RAAD comments on Re-entry draft listed in "@3 27 11 Re-Entry Guidance File.docx"

Ed Roach-Dose Assessor Analyst -3/27/11 @2125

From: PMT11 Hoc
Sent: Sunday, March 27, 2011 9:29 PM
To: PMT02 Hoc
Subject: FW: EPA comments on DRAFT Reentry guidance

Dear Ed,

Appending are draft copies of re-Entry guide. The file name of @3xxx is my commented copy.
Please review my input and take what do you think is right.

Thanks,
Casper

From: Veal.Lee@epamail.epa.gov [mailto:Veal.Lee@epamail.epa.gov]
Sent: Sunday, March 27, 2011 7:59 PM
To: (b)(6)
Cc: Jones, Cynthia; Dietrich.Debbie@epamail.epa.gov; Tupin.Edward@epamail.epa.gov; Eoc.Epahq@epamail.epa.gov; NITOPS@nnsa.doe.gov; PMT09 Hoc; Hoc, PMT12; task-force1@state.gov; EOC_Environmental_Unit@epamail.epa.gov
Subject: EPA comments on DRAFT Reentry guidance

Julie and Cyndi,

Please find our agency comments on the Draft Re-entry Guidance. These have been cleared through our senior leadership. (b)(5) (b)(5).

We hope that you find this to be helpful. Please contact us in the EOC_EnvironmentalUnit@epa.gov mailbox or by phone at 202-564-3850 if you require any further clarification.

Thank you for reaching out on this important guidance.

Lee

Lee B. Veal
Director, Center for Radiological Emergency Management
Radiation Protection Division
Office of Radiation and Indoor Air
Environmental Protection Agency
1310 L Street, NW
Washington DC, 20005
Mail Code: 6608J
202-343-9448
cell (b)(6)

-----"Bentz, Julie A." (b)(6) wrote: -----

To: "'PMT09.Hoc@nrc.gov'" <PMT09.Hoc@nrc.gov>, "Hoc, PMT12" <PMT12.Hoc@nrc.gov>, Epahq Eoc/DC/USEPA/US@EPA, NITOPS <NITOPS@nnsa.doe.gov>, "'task-force1@state.gov'" <task-force1@state.gov>
From: "Bentz, Julie A." (b)(6)
Date: 03/26/2011 09:42AM
Cc: Debbie Dietrich/DC/USEPA/US@EPA, Edward Tupin/DC/USEPA/US@EPA, Lee Veal/DC/USEPA/US@EPA, "Cyndi Jones (Cynthia.Jones@nrc.gov)" <Cynthia.Jones@nrc.gov>
Subject: FW: Request for interagency comments on DRAFT Reentry guidance

Cyndi,

I'd recommend that Lee Veal (EPA) who is leading the interagency reentry working group, be your POC. She can help coordinate this guidance with the appropriate people. I've cc'd her and a couple of others from EPA for quick turn around on this document (with a heads up to EPA, DOS and DOE ops center that coordination will be happening today).

Julie

From: PMT09 Hoc [mailto:PMT09.Hoc@nrc.gov]
Sent: Friday, March 25, 2011 9:47 PM
To: Bentz, Julie A.
Cc: Hoc, PMT12
Subject: Request for interagency comments on DRAFT Reentry guidance

Julie-

Attached please find our request for interagency comments on DRAFT Reentry guidance. We would like to send out to the pertinent interagency staff to get their comments on this draft by Sunday night.

My Q to you is: Would you like to coordinate the comments for USG agencies, or would you like us to coordinate ? If you would like us to coordinate, can you please let me know who should receive at DOS, EPA & DOE? And then I'll send out straight away

Thanks a bunch!

Cyndi Jones

PMT Director, NRC Ops Center

[attachment "2011 03 25 Reentry guidance.doc" removed by Lee Veal/DC/USEPA/US]

3/25/11 Draft for Comment
Reentry Guidance

(b)(5)

C:\FoiaProject\FoiaPDFExport\PSTs\PMT09_HOC\Emails\00259\00002.doc

(b)(5)

3/25/11 Draft for Comment
Reentry Guidance

(b)(5)

C:\FoiaProject\FoiaPDFExport\PSTs\PMT09_HOC\Emails\00259\00002.doc

3/27/11 Draft for Comment
Reentry Guidance

(b)(5)

(b)(5)

3/27/11 Draft for Comment
Reentry Guidance

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3/27/11 Draft for Comment
Reentry Guidance

(b)(5)

3/27/11 Draft for Comment
Reentry Guidance

(b)(5)

(b)(5)

From: PMT02 Hoc
Sent: Sunday, March 27, 2011 9:54 PM
To: Steve LaVie
Cc: PMT11 Hoc
Subject: RE: Please pass to PMT RAAD or assessors

I or Casper will take a look.
ED

From: Steve LaVie [mailto:(b)(6)]
Sent: Sunday, March 27, 2011 9:21 PM
To: Hoc, PMT12; PMT02 Hoc; PMT09 Hoc
Subject: Please pass to PMT RAAD or assessors

In a quiet moment tonight, I was thinking about the shift last night, and I now suspect that the skin dose spreadsheet I prepared has an error that wasn't caught in peer checking. I believe that my conversion of Bq/cc to Bq/M^3 was off by a factor of 10^6--I recall multiplying by only 1000 when it should have been 10^9

This may have already caught and corrected. I think the sheet is on the M drive as skin dose calculation.XLSX.

From: PMT07 Hoc
Sent: Sunday, March 27, 2011 9:25 PM
To: Hoc, PMT12
Subject: FW: Update of forecast wind conditions for Fukushima Daiichi 1
Attachments: WRF_Fukushima_NPP_Forecast_2011-03-27_18Z (5km).xlsx

FYI

-----Original Message-----
From: PMT02 Hoc
Sent: Sunday, March 27, 2011 9:18 PM
To: PMT09 Hoc; PMT07 Hoc
Cc: PMT11 Hoc
Subject: FW: Update of forecast wind conditions for Fukushima Daiichi 1

-----Original Message-----
From: Simpson, Matthew D. [mailto:simpson35@llnl.gov]
Sent: Sunday, March 27, 2011 8:14 PM
To: HOO Hoc; PMT02 Hoc; PMT01 Hoc; CMHT@nnsa.doe.gov; nitops@nnsa.doe.gov; alan.remick@nnsa.doe.gov; 'McMichael, Lukas C CIV SEA 08 NR'; na30ecc@nr.doe.gov; (b)(6)
Cc: narac@llnl.gov
Subject: Update of forecast wind conditions for Fukushima Daiichi 1

A spreadsheet is attached containing the latest forecast wind conditions at the Fukushima Power Plant.

The forecast time series is derived from the latest NARAC WRF simulation with 5 km horizontal grid spacing.

NOTE: Onshore winds during forecast period.

Fukushima Power Plant Forecast Summary:

28 March 01:00 Z to 28 March 08:00 Z: Southeasterly (onshore) winds around 3 - 4 m/s.

28 March 08:00 Z to 29 March 07:00 Z: Highly variable wind directions with onshore flow possible, wind speeds from 1 - 5 m/s.

29 March 07:00 Z to end of forecast period: Westerly winds around 5 - 7 m/s.

Matthew Simpson
NARAC Atmospheric Scientist

===

Forecast Model: WRF
Horizontal Grid Spacing: 5 km
Vertical Levels: 44
Forecast Location: Fukushima NPP, Japan
Data Produced by Matthew Simpson (NARAC, 925 / 422-7627)

YEAR	MO	DY	HR	WSP	WDR	CLASS	Temp (2m)	RAIN
----	--	--	(UTC)	(m/s)	---	----	(C)	(in/hr)
2011	3	28	1	4.1	140	C	6	0
2011	3	28	2	4.5	140	C	6	0
2011	3	28	3	3.9	138	C	7	0
2011	3	28	4	4.1	140	C	7	0
2011	3	28	5	4.3	129	C	7	0
2011	3	28	6	4.1	142	C	7	0
2011	3	28	7	4	152	C	6	0
2011	3	28	8	3.7	164	D	5	0
2011	3	28	9	3	196	F	3	0
2011	3	28	10	3.9	262	E	1	0
2011	3	28	11	4.8	278	E	1	0
2011	3	28	12	5	278	E	1	0
2011	3	28	13	5.3	277	E	1	0
2011	3	28	14	6.3	272	D	2	0
2011	3	28	15	6.3	271	D	2	0
2011	3	28	16	3.5	274	F	0	0
2011	3	28	17	1.8	359	F	1	0
2011	3	28	18	0.3	345	F	1	0
2011	3	28	19	1.8	165	F	1	0
2011	3	28	20	2.7	198	F	2	0
2011	3	28	21	2.6	219	F	2	0
2011	3	28	22	1.5	235	C	5	0
2011	3	28	23	1	24	B	7	0
2011	3	29	0	1.8	193	C	8	0
2011	3	29	1	1.7	192	C	10	0
2011	3	29	2	2.3	260	C	11	0
2011	3	29	3	4.7	293	C	12	0
2011	3	29	4	4.8	296	C	12	0
2011	3	29	5	3.5	317	C	12	0
2011	3	29	6	0.2	198	C	11	0
2011	3	29	7	3	255	D	11	0
2011	3	29	8	3.3	254	E	9	0
2011	3	29	9	4.2	261	E	6	0
2011	3	29	10	5.6	257	D	5	0
2011	3	29	11	5.6	266	D	5	0
2011	3	29	12	5.3	268	D	4	0
2011	3	29	13	5.9	271	D	4	0
2011	3	29	14	6.8	266	D	4	0

2011	3	29	15	7.1	266	D	4	0
2011	3	29	16	7.7	266	D	4	0
2011	3	29	17	7.5	271	D	4	0
2011	3	29	18	8.3	271	D	4	0

From: PMT09 Hoc
Sent: Sunday, March 27, 2011 9:03 PM
To: Batkin, Joshua
Subject: Major Dose Assessment Matrix
Attachments: Major dose assessment matrix.xlsx

Good Evening,

This document (updated Major Dose Assessment Matrix) was requested by the Commission TA at the latest ET meeting. If possible, could you please distribute this to interested parties? Please contact me if you have any questions.

Leroy Hardin
Radiological Assessment Assistant Director
Protective Measures Team
U.S. Nuclear Regulatory Commission

Fuel Melt (FM) and containment release (%/Day) assumed

From:	PMT09 Hoc
Sent:	Sunday, March 27, 2011 9:01 PM
To:	PMT07 Hoc
Subject:	Dose Assessment Matrix
Attachments:	Major dose assessment matrix.xlsx

Fuel Melt (FM) and containment release (%/Day) assumed

From: Jones, Cynthia
Sent: Sunday, March 27, 2011 10:30 PM
To: Hoc, PMT12
Subject: RE: re-entry guide- suggest you do the following

hi Tim-

We got some comments form Japan NR Team last night (Sandi documented). whatever you incorporate is fine with me-

Did we get comments from OSTP & DOE ? Suggest we ask, if we haven't heard from them...

Cyndi

Cynthia G. Jones, Ph.D.
Senior Technical Advisor for Nuclear Security Office of Nuclear Security & Incident Response U.S. Nuclear Regulatory Commission Mail Stop T4-D22A Washington, DC 20555
O: (301) 415-0298
C: (b)(6)

From: Hoc, PMT12
Sent: Sunday, March 27, 2011 10:18 PM
To: Jones, Cynthia
Cc: Hoc, PMT12
Subject: RE: re-entry guide- suggest you do the following

Cyndi,

Some PMT staff have additional comments. Would you be available to look at these comments (tomorrow) before moving to ET - or are you OK with us moving forward without your review?

I haven't seen any comments other than EPA's. Were we expecting additional commentors? Was there a comments due by date?

Tim

-----Original Message-----
From: Jones, Cynthia
Sent: Sunday, March 27, 2011 10:14 PM
To: Hoc, PMT12
Subject: RE: re-entry guide- suggest you do the following

Hi there-

Gather the comments from the interagency (incl Japan) and "finalize" the document, telling the ET that the document is ready for the interagency if needed. Also cc COL Julie Bentz at the white house NSS (her email is on the PMT12) making her aware of the comments compiled on the document and the NRC Japan team.

Cyndi

From: Hoc, PMT12
Sent: Sunday, March 27, 2011 8:41 PM
To: Jones, Cynthia
Cc: Hoc, PMT12; PMT07 Hoc; PMT02 Hoc; PMT09 Hoc
Subject: re-entry guide

Cyndi,

We got the EPA's comments. They look minor.

What are the next steps for the PMT?

Tim

From: PMT09 Hoc
Sent: Sunday, March 27, 2011 8:35 PM
To: Batkin, Joshua
Subject: Major Dose Assessment Matrix
Attachments: Major dose assessment matrix.xlsx

Good Evening,

Per your request, the updated Major Dose Assessment Matrix is attached. Please contact me if you have any questions.

Leroy Hardin
Radiological Assessment Assistant Director
Protective Measures Team
U.S. Nuclear Regulatory Commission

Tracking:

Recipient	Recall
Batkin, Joshua	Succeeded: 3/27/2011 9:01 PM

Fuel Melt (FM) and containment release (%/Day) assumed

From: PMT09 Hoc
Sent: Sunday, March 27, 2011 8:30 PM
To: PMT11 Hoc; PMT02 Hoc
Attachments: Re: EPA comments on DRAFT Reentry guidance; EPA comments on DRAFT Reentry guidance

From:	PMT09 Hoc
Sent:	Sunday, March 27, 2011 7:35 PM
To:	PMT09 Hoc
Subject:	test

From: PMT09 Hoc
Sent: Sunday, March 27, 2011 7:14 PM
To: Hoc, RST16
Subject: Information on hole in side of Unit 2

The following reference is under ML110760432

"TEPCO cut a hole in the side of the Unit 2 secondary containment to prevent hydrogen buildup following a sustained period when there was no water injection into the core."

This is on Page 2, bottom of the first paragraph.

From: PMT09 Hoc
Sent: Sunday, March 27, 2011 5:55 AM
To: LIA01 Hoc
Subject: 2011 03 25 Reentry guidance.doc
Attachments: 2011 03 25 Reentry guidance.doc

From: PMT09 Hoc
Sent: Sunday, March 27, 2011 2:39 AM
To: Hoc, PMT12
Subject: Skin Burn AnalysisBobyEidRevision1.doc
Attachments: Skin Burn AnalysisBobyEidRevision1.doc

PMT Evaluation of Skin Dose to Japanese Workers

Statement of Problem

(b)(5)

Evaluation

(b)(5)

(b)(5)

Conclusion

(b)(5)

M:\PMT\Skin Burn AnalysisBoby EIDRevision1.doc

(b)(5)

Spreadsheet at M:/PMT/Skin Dose calculation.xlsx

From: PMT09 Hoc
Sent: Saturday, March 26, 2011 11:35 PM
To: Jones, Cynthia
Subject: FW: NRC dose estimates (Japan response)

From: PMT02 Hoc
Sent: Saturday, March 26, 2011 10:47 PM
To: Fetter, Steve
Cc: narac@llnl.gov; cmht@nnsa.doe.gov; FOIA Response.hoc Resource; PMT09 Hoc; Hoc, PMT12; PMT11 Hoc
Subject: RE: NRC dose estimates (Japan response)

THIS IS A MONITORING OPERATION FOR THE FUKUSHIMA REACTOR IN JAPAN ---

Dr. Fetter

(b)(5)

We are checking our preliminary assessment and we will get back to you as soon as possible.

Stephen F. LaVie
Radiological Assessment Assistant Director
Protective Measures Team
U.S. Nuclear Regulatory Commission

This information should not be released at this time.

--- THIS IS A MONITORING OPERATION FOR THE FUKUSHIMA REACTOR IN JAPAN ---

From:	Hoc, PMT12
Sent:	Tuesday, April 05, 2011 1:05 PM
To:	Jones, Cynthia
Subject:	FW: NRC dose estimates (Japan response)
Attachments:	26 March 2011 NARAC source term 3 Fukushima Units_Summary_Data.xlsx; Discussion on basis of revised NARAC source term.doc

---

From: PMT02 Hoc
Sent: Tuesday, April 05, 2011 1:00 PM
To: Tinkler, Charles; Schaperow, Jason; Lee, Richard
Cc: PMT02 Hoc; PMT11 Hoc; Hoc, PMT12; FOIA Response.hoc Resource
Subject: FW: NRC dose estimates (Japan response)

Charlie and Jason,

Attached is a spreadsheet that lists the radionuclide releases from Units 1, 2 and 3. The values were based on assumptions in the attached word file, as discussed with other Federal agency representatives.

Tony
PMT NRC Operations Center
301-816-5100

From: PMT02 Hoc
Sent: Saturday, March 26, 2011 4:47 PM
To: 'Fetter, Steve'
Cc: PMT02 Hoc; narac@llnl.gov; cmht@nnsa.doe.gov; FOIA Response.hoc Resource; PMT09 Hoc; Hoc, PMT12; PMT11 Hoc
Subject: RE: NRC dose estimates (Japan response)

Dr. Fetter,

(b)(5)

If you have questions concerning this spreadsheet, please do not hesitate to contact me.

Sincerely,

Steve LaVie, Radiological Assistant Assessment Director
USNRC Protective Measures Team
301-816-5100

From: Fetter, Steve [mailto: (b)(6)]
Sent: Saturday, March 26, 2011 11:51 AM
To: PMT11 Hoc; narac@llnl.gov; cmht@nnsa.doe.gov

Cc: PMT02 Hoc; Hoc, PMT12
Subject: RE: NRC dose estimates (Japan response)
Importance: High

NRC,

(b)(5)

--Steve

Steve Fetter
Assistant Director at-large
Office of Science and Technology Policy
Executive Office of the President
(b)(6)

From: PMT11 Hoc [mailto:PMT11.Hoc@nrc.gov]
Sent: Thursday, March 24, 2011 5:36 PM
To: narac@llnl.gov; cmht@nnsa.doe.gov; Fetter, Steve
Cc: PMT02 Hoc; Hoc, PMT12
Subject: NRC dose estimates (Japan response)

Attn: Ken Foster, NARAC

--- THIS IS A MONITORING OPERATION FOR THE FUKUSHIMA REACTOR IN JAPAN ---

This is a MONITORING OPERATION FOR THE JAPAN EARTHQUAKE TSUNAMI AFTERMATH.

Attached is a spreadsheet that summarizes the projected doses from the three reactors for various downwind distances.

The following are the release durations for the three reactor sources:
Unit 1 – 3/12 15:25 to 3/14 15:25
Unit 2 – 3/15 07:00 to 3/17 07:00
Unit 3 – 3/14 11:00 to 3/16 11:00

NRC suggests running the total case from 3/12 15:25 to 3/17 07:00, all times Japan Standard Time.

Please call if more clarification is needed at: 301-816-5419 (Protective Measures Team)

Please reply to this email to acknowledge receipt.

This information should not be released at this time.

--- THIS IS A MONITORING OPERATION FOR THE FUKUSHIMA REACTOR IN JAPAN ---

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~~Not for further distribution without approval of NRC~~

24-Mar-11

Doses for Fukushima Unit 1 - 70% Core Melt - 10%/d Containment Leak Rate,
Unit 2 - 33% Core Melt - 5 in2 Containment Hole, and
Unit 3 - 33% Core Melt - 100% Containment Leak Rate

	Based on 48 hours	Unit 1 (rem)	Unit 2 (rem)	Unit 3 (rem)	Total Dose (rem)
2 miles	Total EDE	1.70E+00	6.80E+01	7.70E-02	6.98E+01
	Thyroid CEDE	2.40E+01	4.20E+02	7.50E-01	4.45E+02
5 miles	Total EDE	5.90E-01	1.90E+01	2.70E-02	1.96E+01
	Thyroid CEDE	8.70E+00	1.20E+02	2.50E-01	1.29E+02
10 miles	Total EDE	2.10E-01	6.10E+00	8.30E-03	6.32E+00
	Thyroid CEDE	3.10E+00	4.20E+01	6.00E-02	4.52E+01
20 miles	Total EDE	8.20E-02	6.10E-01	2.30E-03	6.94E-01
	Thyroid CEDE	1.20E+00	1.20E+01	2.20E-02	1.32E+01
50 miles	Total EDE	3.20E-02	4.40E-02	1.20E-03	7.72E-02
	Thyroid CEDE	4.90E-01	1.00E+00	1.20E-02	1.50E+00

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26-Mar-11

Source Term for Fukushima Unit 1 - 70% Core Melt - 10%/d Containment Leak Rate, Unit 2 - 33% Core Melt - 5 in^2 Containment Hole, and Unit 3 - 33% Core Melt - 100% Containment

**** TOP 20 RADIONUCLIDES **** Percent of Total Release

	Total NARAC Release (Ci)	NARAC U1 Release	NARAC U2 release	NARAC U3 release	U1	U2	U3
Ba-140	1.39E+05	2.76E+04	1.10E+05	1.40E+03	20%	79%	1%
Ce-144*	3.16E+03	5.28E+02	2.60E+03	3.20E+01	17%	82%	1%
Cm-242	4.02E+01	6.80E+00	3.30E+01	4.00E-01	17%	82%	1%
Cs-134	1.78E+05	2.61E+04	1.50E+05	1.90E+03	15%	84%	1%
Cs-136	6.15E+04	9.86E+03	5.10E+04	6.40E+02	16%	83%	1%
Cs-137*	1.29E+05	1.77E+04	1.10E+05	1.30E+03	14%	85%	1%
I-131	1.20E+06	2.08E+05	9.80E+05	1.20E+04	17%	82%	1%
I-132	7.44E+05	1.32E+05	6.10E+05	1.80E+03	18%	82%	0%
I-133	3.12E+05	1.70E+05	1.40E+05	2.40E+03	54%	45%	1%
Pu-241	3.06E+02	5.30E+01	2.50E+02	3.00E+00	17%	82%	1%
Rb-86	2.28E+03	3.56E+02	1.90E+03	2.40E+01	16%	83%	1%
Ru-103	1.85E+04	3.31E+03	1.50E+04	1.90E+02	18%	81%	1%
Ru-106*	5.40E+03	9.46E+02	4.40E+03	5.40E+01	18%	81%	1%
Sb-127	1.21E+04	2.98E+03	9.00E+03	1.20E+02	25%	74%	1%
Sr-89	8.36E+04	1.48E+04	6.80E+04	8.30E+02	18%	81%	1%
Sr-90	6.70E+03	1.13E+03	5.50E+03	6.70E+01	17%	82%	1%
Te-127m	3.54E+03	6.04E+02	2.90E+03	3.60E+01	17%	82%	1%
Te-129m	1.47E+04	2.56E+03	1.20E+04	1.40E+02	17%	82%	1%
Te-132	1.77E+05	4.53E+04	1.30E+05	1.70E+03	26%	73%	1%
Xe-133	8.33E+07	2.83E+07	2.90E+07	2.60E+07	34%	35%	31%
Sum (Ci)	8.64E+07	2.90E+07	3.14E+07	2.60E+07			

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26-Mar-11

Source Term for Fukushima Unit 1 - 70% Core Melt - 10%/d Containment Leak Rate,
Unit 2 - 33% Core Melt - 5 in^2 Containment Hole, and Unit 3 - 33% Core Melt - 100% Containment

**** TOP 20 RADIONUCLIDES ****

	Total NARAC Release (Ci)	NARAC U1 Release	NARAC U2 release	NARAC U3 release
Ba-140	1.39E+05	2.76E+04	1.10E+05	1.40E+03
Ce-144*	3.16E+03	5.28E+02	2.60E+03	3.20E+01
Cm-242	4.02E+01	6.80E+00	3.30E+01	4.00E-01
Cs-134	1.78E+05	2.61E+04	1.50E+05	1.90E+03
Cs-136	6.15E+04	9.86E+03	5.10E+04	6.40E+02
Cs-137*	1.29E+05	1.77E+04	1.10E+05	1.30E+03
I-131	1.20E+06	2.08E+05	9.80E+05	1.20E+04
I-132	7.44E+05	1.32E+05	6.10E+05	1.80E+03
I-133	3.12E+05	1.70E+05	1.40E+05	2.40E+03
Pu-241	3.06E+02	5.30E+01	2.50E+02	3.00E+00
Rb-86	2.28E+03	3.56E+02	1.90E+03	2.40E+01
Ru-103	1.85E+04	3.31E+03	1.50E+04	1.90E+02
Ru-106*	5.40E+03	9.46E+02	4.40E+03	5.40E+01
Sb-127	1.21E+04	2.98E+03	9.00E+03	1.20E+02
Sr-89	8.36E+04	1.48E+04	6.80E+04	8.30E+02
Sr-90	6.70E+03	1.13E+03	5.50E+03	6.70E+01
Te-127m	3.54E+03	6.04E+02	2.90E+03	3.60E+01
Te-129m	1.47E+04	2.56E+03	1.20E+04	1.40E+02
Te-132	1.77E+05	4.53E+04	1.30E+05	1.70E+03
Xe-133	8.33E+07	2.83E+07	2.90E+07	2.60E+07
Sum (Ci)	8.64E+07	2.90E+07	3.14E+07	2.60E+07

Assumed Core Inventory for Low Enriched Uranium Fuel Operating Core

Nuclide	Core Inventory Ci/MWt	Inventory for 2350 MWt	Nuclide	Core Inventory Ci/MWt	Inventory for 2350 MWt	Nuclide	Core Inventory Ci/MWt	Inventory for 2350 MWt
Ba-139	4.74e+04	1.11E+08	La-141	4.33e+04	1.02E+08	Te-127	2.36e+03	5.55E+06
Ba-140	4.76e+04	1.12E+08	La-142	4.21e+04	9.89E+07	Te-127m	3.97e+02	9.33E+05
Ce-141	4.39e+04	1.03E+08	Mo-99	5.30e+04	1.25E+08	Te-129	8.26e+03	1.94E+07
Ce-143	4.00e+04	9.40E+07	Nb-95	4.50e+04	1.06E+08	Te-129m	1.68e+03	3.95E+06
Ce-144*	3.54e+04	8.32E+07	Nd-147	1.75e+04	4.11E+07	Te-131m	5.41e+03	1.27E+07
Cm-242	1.12e+03	2.63E+06	Np-239	5.69e+05	1.34E+09	Te-132	3.81e+04	8.95E+07
Cs-134	4.70e+03	1.10E+07	Pr-143	3.96e+04	9.31E+07	Xe-131m	3.65e+02	8.58E+05
Cs-136	1.49e+03	3.50E+06	Pu-241	4.26e+03	1.00E+07	Xe-133	5.43e+04	1.28E+08
Cs-137*	3.25e+03	7.64E+06	Rb-86	5.29e+01	1.24E+05	Xe-133m	1.72e+03	4.04E+06
I-131	2.67e+04	6.27E+07	Rh-105	2.81e+04	6.60E+07	Xe-135	1.42e+04	3.34E+07
I-132	3.88e+04	9.12E+07	Ru-103	4.34e+04	1.02E+08	Xe-135m	1.15e+04	2.70E+07
I-133	5.42e+04	1.27E+08	Ru-105	3.06e+04	7.19E+07	Xe-138	4.56e+04	1.07E+08
I-134	5.98e+04	1.41E+08	Ru-106*	1.55e+04	3.64E+07	Y-90	2.45e+03	5.76E+06
I-135	5.18e+04	1.22E+08	Sb-127	2.39e+03	5.62E+06	Y-91	3.17e+04	7.45E+07
Kr-83m	3.05e+03	7.17E+06	Sb-129	8.68e+03	2.04E+07	Y-92	3.26e+04	7.66E+07
Kr-85	2.78e+02	6.53E+05	Sr-89	2.41e+04	5.66E+07	Y-93	2.52e+04	5.92E+07
Kr-85m	6.17e+03	1.45E+07	Sr-90	2.39e+03	5.62E+06	Zr-95	4.44e+04	1.04E+08
Kr-87	1.23e+04	2.89E+07	Sr-91	3.01e+04	7.07E+07	Zr-97*	4.23e+04	9.94E+07
Kr-88	1.70e+04	4.00E+07	Sr-92	3.24e+04	7.61E+07			
La-140	4.91e+04	1.15E+08	Tc-99m	4.37e+04	1.03E+08			

Source Table 1.1 Assumed Core Inventory During Operation for Low Enriched Uranium Fuel from RASCAL 4: Description of Models and Methods, corrected for a 2350 MWt core

Discussions on the Input to the 3/24/2011 Day Shift Plausible Realistic Case

(b)(5)

(b)(5)

M:\PMT\Discussion on basis of revised NARAC source term.doc

(b)(5)

From: Janet.Benini@dot.gov
Sent: Saturday, March 26, 2011 7:24 PM
To: Hoc, PMT12; (b)(6) ; PMT09 Hoc
Cc: Robert.Kern@dot.gov; Rob.Lee@dot.gov
Subject: RE: When you have a chance

much appreciated -- thank you! Janet

From: Hoc, PMT12 [mailto:PMT12.Hoc@nrc.gov]
Sent: Sat 3/26/2011 11:11 AM
To: Bentz, Julie A.; Benini, Janet (OST); PMT09 Hoc
Cc: Kern, Robert (RITA); Lee, Rob (OST)
Subject: RE: When you have a chance

Here is a copy of the NRC Information Digest 2010-2011. Starting on page 98, Appendix A, you will find a listing of nuclear power plants in the US.

This is general information. We also have this information already available in GIS form. If you want that, I will need to find someone who can extract it and send it to you.

From: Bentz, Julie A. [mailto: (b)(6)]
Sent: Saturday, March 26, 2011 10:35 AM
To: 'Janet.Benini@dot.gov'; PMT09 Hoc; Hoc, PMT12
Cc: Robert.Kern@dot.gov; Rob.Lee@dot.gov
Subject: RE: When you have a chance

Jan,

I've added the NRC POCs to this email string and would ask that they contact you directly. If you don't hear back, call them at 301-816-5100

Julie

From: Janet.Benini@dot.gov [mailto:Janet.Benini@dot.gov]
Sent: Friday, March 25, 2011 11:38 AM
To: Bentz, Julie A.

Cc: Robert.Kern@dot.gov; Rob.Lee@dot.gov
Subject: When you have a chance

Hi Julie - do you know a good POC at NRC for the locations of nuclear plants in the US? Our Transportation GIS people would like to add that layer to our transportation system maps. Thanks, Jan

Janet K. Benini

Associate Director, Policy and Plans

Office of Intelligence, Security and Emergency Response

US Department of Transportation

1200 New Jersey Avenue, SW

Washington, DC 20590

202 366-4550

janet.benini@dot.gov

From: PMT09 Hoc
Sent: Saturday, March 26, 2011 5:08 PM
To: Ross-Lee, MaryJane; LIA07 Hoc; LIA06 Hoc; LIA08 Hoc; RST01 Hoc
Subject: RE: March 26 1500 EDT one pager (3).doc

MJ-

Pls send any request to PMT12 as we are not fully staffed in the PMT today and just saw this request. We are updating now.

From: Ross-Lee, MaryJane
Sent: Saturday, March 26, 2011 1:42 PM
To: LIA07 Hoc; LIA06 Hoc; LIA08 Hoc; RST01 Hoc; PMT09 Hoc
Subject: March 26 1500 EDT one pager (3).doc
Importance: High

Please provide any comments by 1430. Thanks, MJ

From: Ross-Lee, MaryJane
Sent: Saturday, March 26, 2011 2:47 PM
To: LIA07 Hoc
Cc: LIA06 Hoc; LIA08 Hoc; RST01 Hoc; Giitter, Joseph; Hoc, PMT12; McGinty, Tim
Subject: March 26 1500 EDT one pager.doc
Attachments: March 26 1500 EDT one pager (3).doc

Please dispatch. Thanks.

From:	McGinty, Tim
Sent:	Saturday, March 26, 2011 5:45 AM
To:	LIA07 Hoc; LIA06 Hoc; LIA08 Hoc; RST01 Hoc; PMT09 Hoc
Cc:	Uhle, Jennifer; Virgilio, Martin; Ross-Lee, MaryJane
Subject:	March 26 0600 EDT one pager (3).doc
Attachments:	March 26 0600 EDT one pager (3).doc

Please provide any comments by 0600. Thanks, Tim McGinty

From: PMT09 Hoc
Sent: Saturday, March 26, 2011 5:35 AM
To: Dorman, Dan
Cc: Hoc; PMT12; Miller, Marie; Jackson, Todd
Subject: Comaprison of Speedi Run Source Term to NARAC Source Term

Per your request, we have developed the ST comparison as follows:

We understand Speedi used 1 E 14 Bq/hr for their projection. However, the projection appears to be a short duration calculation as the wind direction does not vary .

In any case, the latest NARAC run used 2.4 E 18 Bq or ~9 E 15 Bq/hr over the 12 day release we asked NARAC to run.

This suggests the STs are similar in magnitude.

We would be happy to talk to the Speedi operator to compare notes. Please note we do not do the NARAC runs, just supply the source term. If discussion with NARAC is desired, they should be contacted directly. We would be happy to help with coordination, etc, or to discuss RASCAL runs and capabilities.

Full Name: julie_A._Bentz
Last Name: _Bentz
First Name: julie_A.

Business: (b)(6)

E-mail:
E-mail Display As:
(b)(6)

From: Hoc, PMT12
Sent: Friday, March 25, 2011 5:36 PM
To: PMT09 Hoc
Subject: RadNet Measurements - DC

http://www.epa.gov/japan2011/rert/radnet-washington-bg.html

From: PMT09 Hoc
Sent: Friday, March 25, 2011 4:45 PM
To: PMT02 Hoc
Subject: PMT SITREP update 03 25.doc
Attachments: PMT SITREP update 03 25.doc

PMT SITREP update 03/25/201, 1600 EDT

Insert A:

PMT has completed work with NARAC on the source term for Plausible Realistic Case model based on plant conditions as of 03/24/2011. Run was completed at 1400 EDT on 03/25/2011, and results have been verified by the PMT. The Plausible Realistic Case assumed partial melting of Unit 1 (70% core melt; 10%/day release), Unit 2 (33% core melt; a 5-inch sq. hole in containment), and Unit 3 (33% core melt; 100%/day release. The case did not assume any release from the spent fuel pools. Actual meteorological data and forecasts were used. Releases were assumed to occur over 12 days, and dose results were calculated for 14 days for locations in Japan. TEDE was greater than 5 rem out to around 2 miles, and greater than 1 rem (TEDE PAG) out to around 8 miles from the plant. Adult thyroid dose was greater than 10 rem out to around 5.25 miles from the plant. Child thyroid dose was greater than the 5 rem out to around 11 miles from the plant.

Isotopic analysis received 03/25 from TEPCO indicates contaminated water (I-131 and other isotopes) in the U3 turbine building at levels indicating damaged fuel from the core. Workers entering turbine building on 03/24 encountered a few feet of water with surface radiation dose of 40 R/h which may have resulted in skin burns estimated to be 18 rem (beta).

"M:\PMT\SITREP updates\PMT SITREP update 03 25.doc"

From:	PMT09 Hoc
Sent:	Friday, March 25, 2011 4:32 PM
To:	LIA07 Hoc
Subject:	PMT updated SITREP
Attachments:	USNRC Earthquake-Tsunami Update 032511 1800EDT - PMT updated.docx

Attached is our latest update for the SITREP. We have highlighted our addition.

PMT

From: Hoc, PMT12
Sent: Friday, March 25, 2011 4:12 PM
To: PMT09 Hoc
Subject: FW: Status Update draft
Attachments: USNRC Earthquake-Tsunami Update 032511 1800EDT.docx

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From: LIA07 Hoc
Sent: Friday, March 25, 2011 3:59 PM
To: Hoc, PMT12
Subject: Status Update draft

From: Hoc, PMT12
Sent: Friday, March 25, 2011 3:52 PM
To: PMT09 Hoc
Subject: FW: 2011 03 25 Reentry guidance
Attachments: 2011 03 25 Reentry guidance.doc

From: Hoc, PMT12
Sent: Friday, March 25, 2011 8:20 AM
To: LIA06 Hoc; LIA08 Hoc
Subject: 2011 03 25 Reentry guidance

Reentry Guidance

(b)(5)

Reentry Guidance

(b)(5)

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Reentry Guidance

(b)(5)

C:\FoiaProject\FoiaPDFExport\PSTs\PMT09_HOC\Emails\00319\00002.doc

From: Ross-Lee, MaryJane
Sent: Friday, March 25, 2011 2:20 PM
To: PMT09 Hoc; RST01 Hoc; LIA07 Hoc; LIA06 Hoc
Cc: Giitter, Joseph; McGinty, Tim
Subject: March 25 1515 EDT one pager (2).docx
Attachments: March 25 1500 EDT one pager (3).doc

Importance: High

Comments please, on updated one-pager to be discussed with the Chairman this afternoon. Comments if any by 1440, please.
Note whole thing is new so no highlights. The section in green is a question for RST.

Thanks, MJ

From:	Nasstrom, John S. <Nasstrom1@llnl.gov>
Sent:	Friday, March 25, 2011 11:07 AM
To:	PMT02 Hoc; Hoc, PMT12
Cc:	narac@llnl.gov; PMT09 Hoc
Subject:	URGENT: Attn: NRC PMT - Please review NARAC source term
Attachments:	NARAC_PRC-V3-(U1Exp)-JapanRctr_2011Mar25_1450Z_Draft.docx
Importance:	High

Attn: NRC PMT

SEE ATTACHED DRAFT FOR NRC PMT REVIEW – PLEASE CONFIRM SOURCE TERM IN Appendix, and Assumptions in document.

NARAC Operations
925-422-9100

From:	PMT09 Hoc
Sent:	Friday, March 25, 2011 9:08 AM
To:	Hoc, PMT12
Subject:	FW: Action: Q&A Support
Attachments:	Re: Emailing: boardfile.htm; image001.png

From: Nelson, Robert
Sent: Friday, March 25, 2011 9:00 AM
To: PMT01 Hoc; PMT02 Hoc; PMT03 Hoc; PMT04 Hoc; PMT05 Hoc; PMT07 Hoc; PMT08 Hoc; PMT09 Hoc; PMT10 Hoc; PMT11 Hoc
Cc: Markley, Michael; Oesterle, Eric; McGinty, Tim; LIA06 Hoc
Subject: Action: Q&A Support

Sorry for the shotgun but I don't know which PMT station is the lead.

Please prepare a response to Item 3 from Brian Sheron of the attached and respond to me.

R.A. Nelson

Robert A. Nelson
NRR External Communications Coordinator, Japan Events
Deputy Director
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

E-mail: robert.nelson@nrc.gov | Office: (301) 415-1453 | Cell (b)(6) | Fax: (301) 415-2102|

From: LIA01 Hoc
Sent: Friday, March 25, 2011 8:34 AM
To: RMTPACTSU_ELNRC; PMT01 Hoc; Hoc, PMT12; PMT09 Hoc
Cc: LIA11 Hoc
Subject: RE: Potassium Iodide - Action needed by Emb Tokyo
Attachments: image001.png

I thought NSIR released information recently regarding expiration dates of KI and how it can be extended if stored in a certain manner. Annette Stang is the POC (301-415-2918).

Bethany Cecere
Federal Liaison
301-816-5186

From: RMTPACTSU_ELNRC [mailto:RMTPACTSU_ELNRC@ofda.gov]
Sent: Friday, March 25, 2011 8:12 AM
To: PMT01 Hoc; Hoc, PMT12; PMT09 Hoc
Cc: LIA01 Hoc; LIA11 Hoc
Subject: FW: Potassium Iodide - Action needed by Emb Tokyo

Refer to highlighted question below. Is this something the PMT is working, or is this an FDA (or other Federal agency's) responsibility to response?

From: CMS TaskForce1D - Japan - Deputy Coordinator [mailto:1TFD@state.gov] **On Behalf Of** zTask Force 1 Mailbox
Sent: Friday, March 25, 2011 8:03 AM
To: RMT_PACTSU
Cc: zTask Force 1 Mailbox
Subject: FW: Potassium Iodide - Action needed by Emb Tokyo

FYI- it looks like there is still a way to go to resolve this issue.

Deputy Coordinator
Japan Earthquake Task Force (TFJP01)
U.S. Department of State
(202) 647-6611

From: JapanEmbassy, TaskForce
Sent: Friday, March 25, 2011 7:50 AM
To: CMS TaskForce1D - Japan - Deputy Coordinator
Cc: Campbell, Kurt M; Donovan, Joseph R; Tong, Kurt W (TDY/ECN); Tong, Kurt W; zTask Force 1 Mailbox
Subject: FW: Potassium Iodide - Action needed by Emb Tokyo

Readout of Embassy Tokyo (DOS, FCS, CDC) 3/25 17:30 meeting with GOJ regarding possible USG donation of liquid potassium iodide ("liquid KI") (drafted by Robert Gabor, ECON, ext. 5024):

GOJ Agencies Present:

- Ministry of Foreign Affairs (MOFA), First North Americas Division
- Ministry of Economy, Trade, and Industry (METI), Nuclear and Industrial Safety Agency (NISA), International Office

- Ministry of Health, Labor, and Welfare (MHLW), Pharmaceutical and Food Safety Bureau, Office of Chemical Safety

Meeting outcome:

- GOJ agencies will consider specifics of our proposed donation, including the issue of expiration dates, and will reply as soon as possible with a definite request.
- DCM, in his nightly 3/25 20:00 meeting with Special Advisor Hosono, will note the constructive meeting and that ball is in the GOJ court to reply affirmatively regarding its preferences for the donation.
- Please see GOJ questions below, followed by Embassy Tokyo replies in blue to the two sets of USG questions we received today.

GOJ questions:

1. Would the shipment arrive by military or commercial air?
   - We said we expected it would be by commercial charter flight. Action: Please confirm.
2. Requested USG information, if any, about expected duration of efficacy past indicated expiration date.
   - We will request from NRC and or FDA and convey to GOJ if available.
3. Requested quantities and any other details regarding the inactive ingredients (note this to further help GOJ assess possible efficacy beyond expiration)
   - Please advise (note MHLW has a bilateral agreement with the US FDA under which it could receive this otherwise possibly proprietary information)

Question set received in Tokyo on 3/25 afternoon:

1. Has the GOJ decided how much KI it wants and from which expiration date lots?
   - No decision yet, will consider and let us know.
2. Has the GOJ decided who (which agency) will be receiving the KI shipment and where the GOJ prefers the shipment be delivered?
   - No decision yet, will consider and let us know.
3. Will there be any customs, taxation or regulatory issues surrounding the shipments? If the GOJ confirms that it is willing to receive the shipment under the IAEA Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, most of these issues would be resolved.
   - No intention to receive the shipment under the IAEA convention. No specifics regarding customs, tax, or regulatory issues, but GOJ understands our preference for GOJ to be the consignee in order to likely make such issues moot.

Question set received in Tokyo on 3/25 morning:

Action requested by Washington:

- Clarification on below questions.
- Status update on whether IAEA Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency is in effect.

(b)(4)

- Ask GOJ to transmit a letter to DOS requesting the number of doses of KI including expiration dates and acknowledge receipt of the shipment will be taken immediately upon arrival.
  1. Conveyed this request.

2. Explained our strong preference for the GOJ to take immediate receipt of the shipment, i.e. be the consignee.
3. Explained that this can be a simpler letter if GOJ will be the consignee; or would be more complicated if GOJ cannot be the consignee.
4. Offered to provide suggested text of letter when they decide specifics of their request.

- State/USAID lawyers will draft a grant document that GOJ will need to sign [whether this is necessary before shipment is to be determined].
    1. Conveyed this intention.
    2. GOJ asked who would sign on the USG side.
- HHS will load and USAID will ship to GOJ to receive the doses.

Outstanding questions:

1) How many doses of liquid (pediatric) KI and of which expiration date do the Japanese want?
   Items to consider:
   - If GOJ intends to dispense these doses directly to the public, requesting the entire portion of a single expiration date may be preferable to ensure that the public and health officials are able to manage who has available, un-expired countermeasures. The largest allotment of 691,383 doses has an expiration date of 9/31/11.
   - If GOJ intends to dispense the KI immediately from health facilities, the doses that expire soonest would be sufficient. If so, they could request the balance of their 1 million doses [308,617] from the soon-to-expire doses.
   - HHS is prepared to transfer up to 1 million doses from any of the attached listed doses based on GOJ preferences.
       1. Posed this question and provided the list of doses. METI/NISA and MHLW will evaluate and respond as soon as they can.
2) Who in the GOJ will be receiving the KI doses and where?
   - 1 million doses have a significant "foot print." USAID has agreed to transfer but will not have storage capability in Japan.
       1. GOJ asked exact size of footprint. CDC/Bowman will convey that when he gets the answer, likely evening of 3/25 Tokyo time.
       2. We would like to confirm the shipment would be on pallets with shrink wrapping, not stackable.
   - USG is assuming transfer to GOJ at the airport of arrival. No internal transport has been anticipated.
       1. Explained this.
       2. Added that we could of course discuss if GOJ were to request, as a separate issue, USG assistance with internal distribution as part of our continuing relief support.
3) Will there be any customs, taxation or regulatory issues surrounding the importation of the doses?
   - We are working under the assumption that the GOJ will take possession of the doses when they arrive making these issues moot for the USG.
       1. Reiterated our strong preference for the GOJ to take immediate receipt of the shipment, i.e. be the consignee.

on behalf of the Japan Emergency Command Center, +81-3-3224- 5533

Lynda Hinds
Staff Assistant to Ambassador John V. Roos
U.S. Embassy
1-10-5 Akasaka, Minato-ku

Tokyo 107-8420
Tel. (03) 3224- 5370

Twitter.com/AmbassadorRoos

This email is UNCLASSIFIED.

From: CMS TaskForce1D - Japan - Deputy Coordinator
Sent: Friday, March 25, 2011 11:05 AM
To: Zumwalt, James P; JapanEmbassy, TaskForce
Cc: Campbell, Kurt M; Donovan, Joseph R; Tong, Kurt W (TDY/ECN); Tong, Kurt W; zTask Force 1 Mailbox
Subject: Potassium Iodine - Action needed by Emb Japan

Sirs –

Please find below and attached a status update on the HHS's donation of potassium iodine to GOJ. **Action is needed by Embassy Tokyo.** Please let us know if we can answer any questions. Also attached is a PDF with product information for your reference.

Potassium Iodide (KI) Donation
HHS has offered GOJ up to 1 million doses of ThyroShield – a liquid pediatric formulation of potassium iodide in multi-use bottles at no cost to GOJ. The GOJ may select which doses it needs from the attached list of available HHS stocks that expire at different times. HHS will transfer the KI doses to DOS/USAID to be airlifted by USAID and delivered to the appropriate GOJ representative in Japan. DOS/USAID will generate a grant document to legally transfer the KI to the GOJ. To note, the KI doses have a substantial footprint ("one and a half MD11s").

Action needed:

- Clarification on below questions.
- Status update on whether IAEA Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency is in effect.
- Ask GOJ to transmit a letter to DOS requesting the number of doses of KI including expiration dates and acknowledge receipt of the shipment will be taken immediately upon arrival.
- State/USAID lawyers will draft a grant document that GOJ will need to sign [whether this is necessary before shipment is to be determined].
- HHS will load and USAID will ship to GOJ to receive the doses.

Outstanding question:
1) How many doses of liquid (pediatric) KI and of which expiration date do the Japanese want?
Items to consider:

- If GOJ intends to dispense these doses directly to the public, requesting the entire portion of a single expiration date may be preferable to ensure that the public and health officials are able to manage who has available, un-expired countermeasures. The largest allotment of 691,383 doses has an expiration date of 9/31/11.

- If GOJ intends to dispense the KI immediately from health facilities, the doses that expire soonest would be sufficient. If so, they could request the balance of their 1 million doses [308,617] from the soon-to-expire doses.

- HHS is prepared to transfer up to 1 million doses from any of the attached listed doses based on GOJ preferences.

2) Who in the GOJ will be receiving the KI doses and where?
   - 1 million doses have a significant "foot print." USAID has agreed to transfer but will not have storage capability in Japan.

   - USG is assuming transfer to GOJ at the airport of arrival. No internal transport has been anticipated.

3) Will there be any customs, taxation or regulatory issues surrounding the importation of the doses?
   - We are working under the assumption that the GOJ will take possession of the doses when they arrive making these issues moot for the USG.

Deputy Coordinator
Japan Earthquake Task Force (TFJP01)
U.S. Department of State
(202) 647-6611

From: PMT09 Hoc
Sent: Friday, March 25, 2011 6:52 AM
To: Hoc, PMT12
Subject: put will this somewhere
Attachments: 2011 03-25 Proposal to form a Fukushima Source Term Working Group.doc

Proposal to form a Fukushima Source Term Working Group

(b)(5)

C:\FoiaProject\FoiaPDFExport\PSTs\PMT09_HOC\Emails\00325\00002.doc

From: PMT09 Hoc
Sent: Friday, March 25, 2011 6:27 AM
To: PMT02 Hoc
Subject: FW: Daily Update of Navy Radiological Survey Data From Japan 3/24/11 (1430 EST)
Attachments: Japan_Combined_Survey_Data_1200.xlsx

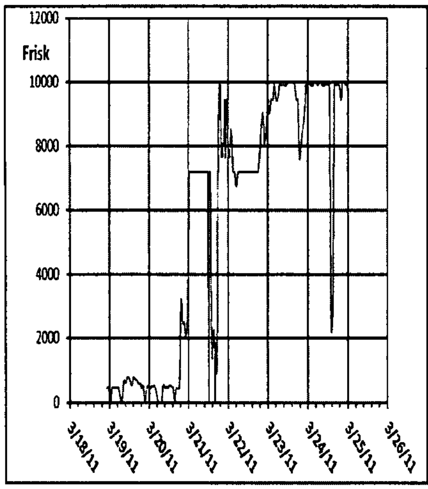
-----Original Message-----
From: Hoc, PMT12
Sent: Friday, March 25, 2011 3:33 AM
To: PMT09 Hoc
Subject: FW: Daily Update of Navy Radiological Survey Data From Japan 3/24/11 (1430 EST)

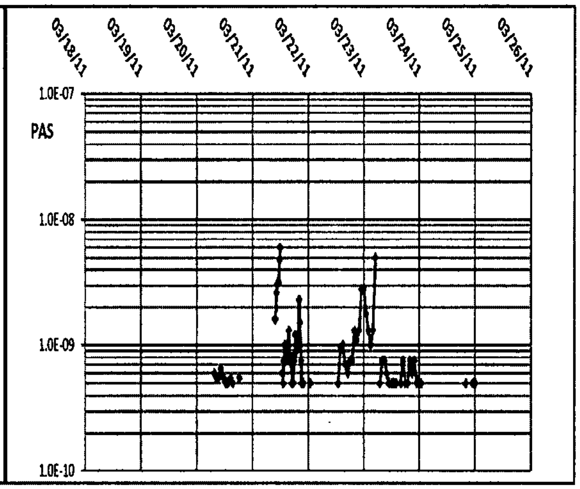
-----Original Message-----
From: Mueller, Troy J SES CIV NAVSEA 08 NR [mailto: (b)(6)]
Sent: Thursday, March 24, 2011 5:12 PM
To: Hoc, PMT12; Foster, Jack
Subject: Fw: Daily Update of Navy Radiological Survey Data From Japan 3/24/11 (1430 EST)

----- Original Message -----
From: Burrows, Charles W SES CIV NAVSEA 08 NR
To: 'rst01.hoc@nrc.gov' <rst01.hoc@nrc.gov>; Mueller, Troy J SES CIV NAVSEA 08 NR; 'browncm@nv.doe.gov' <browncm@nv.doe.gov>; 'CooperJD@state.gov' <CooperJD@state.gov>; 'nitops@nnsa.doe.gov' <nitops@nnsa.doe.gov>; (b)(6)
(b)(6)
(b)(6) ; 'tdykelsord@state.gov' <tdykelsord@state.gov>
Cc: Conran, Thomas C SES CIV NAVSEA 08 NR; Naples, Elmer M SES SEA 08 NR; Hale, Andrew M SES NAVSEA, 08; McKenzie, John M SES CIV NAVSEA 08 NR
Sent: Thu Mar 24 14:37:07 2011
Subject: Daily Update of Navy Radiological Survey Data From Japan 3/24/11 (1430 EST)

All: Attached is the daily update of Navy radiological survey data. Note we have added two more monitoring points north of Tokyo (Oyama and Tsukuba). Also note the "North Team" has been renamed "Ishioka" which is their location.

CWB





Nanaban Tower (Yokosuka): LAT. 35.29N, LONG. 139.67E

Date and Time (EDT)	Date and Time (JST)	Radiation (mr/hr)	Frisk (pCi/probe)	PAS (µCi/mL)	RI (µCi/mL)
3/18/11 0924	3/18/11 2224	0.01	450	<5.0E-10	
3/18/11 1030	3/18/11 2330	0.01	450	<5.0E-10	
3/18/11 1130	3/19/11 0030	0.01	<450	<5.0E-10	
3/18/11 1230	3/19/11 0130	0.01	450	<5.0E-10	
3/18/11 1330	3/19/11 0230	0.01	450	<5.0E-10	
3/18/11 1430	3/19/11 0330	0.01	450	<5.0E-10	
3/18/11 1530	3/19/11 0430	0.01	450	<5.0E-10	
3/18/11 1630	3/19/11 0530	0.01	450	<5.0E-10	
3/18/11 1825	3/19/11 0725	0.01	<450	<5.0E-10	
3/18/11 1940	3/19/11 0840	0.01	675	<5.0E-10	
3/18/11 2044	3/19/11 0944	0.01	585	<5.0E-10	
3/18/11 2140	3/19/11 1040	0.01	765	<5.0E-10	
3/18/11 2239	3/19/11 1139	0.01	765	<5.0E-10	
3/18/11 2350	3/19/11 1250	0.01	585	<5.0E-10	
3/19/11 0037	3/19/11 1337	0.01	540	<5.0E-10	
3/19/11 0130	3/19/11 1430	0.01	765	<5.0E-10	
3/19/11 0238	3/19/11 1538	0.01	720	<5.0E-10	
3/19/11 0335	3/19/11 1635	0.01	675	<5.0E-10	
3/19/11 0430	3/19/11 1730	0.01	585	<5.0E-10	
3/19/11 0530	3/19/11 1830	0.01	585	<5.0E-10	
3/19/11 0630	3/19/11 1930	0.01	450	<5.0E-10	

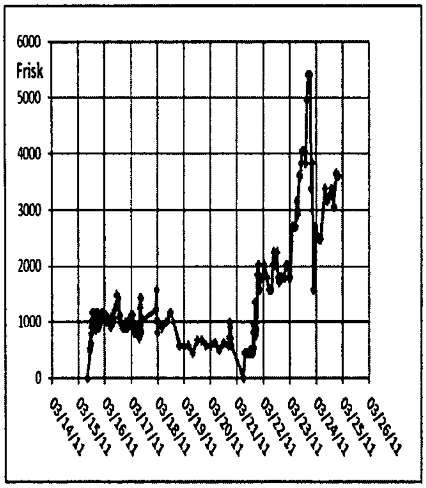
3/19/11 0730	3/19/11 2030	0.01	495	<5.0E-10
3/19/11 0830	3/19/11 2130	0.01	<450	<5.0E-10
3/19/11 0930	3/19/11 2230	0.01	450	<5.0E-10
3/19/11 1030	3/19/11 2330	0.01	495	<5.0E-10
3/19/11 1130	3/20/11 0030	0.01	450	<5.0E-10
3/19/11 1230	3/20/11 0130	0.01	495	<5.0E-10
3/19/11 1330	3/20/11 0230	0.01	495	<5.0E-10
3/19/11 1430	3/20/11 0330	0.01	495	<5.0E-10
3/19/11 1630	3/20/11 0530	0.01	<450	<5.0E-10
3/19/11 1730	3/20/11 0630	0.01	<450	<5.0E-10
3/19/11 1831	3/20/11 0731	0.01	<450	6.0E-10
3/19/11 1932	3/20/11 0832	0.01	540	5.5E-10
3/19/11 2031	3/20/11 0931	0.01	450	5.5E-10
3/19/11 2128	3/20/11 1028	0.01	495	6.5E-10
3/19/11 2228	3/20/11 1128	0.01	450	5.5E-10
3/19/11 2338	3/20/11 1238	0.01	540	5.0E-10
3/20/11 0027	3/20/11 1327	0.01	495	5.0E-10
3/20/11 0130	3/20/11 1430	0.01	450	5.5E-10
3/20/11 0230	3/20/11 1530	0.01	<450	5.0E-10
3/20/11 0325	3/20/11 1625	0.01	450	<5.0E-10
3/20/11 0520	3/20/11 1820	0.01	450	5.5E-10
3/20/11 0630	3/20/11 1930	0.01	3150	<5.0E-10
3/20/11 0730	3/20/11 2030	0.01	2475	<5.0E-10
3/20/11 0830	3/20/11 2130	0.01	2475	<5.0E-10
3/20/11 0930	3/20/11 2230	0.01	2025	<5.0E-10
3/20/11 1030	3/20/11 2330	0.01	2700	<5.0E-10
3/20/11 1130	3/21/11 0030	0.01	7200	<5.0E-10
3/20/11 1230	3/21/11 0130	0.01	7200	<5.0E-10
3/20/11 1330	3/21/11 0230	0.01	7200	<5.0E-10
3/20/11 1430	3/21/11 0330	0.01	7200	<5.0E-10
3/20/11 1530	3/21/11 0430	0.01	7200	<5.0E-10
3/20/11 1630	3/21/11 0530	0.01	7200	<5.0E-10
3/20/11 1730	3/21/11 0630	0.01	7200	<5.0E-10
3/20/11 1830	3/21/11 0730	0.01	7200	<5.0E-10

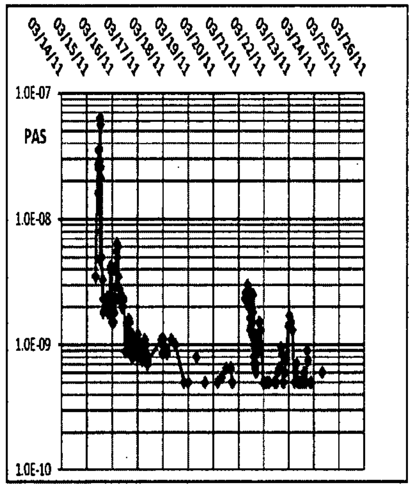
3/20/11 1928	3/21/11 0828	0.01	7200	<5.0E-10	
3/20/11 2035	3/21/11 0935	0.01	7200	1.6E-09	
3/20/11 2058	3/21/11 0958	0.01	7200	1.6E-09	
3/20/11 2115	3/21/11 1015	0.01	7200	2.6E-09	
3/20/11 2140	3/21/11 1040	0.01	7200	3.1E-09	
3/20/11 2200	3/21/11 1100	0.01	7200	3.2E-09	
3/20/11 2218	3/21/11 1118	0.01	7200	3.2E-09	
3/20/11 2235	3/21/11 1135	0.01	7200	4.8E-09	
3/20/11 2257	3/21/11 1157	0.01	7200	6.0E-09	
3/20/11 2318	3/21/11 1218	0.01	NONE	NONE	<1.0E-7
3/20/11 2346	3/21/11 1246	0.01	7200	6.0E-10	
3/21/11 0012	3/21/11 1312	0.01	7200	5.0E-10	
3/21/11 0033	3/21/11 1333	0.01	6750	7.5E-10	
3/21/11 0057	3/21/11 1357	0.01	1800	1.0E-09	
3/21/11 0120	3/21/11 1420	0.01	1350	7.5E-10	
3/21/11 0139	3/21/11 1439	0.01	1800	7.5E-10	
3/21/11 0157	3/21/11 1457	0.01	1800	8.0E-10	
3/21/11 0214	3/21/11 1514	0.01	2250	1.0E-09	
3/21/11 0245	3/21/11 1545	0.01	1800	1.3E-09	
3/21/11 0303	3/21/11 1603	0.01	NONE	7.5E-10	
3/21/11 0325	3/21/11 1625	0.01	1800	8.0E-10	
3/21/11 0345	3/21/11 1645	0.01	1350	7.0E-10	
3/21/11 0402	3/21/11 1702	0.01	900	5.0E-10	
3/21/11 0418	3/21/11 1718	0.01	1800	7.0E-10	
3/21/11 0432	3/21/11 1732	0.01	2250	5.0E-10	
3/21/11 0450	3/21/11 1750	0.01	7200	8.5E-10	
3/21/11 0509	3/21/11 1809	0.01	7200	7.5E-10	
3/21/11 0525	3/21/11 1825	0.01	9450	1.2E-09	
3/21/11 0545	3/21/11 1845	0.01	9900	1.0E-09	
3/21/11 0600	3/21/11 1900	0.01	9900	9.0E-10	
3/21/11 0615	3/21/11 1915	0.01	9900	1.0E-09	
3/21/11 0630	3/21/11 1930	0.01	9900	1.0E-09	
3/21/11 0645	3/21/11 1945	0.01	8550	1.0E-09	
3/21/11 0700	3/21/11 2000	0.01	8100	2.3E-09	

3/21/11 0715	3/21/11 2015	0.01	7650	2.3E-09
3/21/11 0732	3/21/11 2032	0.01	8100	1.5E-09
3/21/11 0745	3/21/11 2045	0.01	7650	1.0E-09
3/21/11 0800	3/21/11 2100	0.01	8100	7.5E-10
3/21/11 0815	3/21/11 2115	0.01	8100	5.0E-10
3/21/11 0830	3/21/11 2130	0.01	8100	5.0E-10
3/21/11 0845	3/21/11 2145	0.01	8550	5.0E-10
3/21/11 0900	3/21/11 2200	0.01	9450	5.0E-10
3/21/11 0930	3/21/11 2230	0.01	7650	<5.0E-10
3/21/11 1000	3/21/11 2300	0.01	9450	<5.0E-10
3/21/11 1100	3/22/11 0000	0.01	8100	<5.0E-10
3/21/11 1200	3/22/11 0100	0.01	7650	5.0E-10
3/21/11 1300	3/22/11 0200	0.01	8550	<5.0E-10
3/21/11 1400	3/22/11 0300	0.01	7200	<5.0E-10
3/21/11 1500	3/22/11 0400	0.01	7200	<5.0E-10
3/21/11 1600	3/22/11 0500	0.01	6750	<5.0E-10
3/21/11 1700	3/22/11 0600	0.01	7200	<5.0E-10
3/21/11 1755	3/22/11 0655	0.01	7200	<5.0E-10
3/21/11 1900	3/22/11 0800	0.01	7200	<5.0E-10
3/21/11 1958	3/22/11 0858	0.01	7200	<5.0E-10
3/21/11 2100	3/22/11 1000	0.01	7200	<5.0E-10
3/21/11 2200	3/22/11 1100	0.01	7200	<5.0E-10
3/21/11 2300	3/22/11 1200	0.01	7200	<5.0E-10
3/22/11 0000	3/22/11 1300	0.01	7200	5.0E-10
3/22/11 0100	3/22/11 1400	0.01	7200	9.5E-10
3/22/11 0200	3/22/11 1500	0.01	7200	1.0E-09
3/22/11 0300	3/22/11 1600	0.01	7200	7.0E-10
3/22/11 0400	3/22/11 1700	0.01	7200	6.0E-10
3/22/11 0500	3/22/11 1800	0.01	7200	7.5E-10
3/22/11 0600	3/22/11 1900	0.01	7650	7.5E-10
3/22/11 0700	3/22/11 2000	0.01	8550	1.3E-09
3/22/11 0800	3/22/11 2100	0.01	9000	1.1E-09
3/22/11 0900	3/22/11 2200	0.01	8100	1.3E-09
3/22/11 1000	3/22/11 2300	0.01	8550	2.8E-09

3/22/11 1100	3/23/11 0000	0.01	9450	2.8E-09
3/22/11 1200	3/23/11 0100	0.01	9000	1.8E-09
3/22/11 1300	3/23/11 0200	0.01	9450	1.3E-09
3/22/11 1400	3/23/11 0300	0.01	9450	1.0E-09
3/22/11 1500	3/23/11 0400	0.01	9900	1.3E-09
3/22/11 1600	3/23/11 0500	0.01	9450	5.0E-09
3/22/11 1700	3/23/11 0600	0.01	9450	<5.0E-10
3/22/11 1800	3/23/11 0700	0.01	9900	5.0E-10
3/22/11 1900	3/23/11 0800	0.01	9900	7.5E-10
3/22/11 2000	3/23/11 0900	0.01	9900	7.5E-10
3/22/11 2100	3/23/11 1000	0.01	9900	6.0E-10
3/22/11 2200	3/23/11 1100	0.01	9900	5.0E-10
3/22/11 2300	3/23/11 1200	0.01	10000	5.0E-10
3/23/11 0000	3/23/11 1300	0.01	10000	5.0E-10
3/23/11 0100	3/23/11 1400	0.01	10000	5.0E-10
3/23/11 0200	3/23/11 1500	0.01	10000	<5.0E-10
3/23/11 0300	3/23/11 1600	0.01	10000	5.0E-10
3/23/11 0400	3/23/11 1700	0.01	9450	7.5E-10
3/23/11 0500	3/23/11 1800	0.01	9450	5.0E-10
3/23/11 0600	3/23/11 1900	0.01	7650	5.0E-10
3/23/11 0700	3/23/11 2000	0.01	8100	7.5E-10
3/23/11 0800	3/23/11 2100	0.01	8550	6.0E-10
3/23/11 0900	3/23/11 2200	0.01	9000	7.5E-10
3/23/11 1000	3/23/11 2300	0.01	10000	5.0E-10
3/23/11 1100	3/24/11 0000	0.01	9900	5.0E-10
3/23/11 1200	3/24/11 0100	0.01	10000	5.0E-10
3/23/11 1300	3/24/11 0200	0.01	9900	<5.0E-10
3/23/11 1400	3/24/11 0300	0.01	9900	<5.0E-10
3/23/11 1500	3/24/11 0400	0.01	10000	<5.0E-10
3/23/11 1600	3/24/11 0500	0.01	10000	<5.0E-10
3/23/11 1700	3/24/11 0600	0.01	9900	<5.0E-10
3/23/11 1800	3/24/11 0700	0.01	10000	<5.0E-10
3/23/11 1900	3/24/11 0800	0.01	10000	<5.0E-10
3/23/11 2000	3/24/11 0900	0.01	9900	<5.0E-10

3/23/11 2100	3/24/11 1000	0.01	9900	<5.0E-10
3/23/11 2200	3/24/11 1100	0.01	10000	<5.0E-10
3/23/11 2300	3/24/11 1200	0.01	9900	<5.0E-10
3/24/11 0000	3/24/11 1300	0.01	9900	<5.0E-10
3/24/11 0100	3/24/11 1400	0.01	2250	<5.0E-10
3/24/11 0200	3/24/11 1500	0.01	2925	<5.0E-10
3/24/11 0300	3/24/11 1600	0.01	9900	<5.0E-10
3/24/11 0400	3/24/11 1700	0.01	9900	<5.0E-10
3/24/11 0500	3/24/11 1800	0.01	9900	<5.0E-10
3/24/11 0600	3/24/11 1900	0.01	9900	<5.0E-10
3/24/11 0700	3/24/11 2000	0.01	9450	5.0E-10
3/24/11 0800	3/24/11 2100	0.01	10000	<5.0E-10
3/24/11 0900	3/24/11 2200	0.01	10000	<5.0E-10
3/24/11 1000	3/24/11 2300	0.01	9900	5.0E-10
3/24/11 1100	3/25/11 0000	0.01	9900	5.0E-10





Atsugi NAS: LAT 35.42N, LONG. 139.36E

Date and Time (EDT)	Date and Time (JST)	Radiation (mr/hr)	Frisk (pCi/Probe)	PAS (µCi/ml)
3/14/11 1912	3/15/11 0812	NONE	NONE	3.5E-09
3/14/11 2136	3/15/11 1036	0.01	495	2.7E-08
3/14/11 2148	3/15/11 1048	0.01	540	1.6E-08
3/14/11 2205	3/15/11 1105	0.01	585	2.5E-08
3/14/11 2225	3/15/11 1125	0.01	630	3.5E-08
3/14/11 2248	3/15/11 1148	0.01	788	3.6E-08
3/14/11 2302	3/15/11 1202	0.01	900	2.9E-08
3/14/11 2317	3/15/11 1217	0.02	990	4.8E-09
3/14/11 2335	3/15/11 1235	0.02	1035	6.3E-08
3/14/11 2350	3/15/11 1250	0.01	1170	5.6E-08
3/15/11 0004	3/15/11 1304	0.01	1170	2.6E-08
3/15/11 0020	3/15/11 1320	0.01	1170	2.1E-08
3/15/11 0035	3/15/11 1335	0.01	1170	5.0E-09
3/15/11 0200	3/15/11 1500	0.01	1035	3.3E-09
3/15/11 0225	3/15/11 1525	0.01	1125	1.8E-09
3/15/11 0240	3/15/11 1540	0.01	945	2.3E-09
3/15/11 0255	3/15/11 1555	0.01	855	NONE
3/15/11 0315	3/15/11 1615	0.01	1170	NONE
3/15/11 0330	3/15/11 1630	0.01	1080	NONE
3/15/11 0400	3/15/11 1700	0.01	945	NONE
3/15/11 0415	3/15/11 1715	0.01	900	NONE

3/15/11 0445	3/15/11 1745	0.01	945	NONE
3/15/11 0500	3/15/11 1800	0.01	1170	NONE
3/15/11 0515	3/15/11 1815	0.01	990	NONE
3/15/11 0530	3/15/11 1830	0.01	900	NONE
3/15/11 0600	3/15/11 1900	0.01	900	2.3E-09
3/15/11 0615	3/15/11 1915	0.01	990	2.0E-09
3/15/11 0630	3/15/11 1930	0.01	990	2.4E-09
3/15/11 0653	3/15/11 1953	0.01	990	1.8E-09
3/15/11 0700	3/15/11 2000	0.01	1125	2.3E-09
3/15/11 0715	3/15/11 2015	0.01	990	1.8E-09
3/15/11 0730	3/15/11 2030	0.01	1035	1.8E-09
3/15/11 0745	3/15/11 2045	0.01	1125	2.0E-09
3/15/11 0800	3/15/11 2100	0.01	1170	1.8E-09
3/15/11 0830	3/15/11 2130	0.01	1125	1.8E-09
3/15/11 0900	3/15/11 2200	0.01	1170	2.5E-09
3/15/11 0930	3/15/11 2230	0.01	1125	4.2E-09
3/15/11 1000	3/15/11 2300	0.01	1125	4.0E-09
3/15/11 1030	3/15/11 2330	0.01	1125	3.8E-09
3/15/11 1100	3/16/11 0000	0.01	1125	1.5E-09
3/15/11 1130	3/16/11 0030	0.01	1125	2.0E-09
3/15/11 1200	3/16/11 0100	0.01	1125	2.1E-09
3/15/11 1230	3/16/11 0130	0.01	1125	1.5E-09
3/15/11 1300	3/16/11 0200	0.01	990	1.8E-09
3/15/11 1330	3/16/11 0230	0.01	990	2.4E-09
3/15/11 1400	3/16/11 0300	0.01	990	2.9E-09
3/15/11 1430	3/16/11 0330	0.01	990	4.3E-09
3/15/11 1500	3/16/11 0400	0.01	990	5.5E-09
3/15/11 1530	3/16/11 0430	0.01	945	6.4E-09
3/15/11 1600	3/16/11 0500	0.01	945	5.0E-09
3/15/11 1630	3/16/11 0530	0.01	900	6.0E-09
3/15/11 1700	3/16/11 0600	0.01	1080	3.5E-09
3/15/11 1730	3/16/11 0630	0.01	945	2.3E-09
3/15/11 1800	3/16/11 0700	0.01	990	2.8E-09
3/15/11 1830	3/16/11 0730	0.01	1080	2.3E-09

3/15/11 1900	3/16/11 0800	0.01	1080	2.3E-09
3/15/11 1930	3/16/11 0830	0.01	1080	2.5E-09
3/15/11 2000	3/16/11 0900	0.01	1215	2.0E-09
3/15/11 2130	3/16/11 1030	0.01	1305	2.0E-09
3/15/11 2200	3/16/11 1100	0.01	1485	2.3E-09
3/15/11 2330	3/16/11 1230	0.01	1440	8.8E-10
3/16/11 0030	3/16/11 1330	0.01	1080	1.5E-09
3/16/11 0100	3/16/11 1400	0.01	1125	1.5E-09
3/16/11 0130	3/16/11 1430	0.01	990	9.0E-10
3/16/11 0300	3/16/11 1600	0.01	900	1.6E-09
3/16/11 0330	3/16/11 1630	0.01	945	1.5E-09
3/16/11 0400	3/16/11 1700	0.01	900	1.2E-09
3/16/11 0430	3/16/11 1730	0.01	900	1.2E-09
3/16/11 0500	3/16/11 1800	0.01	945	1.0E-09
3/16/11 0530	3/16/11 1830	0.01	900	8.0E-10
3/16/11 0600	3/16/11 1900	0.01	990	8.0E-10
3/16/11 0630	3/16/11 1930	0.01	900	1.2E-09
3/16/11 0700	3/16/11 2000	0.01	945	8.0E-10
3/16/11 0730	3/16/11 2030	0.01	900	9.0E-10
3/16/11 0800	3/16/11 2100	0.01	900	9.3E-10
3/16/11 0830	3/16/11 2130	0.01	990	1.1E-09
3/16/11 0900	3/16/11 2200	0.01	990	8.8E-10
3/16/11 0930	3/16/11 2230	0.01	1035	8.8E-10
3/16/11 1000	3/16/11 2300	0.01	990	9.0E-10
3/16/11 1030	3/16/11 2330	0.01	990	1.0E-09
3/16/11 1100	3/17/11 0000	0.01	1125	8.0E-10
3/16/11 1130	3/17/11 0030	0.01	1080	1.2E-09
3/16/11 1200	3/17/11 0100	0.01	900	1.0E-09
3/16/11 1230	3/17/11 0130	0.01	1125	1.0E-09
3/16/11 1300	3/17/11 0200	0.01	945	9.0E-10
3/16/11 1330	3/17/11 0230	0.01	900	8.8E-10
3/16/11 1400	3/17/11 0300	0.01	810	1.0E-09
3/16/11 1430	3/17/11 0330	0.01	810	9.0E-10
3/16/11 1500	3/17/11 0400	0.01	810	9.0E-10

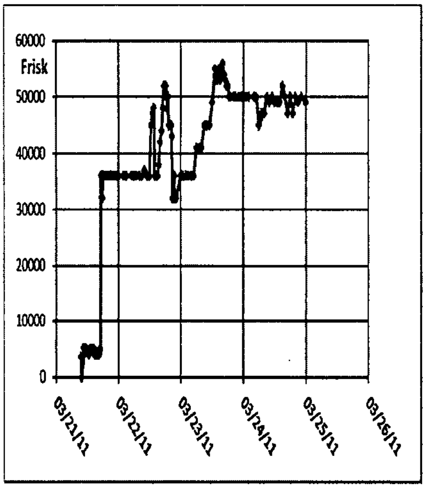
3/16/11 1530	3/17/11 0430	0.01	900	7.5E-10
3/16/11 1600	3/17/11 0500	0.01	945	1.0E-09
3/16/11 1630	3/17/11 0530	0.01	900	9.5E-10
3/16/11 1700	3/17/11 0600	0.01	810	9.0E-10
3/16/11 1730	3/17/11 0630	0.01	810	1.1E-09
3/16/11 1800	3/17/11 0700	0.01	855	1.1E-09
3/16/11 1830	3/17/11 0730	0.01	720	1.0E-09
3/16/11 1900	3/17/11 0800	0.01	1260	7.5E-10
3/16/11 1930	3/17/11 0830	0.01	1440	8.5E-10
3/16/11 2000	3/17/11 0900	0.01	1440	7.0E-10
3/16/11 2030	3/17/11 0930	0.01	810	7.0E-10
3/16/11 2100	3/17/11 1000	0.01	1035	7.5E-10
3/17/11 0930	3/17/11 2230	0.01	1215	1.1E-09
3/17/11 1000	3/17/11 2300	0.01	1575	1.1E-09
3/17/11 1030	3/17/11 2330	0.01	1035	1.0E-09
3/17/11 1100	3/18/11 0000	0.01	810	8.5E-10
3/17/11 1130	3/18/11 0030	0.01	990	1.1E-09
3/17/11 1500	3/18/11 0400	0.01	900	8.5E-10
3/17/11 1900	3/18/11 0800	0.01	990	1.1E-09
3/17/11 2300	3/18/11 1200	0.01	1170	1.0E-09
3/18/11 0700	3/18/11 2000	0.01	585	5.0E-10
3/18/11 1100	3/19/11 0000	0.01	563	5.0E-10
3/18/11 1500	3/19/11 0400	0.01	585	<5.0E-10
3/18/11 1900	3/19/11 0800	0.01	450	8.0E-10
3/18/11 2300	3/19/11 1200	0.01	675	<5.0E-10
3/19/11 0300	3/19/11 1600	0.01	675	5.0E-10
3/19/11 0700	3/19/11 2000	0.01	585	<5.0E-10
3/19/11 1100	3/20/11 0000	0.01	585	<5.0E-10
3/19/11 1500	3/20/11 0400	0.01	630	5.0E-10
3/19/11 1900	3/20/11 0800	0.01	495	5.5E-10
3/19/11 2300	3/20/11 1200	0.01	630	6.5E-10
3/20/11 0330	3/20/11 1630	0.01	585	6.5E-10
3/20/11 0400	3/20/11 1700	0.01	720	6.5E-10
3/20/11 0430	3/20/11 1730	0.01	990	5.0E-10

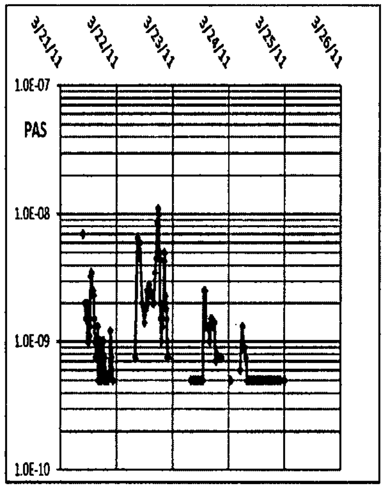
3/20/11 0500	3/20/11 1800	0.01	900	5.0E-10
3/20/11 0530	3/20/11 1830	0.01	720	5.0E-10
3/20/11 0600	3/20/11 1900	0.01	585	<5.0E-10
3/20/11 1700	3/21/11 0600	0.01	<450	2.3E-09
3/20/11 1800	3/21/11 0700	0.01	450	2.6E-09
3/20/11 1815	3/21/11 0715	0.01	450	2.5E-09
3/20/11 1830	3/21/11 0730	0.01	450	2.3E-09
3/20/11 1845	3/21/11 0745	0.01	450	2.5E-09
3/20/11 1900	3/21/11 0800	0.01	450	2.3E-09
3/20/11 1915	3/21/11 0815	0.01	450	2.3E-09
3/20/11 1930	3/21/11 0830	0.01	450	2.5E-09
3/20/11 1945	3/21/11 0845	0.01	450	3.0E-09
3/20/11 2000	3/21/11 0900	0.01	450	2.8E-09
3/20/11 2015	3/21/11 0915	0.01	450	2.5E-09
3/20/11 2030	3/21/11 0930	0.01	450	2.3E-09
3/20/11 2045	3/21/11 0945	0.01	450	2.0E-09
3/20/11 2100	3/21/11 1000	0.01	450	2.2E-09
3/20/11 2115	3/21/11 1015	0.01	450	2.3E-09
3/20/11 2130	3/21/11 1030	0.01	450	2.1E-09
3/20/11 2145	3/21/11 1045	0.01	450	2.0E-09
3/20/11 2200	3/21/11 1100	0.01	450	1.6E-09
3/20/11 2215	3/21/11 1115	0.01	450	1.3E-09
3/20/11 2230	3/21/11 1130	0.01	450	1.3E-09
3/20/11 2245	3/21/11 1145	0.01	495	1.4E-09
3/20/11 2315	3/21/11 1215	0.01	495	1.6E-09
3/20/11 2330	3/21/11 1230	0.01	450	1.3E-09
3/20/11 2345	3/21/11 1245	0.01	495	1.9E-09
3/21/11 0000	3/21/11 1300	0.01	450	1.2E-09
3/21/11 0015	3/21/11 1315	0.01	450	1.5E-09
3/21/11 0030	3/21/11 1330	0.01	450	1.8E-09
3/21/11 0045	3/21/11 1345	0.01	450	1.8E-09
3/21/11 0100	3/21/11 1400	0.01	450	2.5E-09
3/21/11 0115	3/21/11 1415	0.01	450	1.1E-09
3/21/11 0145	3/21/11 1445	0.01	450	8.0E-10

3/21/11 0200	3/21/11 1500	0.01	810	7.0E-10
3/21/11 0215	3/21/11 1515	0.01	945	9.5E-10
3/21/11 0230	3/21/11 1530	0.01	540	1.2E-09
3/21/11 0245	3/21/11 1545	0.01	900	9.5E-10
3/21/11 0300	3/21/11 1600	0.01	855	8.0E-10
3/21/11 0315	3/21/11 1615	0.01	945	6.5E-10
3/21/11 0330	3/21/11 1630	0.01	1350	8.5E-10
3/21/11 0345	3/21/11 1645	0.01	990	6.0E-10
3/21/11 0400	3/21/11 1700	0.01	900	7.0E-10
3/21/11 0415	3/21/11 1715	0.01	765	8.5E-10
3/21/11 0445	3/21/11 1745	0.01	855	8.5E-10
3/21/11 0545	3/21/11 1845	0.01	1845	1.2E-09
3/21/11 0615	3/21/11 1915	0.01	2025	1.0E-09
3/21/11 0645	3/21/11 1945	0.01	2025	1.5E-09
3/21/11 0715	3/21/11 2015	0.01	1800	1.5E-09
3/21/11 0745	3/21/11 2045	0.01	1575	1.3E-09
3/21/11 0815	3/21/11 2115	0.01	1800	1.3E-09
3/21/11 0845	3/21/11 2145	0.01	1800	1.0E-09
3/21/11 1029	3/21/11 2329	0.01	1800	5.0E-10
3/21/11 1148	3/22/11 0048	0.01	2025	5.0E-10
3/21/11 1430	3/22/11 0330	0.01	1800	5.0E-10
3/21/11 1630	3/22/11 0530	0.01	1575	5.0E-10
3/21/11 1730	3/22/11 0630	0.01	1575	<5.0E-10
3/21/11 1837	3/22/11 0737	0.01	1575	<5.0E-10
3/21/11 1930	3/22/11 0830	0.01	2025	<5.0E-10
3/21/11 2030	3/22/11 0930	0.01	2250	<5.0E-10
3/21/11 2130	3/22/11 1030	0.01	2025	5.0E-10
3/21/11 2230	3/22/11 1130	0.01	2025	5.0E-10
3/21/11 2330	3/22/11 1230	0.01	2250	5.0E-10
3/22/11 0030	3/22/11 1330	0.01	1800	6.0E-10
3/22/11 0130	3/22/11 1430	0.01	1710	6.5E-10
3/22/11 0230	3/22/11 1530	0.01	1800	<5.0E-10
3/22/11 0330	3/22/11 1630	0.01	1800	9.5E-10
3/22/11 0430	3/22/11 1730	0.01	1800	8.5E-10

3/22/11 0530	3/22/11 1830	0.01	1800	5.0E-10
3/22/11 0630	3/22/11 1930	0.01	1800	5.0E-10
3/22/11 0730	3/22/11 2030	0.01	2025	6.0E-10
3/22/11 0830	3/22/11 2130	0.01	2025	7.5E-10
3/22/11 1030	3/22/11 2330	0.01	1800	1.4E-09
3/22/11 1130	3/23/11 0030	0.01	1800	1.7E-09
3/22/11 1330	3/23/11 0230	0.01	2700	1.5E-09
3/22/11 1430	3/23/11 0330	0.01	2700	1.3E-09
3/22/11 1630	3/23/11 0530	0.01	2700	5.0E-10
3/22/11 1730	3/23/11 0630	0.01	3150	6.0E-10
3/22/11 1830	3/23/11 0730	0.01	2925	7.0E-10
3/22/11 1930	3/23/11 0830	0.01	3600	5.0E-10
3/22/11 2030	3/23/11 0930	0.01	3600	5.0E-10
3/22/11 2130	3/23/11 1030	0.01	3825	<5.0E-10
3/22/11 2230	3/23/11 1130	0.01	4050	5.0E-10
3/22/11 2330	3/23/11 1230	0.01	4050	5.0E-10
3/23/11 0030	3/23/11 1330	0.01	4050	5.0E-10
3/23/11 0130	3/23/11 1430	0.01	3825	6.0E-10
3/23/11 0230	3/23/11 1530	0.01	4950	5.0E-10
3/23/11 0330	3/23/11 1630	0.01	5400	5.0E-10
3/23/11 0430	3/23/11 1730	0.01	5400	9.0E-10
3/23/11 0530	3/23/11 1830	0.01	5400	7.5E-10
3/23/11 0630	3/23/11 1930	0.01	3375	<5.0E-10
3/23/11 0730	3/23/11 2030	0.01	3825	5.0E-10
3/23/11 0830	3/23/11 2130	0.01	1575	5.0E-10
3/23/11 1030	3/23/11 2330	0.01	2700	<5.0E-10
3/23/11 1339	3/24/11 0239	0.01	2475	<5.0E-10
3/23/11 1500	3/24/11 0400	0.01	2475	<5.0E-10
3/23/11 1900	3/24/11 0800	0.01	3375	6.0E-10
3/23/11 2100	3/24/11 1000	0.01	3150	<5.0E-10
3/23/11 2300	3/24/11 1200	0.01	3240	<5.0E-10
3/24/11 0100	3/24/11 1400	0.01	3375	<5.0E-10
3/24/11 0300	3/24/11 1600	0.01	3060	<5.0E-10
3/24/11 0500	3/24/11 1800	0.01	3645	<5.0E-10

3/24/11 0700	3/24/11 2000	0.01	3600	<5.0E-10





Ishioka (North Advanced Team): 55nm N of Yokosuka, 93nm S of Fukushima; LAT. 36.18N, LONG. 140.27E

Date and Time (EDT)	Date and Time (JST)	Radiation (mr/hr)	Frisk (pCi/probe)	PAS (µCi/mL)	RI (µCi/mL)
3/20/11 2035	3/21/11 0935	0.04	3600	7.0E-09	
3/20/11 2045	3/21/11 0945	NONE	NONE	NONE	1.60E-07
3/20/11 2200	3/21/11 1100	0.04	5220	1.5E-09	
3/20/11 2125	3/21/11 1025	0.04	5220	2.0E-09	
3/20/11 2230	3/21/11 1130	0.01	4500	2.0E-09	
3/20/11 2245	3/21/11 1145	0.04	4950	1.0E-09	<1.0E-7
3/20/11 2300	3/21/11 1200	0.01	4500	1.5E-09	
3/20/11 2315	3/21/11 1215	0.01	4500	1.0E-09	
3/20/11 2330	3/21/11 1230	0.01	4050	1.1E-09	
3/20/11 2345	3/21/11 1245	0.01	4500	1.3E-09	
3/21/11 0000	3/21/11 1300	0.06	4950	3.3E-09	
3/21/11 0015	3/21/11 1315	0.06	4950	3.5E-09	
3/21/11 0030	3/21/11 1330	0.04	4950	2.5E-09	<1.0E-7
3/21/11 0100	3/21/11 1400	0.04	4950	2.5E-09	
3/21/11 0115	3/21/11 1415	0.04	4950	2.3E-09	
3/21/11 0130	3/21/11 1430	0.04	4950	1.5E-09	
3/21/11 0145	3/21/11 1445	0.02	4050	1.0E-09	
3/21/11 0200	3/21/11 1500	0.02	4500	1.0E-09	
3/21/11 0215	3/21/11 1515	0.02	4050	7.5E-10	
3/21/11 0230	3/21/11 1530	0.02	4050	7.5E-10	
3/21/11 0245	3/21/11 1545	0.02	4500	7.5E-10	

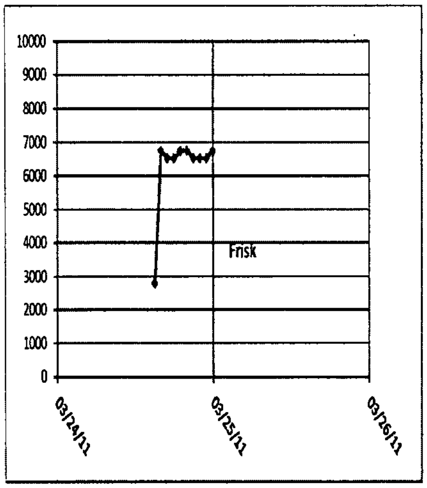
*NOTES:
1. 2045 RI results considered to be in error due to sample/analysis error.
2. Subsequent RI samples at 2245 and 0030 (3/21/11) were negative.
3. Recount of the 2045 RI sample 2hrs later had no detectable activity.

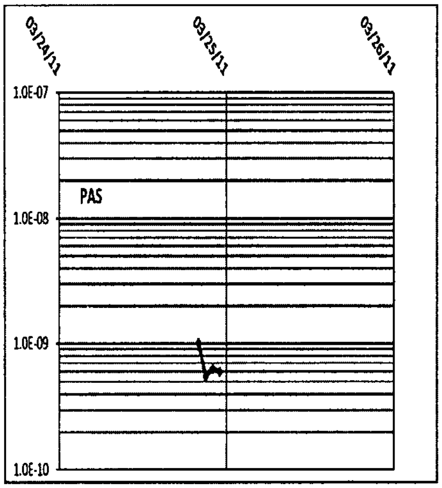
3/21/11 0300	3/21/11 1600	0.02	4500	1.3E-09
3/21/11 0315	3/21/11 1615	0.02	4050	5.0E-10
3/21/11 0330	3/21/11 1630	0.01	4050	1.0E-09
3/21/11 0345	3/21/11 1645	0.01	4950	1.0E-09
3/21/11 0400	3/21/11 1700	0.01	4950	7.5E-10
3/21/11 0415	3/21/11 1715	0.01	36000	1.0E-09
3/21/11 0430	3/21/11 1730	0.01	32000	5.0E-10
3/21/11 0445	3/21/11 1745	0.01	32000	7.5E-10
3/21/11 0500	3/21/11 1800	0.01	36000	7.5E-10
3/21/11 0515	3/21/11 1815	0.01	36000	1.0E-09
3/21/11 0530	3/21/11 1830	0.01	36000	1.0E-09
3/21/11 0545	3/21/11 1845	0.01	36000	5.0E-10
3/21/11 0600	3/21/11 1900	0.01	36000	7.5E-10
3/21/11 0630	3/21/11 1930	0.01	36000	5.0E-10
3/21/11 0700	3/21/11 2000	0.01	36000	5.0E-10
3/21/11 0730	3/21/11 2030	0.01	36000	5.0E-10
3/21/11 0800	3/21/11 2100	0.01	36000	5.5E-10
3/21/11 0830	3/21/11 2130	0.03	36000	1.2E-09
3/21/11 0900	3/21/11 2200	0.02	36000	7.5E-10
3/21/11 0930	3/21/11 2230	0.01	36000	5.0E-10
3/21/11 1000	3/21/11 2300	0.01	36000	<5.0E-10
3/21/11 1100	3/22/11 0000	0.01	36000	<5.0E-10
3/21/11 1300	3/22/11 0200	0.01	36000	<5.0E-10
3/21/11 1400	3/22/11 0300	0.01	36000	<5.0E-10
3/21/11 1600	3/22/11 0500	0.01	36000	<5.0E-10
3/21/11 1700	3/22/11 0600	0.01	36000	<5.0E-10
3/21/11 1800	3/22/11 0700	0.01	36000	<5.0E-10
3/21/11 1900	3/22/11 0800	0.01	36000	7.5E-10
3/21/11 2000	3/22/11 0900	0.01	36000	6.5E-09
3/21/11 2100	3/22/11 1000	0.02	37000	6.0E-09
3/21/11 2200	3/22/11 1100	0.01	36000	2.0E-09
3/21/11 2300	3/22/11 1200	0.01	36000	1.4E-09
3/21/11 2330	3/22/11 1230	0.01	45000	1.8E-09
3/22/11 0000	3/22/11 1300	0.01	47000	2.5E-09

3/22/11 0030	3/22/11 1330	0.01	48000	2.0E-09
3/22/11 0100	3/22/11 1400	0.01	36000	2.8E-09
3/22/11 0130	3/22/11 1430	0.02	36000	2.5E-09
3/22/11 0200	3/22/11 1500	0.01	36000	2.3E-09
3/22/11 0230	3/22/11 1530	0.01	38000	2.0E-09
3/22/11 0300	3/22/11 1600	0.01	42000	2.0E-09
3/22/11 0330	3/22/11 1630	0.01	44000	3.5E-09
3/22/11 0400	3/22/11 1700	0.01	48000	4.5E-09
3/22/11 0430	3/22/11 1730	0.01	52000	8.5E-09
3/22/11 0445	3/22/11 1745	0.02	52000	1.1E-08
3/22/11 0500	3/22/11 1800	0.02	52000	1.0E-08
3/22/11 0515	3/22/11 1815	0.02	52000	4.5E-09
3/22/11 0530	3/22/11 1830	0.01	48000	5.0E-09
3/22/11 0545	3/22/11 1845	0.02	50000	2.0E-09
3/22/11 0600	3/22/11 1900	0.01	50000	1.5E-09
3/22/11 0615	3/22/11 1915	0.02	45000	1.0E-09
3/22/11 0630	3/22/11 1930	0.02	45000	1.5E-09
3/22/11 0645	3/22/11 1945	0.02	45000	1.3E-09
3/22/11 0700	3/22/11 2000	0.02	45000	1.8E-09
3/22/11 0715	3/22/11 2015	0.02	45000	4.3E-09
3/22/11 0730	3/22/11 2030	0.04	43000	5.0E-09
3/22/11 0745	3/22/11 2045	0.04	32000	2.0E-09
3/22/11 0800	3/22/11 2100	0.04	32000	2.3E-09
3/22/11 0815	3/22/11 2115	0.03	32000	1.8E-09
3/22/11 0830	3/22/11 2130	0.01	36000	1.5E-09
3/22/11 0845	3/22/11 2145	0.03	32000	1.0E-09
3/22/11 0900	3/22/11 2200	0.03	32000	7.5E-10
3/22/11 0915	3/22/11 2215	0.03	32000	7.5E-10
3/22/11 1100	3/23/11 0000	0.03	36000	<5.0E-10
3/22/11 1130	3/23/11 0030	0.02	36000	<5.0E-10
3/22/11 1200	3/23/11 0100	0.02	36000	<5.0E-10
3/22/11 1300	3/23/11 0200	0.02	36000	<5.0E-10
3/22/11 1400	3/23/11 0300	0.02	36000	<5.0E-10
3/22/11 1500	3/23/11 0400	0.01	36000	<5.0E-10

3/22/11 1600	3/23/11 0500	0.02	36000	<5.0E-10
3/22/11 1700	3/23/11 0600	0.01	41000	<5.0E-10
3/22/11 1800	3/23/11 0700	0.03	41000	<5.0E-10
3/22/11 1900	3/23/11 0800	0.03	41000	5.0E-10
3/22/11 2000	3/23/11 0900	0.03	45000	5.0E-10
3/22/11 2100	3/23/11 1000	0.03	45000	5.0E-10
3/22/11 2200	3/23/11 1100	0.03	45000	5.0E-10
3/22/11 2300	3/23/11 1200	0.03	49000	5.0E-10
3/23/11 0000	3/23/11 1300	0.03	55000	5.0E-10
3/23/11 0030	3/23/11 1330	0.03	53000	2.5E-09
3/23/11 0100	3/23/11 1400	0.03	53000	2.5E-09
3/23/11 0130	3/23/11 1430	0.03	55000	1.3E-09
3/23/11 0200	3/23/11 1500	0.03	53000	1.3E-09
3/23/11 0230	3/23/11 1530	0.03	55000	1.3E-09
3/23/11 0300	3/23/11 1600	0.03	56000	1.0E-09
3/23/11 0330	3/23/11 1630	0.03	54000	1.5E-09
3/23/11 0400	3/23/11 1700	0.04	53000	1.5E-09
3/23/11 0430	3/23/11 1730	0.03	52000	1.3E-09
3/23/11 0500	3/23/11 1800	0.03	52000	1.4E-09
3/23/11 0530	3/23/11 1830	0.03	50000	7.0E-10
3/23/11 0600	3/23/11 1900	0.03	50000	8.0E-10
3/23/11 0700	3/23/11 2000	0.03	50000	7.5E-10
3/23/11 0800	3/23/11 2100	0.03	50000	7.5E-10
3/23/11 0900	3/23/11 2200	0.02	50000	<5.0E-10
3/23/11 1000	3/23/11 2300	0.02	50000	<5.0E-10
3/23/11 1100	3/24/11 0000	0.02	50000	<5.0E-10
3/23/11 1200	3/24/11 0100	0.02	50000	5.0E-10
3/23/11 1300	3/24/11 0200	0.02	50000	<5.0E-10
3/23/11 1500	3/24/11 0400	0.02	50000	<5.0E-10
3/23/11 1600	3/24/11 0500	0.02	50000	6.0E-10
3/23/11 1700	3/24/11 0600	0.01	45000	1.3E-09
3/23/11 1730	3/24/11 0630	0.02	46000	9.0E-10
3/23/11 1800	3/24/11 0700	0.02	47000	9.0E-10
3/23/11 1830	3/24/11 0730	0.02	47000	7.5E-10

3/23/11 1900	3/24/11 0800	0.02	47000	5.0E-10
3/23/11 2000	3/24/11 0900	0.02	50000	5.0E-10
3/23/11 2100	3/24/11 1000	0.02	49000	5.0E-10
3/23/11 2200	3/24/11 1100	0.03	50000	5.0E-10
3/23/11 2300	3/24/11 1200	0.03	49000	5.0E-10
3/24/11 0000	3/24/11 1300	0.03	49000	5.0E-10
3/24/11 0100	3/24/11 1400	0.01	49000	5.0E-10
3/24/11 0200	3/24/11 1500	0.03	52000	5.0E-10
3/24/11 0300	3/24/11 1600	0.03	50000	5.0E-10
3/24/11 0400	3/24/11 1700	0.03	47000	5.0E-10
3/24/11 0500	3/24/11 1800	0.03	50000	5.0E-10
3/24/11 0600	3/24/11 1900	0.03	47000	5.0E-10
3/24/11 0700	3/24/11 2000	0.03	50000	5.0E-10
3/24/11 0800	3/24/11 2100	0.03	49000	5.0E-10
3/24/11 0913	3/24/11 2213	0.03	50000	5.0E-10
3/24/11 1100	3/25/11 0000	0.03	49000	5.0E-10

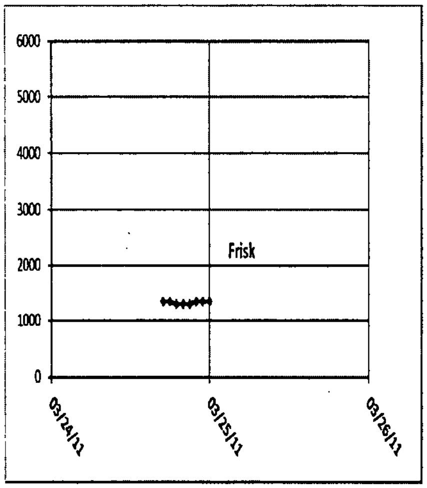


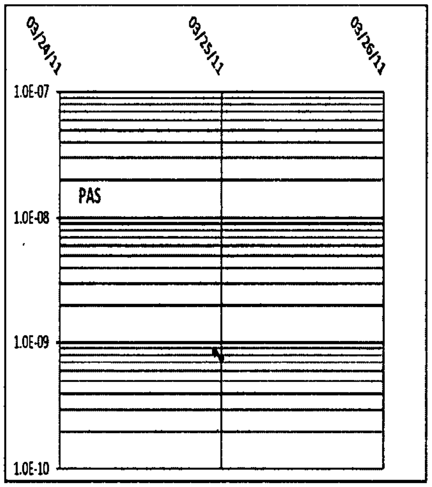


Tsukuba: LAT. 36.04N, LONG. 140.06E

Location ~ 60 miles north-east of Yokosha and 106 miles south of Fukushima

Date and Time (EDT)	Date and Time (JST)	Radiation (mr/hr)	Frisk (pCi/probe)	PAS (μCi/mL)	
3/23/11 2330	3/24/11 1230	0.01		<5.0E-10	*First Entry
3/24/11 0000	3/24/11 1300	0.01		<5.0E-10	
3/24/11 0200	3/24/11 1500	0.01	2790	<5.0E-10	
3/24/11 0300	3/24/11 1600	0.01	6750	<5.0E-10	
3/24/11 0400	3/24/11 1700	0.01	6525	<5.0E-10	
3/24/11 0500	3/24/11 1800	0.01	6525	<5.0E-10	
3/24/11 0600	3/24/11 1900	0.01	6750	<5.0E-10	
3/24/11 0700	3/24/11 2000	0.01	6750	1.0E-09	
3/24/11 0800	3/24/11 2100	0.01	6525	5.5E-10	
3/24/11 0900	3/24/11 2200	0.01	6525	6.3E-10	
3/24/11 1000	3/24/11 2300	0.01	6525	6.0E-10	
3/24/11 1100	3/25/11 0000	0.01	6750	<5.0E-10	

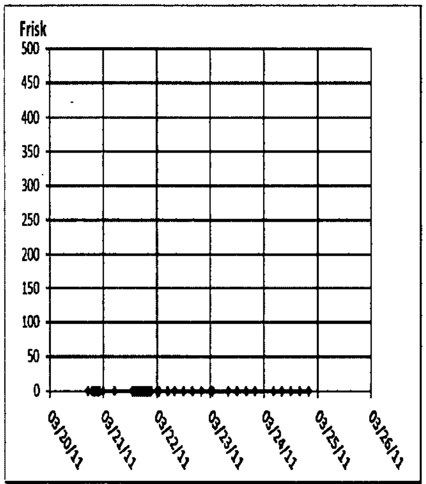


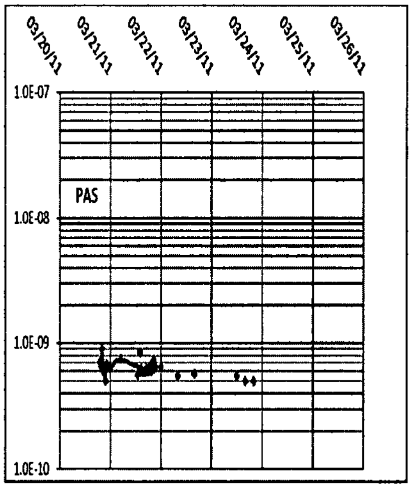


Oyama: LAT. 39.24N, LONG. 140.12E

Location ~ 72 miles north of Yokosha and 100 miles south of Fukushima

Date and Time (EDT)	Date and Time (JST)	Radiation (mr/hr)	Frisk (pCi/probe)	PAS (µCi/mL)	
3/24/11 0330	3/24/11 1630	0.01		<5.0E-10	*First Entry
3/24/11 0400	3/24/11 1700	0.01	1350	<5.0E-10	
3/24/11 0500	3/24/11 1800	0.01	1350	<5.0E-10	
3/24/11 0600	3/24/11 1900	0.01	1305	<5.0E-10	
3/24/11 0700	3/24/11 2000	0.01	1305	<5.0E-10	
3/24/11 0800	3/24/11 2100	0.01	1305	<5.0E-10	
3/24/11 0900	3/24/11 2200	0.01	1350	<5.0E-10	
3/24/11 1000	3/24/11 2300	0.01	1350	8.5E-10	
3/24/11 1100	3/25/11 0000	0.01	1350	7.5E-10	





Misawa (NAS): LAT. 40.71N, LONG. 141.37E

Date and Time (EDT)	Date and Time (JST)	Radiation (mr/hr)	Frisk (pCi/probe)	PAS (µCi/mL)
3/20/11 0400	3/20/11 1700	0.01	<450	<5.0E-10
3/20/11 0600	3/20/11 1900	0.01	<450	7.0E-10
3/20/11 0630	3/20/11 1930	0.01	<450	6.5E-10
3/20/11 0700	3/20/11 2000	0.01	<450	9.0E-10
3/20/11 0730	3/20/11 2030	0.01	<450	6.3E-10
3/20/11 0800	3/20/11 2100	0.01	<450	5.8E-10
3/20/11 0830	3/20/11 2130	0.01	<450	6.5E-10
3/20/11 0845	3/20/11 2145	0.01	<450	5.0E-10
3/20/11 0900	3/20/11 2200	0.01	<450	6.5E-10
3/20/11 0915	3/20/11 2215	0.01	<450	6.8E-10
3/20/11 1049	3/20/11 2349	0.01	<450	6.3E-10
3/20/11 1600	3/21/11 0500	0.01	<450	7.5E-10
3/21/11 0000	3/21/11 1300	0.01	<450	5.6E-10
3/21/11 0030	3/21/11 1330	0.01	<450	<5.0E-10
3/21/11 0100	3/21/11 1400	0.01	<450	8.5E-10
3/21/11 0130	3/21/11 1430	0.01	<450	6.3E-10
3/21/11 0200	3/21/11 1500	0.01	<450	5.9E-10
3/21/11 0230	3/21/11 1530	0.01	<450	<5.0E-10
3/21/11 0300	3/21/11 1600	0.01	<450	6.0E-10
3/21/11 0330	3/21/11 1630	NONE	<450	5.9E-10
3/21/11 0400	3/21/11 1700	0.01	<450	6.3E-10

3/21/11 0430	3/21/11 1730	0.01	<450	6.0E-10
3/21/11 0500	3/21/11 1800	0.01	<450	6.0E-10
3/21/11 0530	3/21/11 1830	0.01	<450	6.5E-10
3/21/11 0600	3/21/11 1900	0.01	<450	6.5E-10
3/21/11 0630	3/21/11 1930	0.01	<450	6.0E-10
3/21/11 0700	3/21/11 2000	0.01	<450	6.5E-10
3/21/11 0730	3/21/11 2030	0.01	<450	7.3E-10
3/21/11 0800	3/21/11 2100	0.01	<450	6.3E-10
3/21/11 0830	3/21/11 2130	0.01	<450	6.5E-10
3/21/11 1100	3/22/11 0000	0.01	<450	6.5E-10
3/21/11 1200	3/22/11 0100	0.01	<450	<5.0E-10
3/21/11 1600	3/22/11 0500	0.01	<450	<5.0E-10
3/21/11 1900	3/22/11 0800	0.01	<450	5.5E-10
3/21/11 2300	3/22/11 1200	0.01	<450	<5.0E-10
3/22/11 0300	3/22/11 1600	0.01	<450	5.7E-10
3/22/11 0700	3/22/11 2000	0.01	<450	<5.0E-10
3/22/11 1100	3/23/11 0000	0.01	<450	<5.0E-10
3/22/11 1200	3/23/11 0100	0.01	<450	<5.0E-10
3/22/11 1900	3/23/11 0800	0.01	<450	<5.0E-10
3/22/11 2300	3/23/11 1200	0.01	<450	5.5E-10
3/23/11 0300	3/23/11 1600	0.01	<450	5.0E-10
3/23/11 0700	3/23/11 2000	0.01	<450	5.0E-10
3/23/11 1514	3/24/11 0414	0.01	<450	<5.0E-10
3/23/11 1900	3/24/11 0800	0.01	<450	<5.0E-10
3/23/11 2300	3/24/11 1200	0.01	<450	<5.0E-10
3/24/11 0300	3/24/11 1600	0.01	<450	<5.0E-10
3/24/11 0700	3/24/11 2000	0.01	<450	<5.0E-10

From:	PMT09 Hoc
Sent:	Friday, March 25, 2011 6:27 AM
To:	PMT02 Hoc
Subject:	FW: Gamma Isotopic Analysis Results Obtained by Navy Surveys
Attachments:	RARCR.PDF; North Advance Team Doc 1.pdf; North Advance Team Doc 2.pdf; Compilation of Navy Data -- Please pass to Protective Measures Team (Gre... (65.4 KB); Gamma Counting Results.pdf; KAPL RARCR.PDF; Sample Gamma Analysis Report - Japan.pdf

-----Original Message-----
From: Hoc, PMT12
Sent: Friday, March 25, 2011 3:33 AM
To: PMT09 Hoc
Subject: FW: Gamma Isotopic Analysis Results Obtained by Navy Surveys

-----Original Message-----
From: Burrows, Charles W SES CIV NAVSEA 08 NR [mailto:(b)(6)]
Sent: Monday, March 21, 2011 11:39 PM
To: RST01 Hoc; Mueller, Troy J SES CIV NAVSEA 08 NR; browncm@nv.doe.gov; Cooper, Justin D; nitops@nnsa.doe.gov; (b)(6)
Cc: Roros, John CIV NAVSEA, 08; Brann, Jeffrey A CIV NAVSEA, 08; Smith, Jerry L; Conran, Thomas C SES CIV NAVSEA 08 NR; Naples, Elmer M SES SEA 08 NR; Donald, Kirkland H ADM SEA 08; Davenport, George M CIV SEA 08 NR
Subject: Gamma Isotopic Analysis Results Obtained by Navy Surveys

All: Attached are gamma isotopic analysis results obtained by the Navy.

The first file (RARCR.PDF) contains isotopic analysis of data (three separate rag wipe samples) from surfaces of aircraft operating off USS RONALD REAGAN on 3/13/11.

The second file (North Advance Team DOC1) contains two filtered air sample results (labeled Team One PAS 1 of 1 and Team One PAS 1 of 2) from the North Advance Team taken on 3/21 (JST).

The third file (North Advance Team DOC2) contains two filtered air sample results from Yokosuka labeled Nanaba Tower (onsite 1 and onsite 2) taken on 3/21.

The fourth file (Gamma Counting Results) contains one filtered air sample result from USS GEORGE WASHINGTON inport in Yokosuka on 3/21.

The fifth file (KAPL RARCR.PDF) contains one composite sample of five wipes taken from aircraft at Atsugi on 3/18.

The six file (Sample Gamma Analysis Report - Japan) Gamma Counting Results.pdf) contains one sample from a wipe of surface contamination on a barge in Yokosuka taken on 3/15.

The seventh file (Compilation of Navy Data) is the summary of survey data forwarded previously in order to keep all the Navy data in one e-mail.

Any questions, please call the NR ECC at 202-781-6397/8/9.

We will update this e-mail as additional data becomes available so that you alcon have a complete set of available Navy data.

C. W. Burrows

CRONOS-11 Summary of Gamma Counting Results

C12243 JAPAN CONEX BOX 0801-001 2011/03/21 12:57:58

Object S/N :	2011-00541
Object Description :	HANGAR PAS
Project :	CVN 73
Barcode/TGI Step :	
Option Switch Position =	4 Items w/No Self Shielding

Background Rate :	814.8 cps
Gross Rate :	903.0 cps
Net Rate :	88.21 cps
Count Time :	120 s
Transmission Factor :	1
Self Shield :	1
Alarm Activity :	665.0 pCi
Activity :	3929 pCi
Weight :	0 lb

COMMENTS

RCT SIGNATURE/ID NO.	DATE	TIME COMPLETE
15825	3/21/11	1259

Item Gamma Counted <=2000/<300 pCi or regulated waste gamma counted <1 pCi/g Accessible surfaces frisked <450 uuCi/probe (no frisk required of regulated bulk waste). Packaging materials have been removed and all radiological markings have been removed or covered. (N/A if item controlled)

RCT SIGNATURE/ID NO.	DATE	TIME
NA		

SUPERVISORY RCT SIGNATURE/ID NO.	DATE	TIME

RAD ENG MANAGER or DIRECTOR OF RADCON/ID NO	DATE	TIME

SHIP/PROJECT:	# OF ITEMS	C/105.5 CONTROL NUMBER(S):	
CVN 73	1	2011-00541	
SHOP/CODE REQUESTING ISO ID: C/105.3	PHONE:	ORIGINATOR (Signature/Badge): 158259	DATE: 3/21/11
TECHNICAL WORK DOCUMENT (IF APPLICABLE):		105 HP/RCT FORM COMPLETED BY (Signature/Badge): 158259	DATE: 3/11/11
ISOTOPE OF CONCERN ☐ Cobalt-60 ☒ OTHER (SPECIFY) Fallout from plume		105 HP REVIEWED BY (Signature/Badge):	DATE:
		C105.3 SUPERVISOR (Signature/Badge):	DATE:

	Rain			☐	☑		

AIRBORNE RADIOACTIVITY SURVEY RECORD — CNPM RADCON-A-5

1. SHIP/FACILITY/AREA: CVN73			3. REVIEWER SIGNATURE/ID No.: [signature] 182333			DATE: 3/21/11
2. DATE	3/21/11	3/21/11	3/21/11	3/21/11	3/21/11	3/21/11
4. SAMPLE NUMBER	1	2	3	4	5	6
5. SURVEY LOCATION	2 RAR L/L	HB 2	HB 2	HB 2	HB 2	HB2
6. REASON FOR SURVEY WORK OPERATION	Fallout	Fallout	Fallout	Fallout	Fallout	Fallout
7. INSTRUMENT	IM271	IM271	IM271	IM271	IM27	IM 271
SERIAL NUMBER	A00581	A00581	A00581	A00581	A0058	A00581
8. TIME SAMPLED	1150	1158	1224	1255	1330	1400
9. TIME COUNTED	1155	1203	1230	1300	1335	1405
11. BACKGROUND CPM	30	30	30	30	30	30
12. NET CCPM	750	1000	700	400	200	200
13. ALPHA CCPM	N/A	0	N/A	N/A	N/A	N/A
14. ACTIVITY (µCi/ml)	3.75×10^{-9}	5×10^{-9}	3.5×10^{-9}	2×10^{-9}	1×10^{-9}	1×10^{-9}
15. SURVEYOR SIGNATURE	[signature]	[signature]	[signature]	[signature]	[signature]	[signature]
ID No	180315	182817	182817	182817	182817	182817

16. REMARKS
Samples taken @ $1m^3$
HB = Hanger Bay

COPY

PSNS&IMF 5900/214 (Rev. 4-07)

SAMPLE GAMMA ANALYSIS EQUIPMENT

DET NAME	HPGE DET S/N	MCA	MCA S/N
JAPAN	09079312	DSA 1000	07077176
PCF	12089491	DSA 1000	07077177
GIANT	10079336		

U N I D E N T I F I E D P E A K S

	Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS % Uncertainty	
	1	228.4	2.4E+000	8	
	~~2~~	~~273.6~~	~~9.9E-002~~	~~81~~	NOT A PEAK
	3	284.4	2.7E-001	34	
	4	340.6	1.3E-001	59	
	~~6~~	~~505.6~~	~~5.3E-002~~	127	NOT A PEAK
	7	522.8	8.9E-002	90	
	10	636.5	1.8E-001	36	
m	12	667.7	6.9E-001	14	
	13	772.6	4.2E-001	21	
~~m~~	~~15~~	~~801.5~~	~~5.6E-002~~	~~65~~	NOT A PEA
	16	818.5	1.3E-001	41	
	~~17~~	~~895.0~~	~~2.3E-002~~	~~76~~	NOT A PEAK
	18	1048.1	1.1E-001	44	

N U C L I D E I D E N T I F I C A T I O N R E P O R T

Nuclide Name	Energy(keV)	Yield(%)
I-131	364.5*	81.20
CS-134	569.3*	15.43
	604.7*	97.60
	795.8*	85.40
CS-137	661.7*	85.21

* denotes radioisotopes identified by photopeak analysis

```
*****************************************************************************
*                 HPGE SAMPLE GAMMA ANALYSIS REPORT - JAPAN                 *
*****************************************************************************
```

```
Report Generated On      : 03/21/11  1:01:13 PM
Sample Description       : Hangar Bay PAS filter
Sample Number            : 1
Control Number           : 2011-0054
Sample Type              : ISO
Detector Name            : GIANT
Sample Quantity          :       1.0000 EA
Sample Date              : 03/21/11
Acquisition Started      : 03/21/11 12:56:11 PM
Count Time               :      300.0 seconds
Calibration File         : AIR_FILTER
Energy Cal Date          :
Efficiency Cal Date      : 07/15/08
Nuclide Library: C:\GENIE2K\CAMFILES\Waterfront.NLB
BKG File        : C:\PCNT2K\BKGFILES\G01D03B.CNF
```

A N A L Y S I S   R E S U L T S

Nuclide Name

I-131
CS-134
CS-137

Performed by: [signature] Badge No. 15825 Date: 3/21/11

Reviewed by: ______ Badge No.: ______ Date: ______

PUGET SOUND NAVAL SHIPYARD
& INTERMEDIATE MAINTENANCE FACILITY

FACSIMILE TRANSMITTAL COVER SHEET

From:

Name: David Olson Code: 105.52 Phone No. 360-476-4306

Transmitted to facsimile phone no: 518-395-6997

Total number of pages (including cover sheet): 8

Date and time sent: 3/18/11 1620

Please Deliver the Following Pages

To:

Activity: KAPL Code:

Name:

Comments/Special instructions: Laws from Aircraft Atsugi

Need help with identifying unidentified peaks

If problems occur during transmission, contact:

Name: David Olson Code: 105.52 Phone No: 476-4306

PSNS [illegible]

RADIOLOGICAL ANALYSIS REQUEST AND COUNTING RESULTS [illegible]

ATSUGIE	5 Lpms	2011 - 00524
Tail Number EP-4456 17		
N/A		BD 158259 — DATE: 3/19/11
C/105	7358	BD 158259 — 3-19-11
N/A	N/A	BD 158259 — 3-19-11
		BD 158259 — DATE: 3-19-11
		180725 — 3/19/11
		154129 — 3-18-11

@ 5/19/11

1-5	00524	NA	NA	BT		X	YES	7.3×10^5 pCi

I-131, I-132, Te-132, Cs-138, Cs-136, Cs-137

****
* SAMPLE GAMMA ANALYSIS REPORT - JAPAN *
****

Report Generated On	: 03/19/2011 6:56:26 AM
Sample Description	: Atsugi Tail # BP-6458 17
Sample Number	: I-5
Control Number	: 2011-00524
Sample Type/Filename	: WFT C:\PCNT2K\CAMFILES\NPHODLC\W1100524.CNF
Detector Name	: GIANT
Sample Quantity	: 1.000 Sm
Sample Taken On	: 03/19/2011
Acquisition Started	: 03/19/2011 4:27:03 AM
Live Time	: 3600.0 seconds
Calibration File	: 500_ML_BOTTLE
Energy Cal Date	:
Efficiency Cal Date	: 07/16/2008
Nuclide Library	: C:\GENIE2K\CAMFILES\Explume.NLB
BKG	: C:\PCNT2K\BKGFILES\G02D03B.CNF

A N A L Y S I S R E S U L T S

IDENTIFIED NUCLIDES

	Nuclide Name	Wt mean Activity (pCi /Sm)	Wt mean Activity Uncertainty	Nuclide DLC (pCi /Sm)	
	BE-7	5.462E+003	1.4E+003	2.0E+003	
X	CO-58				
	~~CO-60~~	~~1.163E+003~~	~~3.7E+002~~	~~5.0E+001~~	I-132 peak
	~~NB-95~~	~~1.131E+003~~	~~1.1E+002~~	~~1.3E+002~~	
	I-131	5.948E+004	2.7E+003	3.1E+002	
	I-132	2.118E+005	4.1E+003	1.7E+002	
	TE-132	2.138E+005	2.1E+004	3.5E+002	
	CS-134	1.045E+005	3.1E+003	1.4E+002	
	CS-136	1.857E+004	7.2E+002	1.2E+002	
	CS-137	1.180E+005	5.6E+003	1.8E+002	
	BI-212	3.534E+004	5.9E+003	3.1E+003	
	RA-226	6.644E+003	3.3E+003	4.4E+003	

UNIDENTIFIED NUCLIDES

Nuclide Name	Activity (pCi /Ea)	Activity Uncertainty	Nuclide DLC (pCi /Ea)
K-40	1.306E+002	4.5E+002	4.6E+002
CR-51	7.477E+002	2.7E+003	1.3E+003
MN-54	-5.207E+001	9.6E+001	8.2E+001
CO-58	3.991E+003	2.2E+002	1.2E+002
FE-59	8.847E+001	1.5E+002	1.3E+002
ZN-65	-2.115E+002	1.7E+002	1.5E+002
ZR-95	-7.850E+001	2.0E+002	1.7E+002
SB-124	-7.799E+003	6.4E+002	8.3E+001
SB-125	7.278E+001	5.1E+002	5.2E+002
I-133	3.170E+002	2.2E+002	1.7E+002
TL-208	-1.068E+002	2.1E+002	1.7E+002
PB-212	-3.048E+002	2.8E+002	2.4E+002
BI-214	1.655E+002	3.3E+002	2.7E+002
PB-214	2.798E+002	4.8E+002	3.8E+002
AC-228	5.746E+003	5.0E+002	4.1E+002
PA-234M	2.784E+003	1.1E+004	9.3E+003
U-235	-3.213E+003	1.3E+003	2.2E+002

SAMPLE GAMMA ANALYSIS EQUIPMENT

DET NAME	HPGE DET S/N	MCA	MCA S/N
JAPAN	09079312	DSA 1000	07077176
PCF	12089491	DSA 1000	07077177
GIANT	10079336		

UNIDENTIFIED PEAKS

	Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS % Uncertainty
M	3	140.6	3.5E+000	4 Tc99m
m	4	147.6	2.4E-001	40 I132
m	5	149.8	4.3E-001	21 ?
m	6	153.4	1.5E+000	7 Cs136
	7	163.9	1.3E+000	21 Cs136
m	9	183.2	1.9E-001	56 I-132
M	12	245.7	1.2E-001	71
m	13	250.6	2.1E-001	43 I-132
m	14	254.9	4.4E-001	23
M	16	273.7	1.2E+000	5 Cs136
m	17	278.2	4.1E-001	21 I-132
	19	328.8	7.0E-001	32
	22	387.7	2.5E-001	81
M	23	416.7	6.9E-001	17 I-132
m	24	423.3	4.0E-001	26
	25	431.8	6.0E-001	36 I-132
M	26	446.1	5.3E-001	17 I-132
m	27	459.4	2.0E+000	5

Sample 2011-03524 03/19/2011 6:56:26 AM Page 3

M	28	475.2	1.3E+000	8	
m	30	487.2	7.1E+000	5	I-132
M	33	535.3	5.0E-001	15	I-132
m	34	537.2	7.4E-001	11	
	35	546.8	1.2E+000	17	I-131
M	36	563.1	4.9E+000	2	
	46	699.7	1.0E+000	8	
	49	739.1	2.3E-001	46	
	50	751.5	8.7E-002	87	
m	53	780.1	1.1E+000	5	I-132
m	56	801.8	4.7E+000	2	
	60	852.0	2.6E-001	33	

03-19-11 06:30 Pg: 5/9

Fax sent by : 18004738723

Sample 2011-00524 03/19/2011 6:58:26 AM Page 4

	Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS % Uncertainty
M	61	863.0	4.6E-001	10 I-132
m	62	867.3	1.2E-001	31
M	63	876.7	8.2E-001	6 I-132
m	64	884.4	9.8E-002	38
	65	910.2	8.2E-001	9 I-132
	66	927.7	4.9E-001	32 I-132
	68	984.2	6.1E-001	13 I-132
M	69	1035.1	3.9E-001	9 I-132
m	70	1038.5	4.5E-001	8
	72	1083.9	1.7E-001	37
	73	1125.9	1.7E-001	35 I-132
M	75	1143.6	1.2E+000	4 I-132
m	76	1148.3	2.4E-001	13 I-132
M	77	1158.9	1.4E-001	22
m	78	1167.9	8.7E-001	5
	80	1190.4	6.5E-001	10
	81	1206.3	6.5E-002	71
	82	1235.4	1.4E+000	7 Cs136
	83	1272.6	7.3E-002	63 I-132
M	84	1290.8	7.4E-001	5 I-132
m	85	1295.4	1.6E+000	4 I-132
m	86	1298.0	8.2E-001	6 I-132
M	87	1316.8	2.1E-001	15
m	88	1321.3	7.4E-002	35
	89	1338.0	2.0E-001	24
M	90	1365.3	1.5E+000	3
M	92	1388.8	1.9E-001	6
m	94	1406.5	3.8E-002	33
	95	1433.7	5.0E-002	61
	96	1440.7	3.4E+000	2 — 9E I-132
	97	1456.7	2.6E-002	104
	98	1478.9	2.9E-001	13
	99	1499.6	1.3E-001	23
	100	1519.8	4.5E-002	55
	101	1596.6	1.3E+000	4
	102	1622.6	5.1E-001	7
	103	1644.3	2.5E-002	101 I-132
	104	1683.0	4.0E-002	69
	105	1727.6	4.0E-001	8 I-132
	106	1757.4	1.7E-001	16 I-132
	107	1778.8	5.2E-002	45 I-132
M	108	1804.1	7.6E-002	18
m	109	1811.9	2.9E-002	37
	110	1841.4	1.9E-002	79
	111	1867.0	1.7E-001	13
	112	1921.8	6.7E-001	5 I-132
	113	1946.4	5.2E-002	31
M	114	1963.8	3.3E-002	29
m	115	1970.6	6.7E-002	17
	116	2003.1	6.9E-001	5
	117	2040.4	4.1E-002	32

Sample 2011-00524 03/19/2011 6:56:26 AM Page 5

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS % Uncertainty

N U C L I D E I D E N T I F I C A T I O N R E P O R T

Nuclide Name	Energy (keV)	Yield (%)	Activity (pCi/Ea)	Activity Uncertainty
BE-7	477.6*	10.42	5.46E+003	1.4E+003
~~CO-60~~	~~1173.2*~~	~~99.90~~	~~3.15E+003~~	~~1.3E+003~~
	1332.5	99.98		
~~NB-95~~	~~765.8*~~	~~99.81~~	~~1.13E+003~~	~~1.1E+003~~
I-131	177.2*	0.26	1.15E+006	1.3E+005
	284.3*	6.06	8.07E+004	8.2E+003
	364.5*	81.20	5.91E+004	4.7E+003
	637.0*	7.27	5.55E+004	3.7E+003
	722.9*	1.80	5.53E+004	6.6E+003
I-132	262.7*	1.44	1.98E+005	3.8E+004
	505.9*	5.03	1.98E+005	2.2E+004
	522.7*	16.10	2.08E+005	2.0E+004
	621.2*	1.58	2.79E+005	2.6E+004
	630.2*	13.70	2.09E+005	2.1E+004
	650.6*	2.66	2.01E+005	3.4E+004
	667.7*	98.70	2.20E+005	1.0E+004
	669.8	4.90		
	671.6*	5.20	2.56E+005	4.1E+004
	727.2*	5.40	2.63E+005	5.5E+004
	772.6*	76.20	2.07E+005	1.3E+004
	809.3*	2.90	1.59E+005	3.4E+004
	812.2*	5.60	1.86E+005	3.6E+004
	954.5*	18.10	1.93E+005	1.6E+004
	1136.0*	2.96	2.21E+005	3.1E+004
	1173.2*	1.09	3.36E+005	6.4E+004
	1372.1*	2.47	1.87E+005	1.8E+004
	1398.6*	7.10	2.70E+005	2.5E+004
TE-132	111.8*	1.85	1.85E+005	4.5E+004
	116.3*	1.94	1.95E+005	4.7E+004
	228.2*	88.20	2.32E+005	2.8E+004
CS-134	569.3*	15.43	9.74E+004	5.6E+003
	604.7*	97.60	1.08E+005	5.6E+003
	795.8*	85.40	1.08E+005	5.1E+003
CS-136	340.5*	42.20	2.02E+004	2.1E+003
	818.5*	99.70	1.85E+004	8.8E+002
	1048.1*	80.00	1.78E+004	1.6E+003
CS-137	661.7*	85.21	1.18E+005	5.6E+003
BI-212	727.2*	6.65	1.70E+005	8.3E+003
	785.4*	1.11	4.79E+006	8.0E+003
RA-226	186.2*	3.28	6.64E+003	3.3E+003

* denotes radioisotopes identified by photopeak analysis

Sample 2011-00524 03/19/2011 6:56:26 AM Page 6

Analysis by ______ Badge No. 166972 Date 3/18/11

Reviewed by ______ Badge No. 159179 Date 3-18-11

ALL ERRORS ARE QUOTED AT 2.000 sigma

Page : 1
Sample ID : TEAM 1 Acquisition Start: 3/21/2011 2:39:19 PM

Report Generated On : 3/21/2011 2:56:03 PM

```
Sample Description : TM 1 PAS 2 OF 2 03212011
Sample ID          : TEAM 1          Sample Quantity :      1.000 FILTER
Sample Filename    : C:\PCNT2K\CAMFILES\CR1START\CR100027.CNF
Sample Type        : CR1
Sample Requestor   :                 Barcode Number  :
Sample Analyst     : manager
Background File    : C:\PCNT2K\BKGFILES\G00D07B.CNF
Background Date    :
NID Library        : C:\GENIE2K\CAMFILES\STARTUP 05.NLB
NID Library Title  : STARTUP RADIOCHEMISTRY 2005
ASF Name           : Startup Sample Report (NO Bkg)

                ---- Q2 Sample Information ----

Matrix Volume (Liters) :     0.000    Percent Full     :    0
Density                :     0.00     Dose Rate (mR/hr):      0.00

                ---- Sample Deposition Information ----

Dep. Correction?       : No            Deposition End    : 3/21/2011   2:39:19 PM
Dep. Duration (minutes) :              Deposition Start  :

                ---- Sample Decay/Count Information ----

Acquisition Start: 3/21/2011   2:39:19 PM Sample Taken On  : 3/21/2011   2:39:19 PM
Elapsed Live Time:    1000.0 seconds      Elapsed Real Time:    1002.0 seconds
Decay Time (minutes) :       0.00         % Dead Time      :    0.20
Elapsed Time From Sample Time to Midpoint of Sample Count :      8.35 Minutes OR    0.14 Hours

                ---- Detector Parameters ----

Detector Name    : CAN7252               Counting Geometry   : FP, 11/11
Energy Cal. Time: 3/21/2011   7:29:39 AM Energy Cal. Operator:
Shape Cal. Time  : 3/21/2011   7:29:39 AM Shape Cal. Operator :
Eff. Cal. Time   : 1/11/2011   2:37:46 PM Eff. Cal. Operator  :

                ---- Processing Parameters ----

Start Channel    :   100              End Channel          :  4096
Start Energy     :  52.0              End Energy           : 2041.6
Sensitivity      :  3.00              MDA Width(FWHM)      :   0.00
Critical Level   : NO                 MDA Confidence Level :  5.0000 %
Efficiency Type  : DUAL               Energy Tolerance     :   1.500 keV
keV/channel      :   0.497898         Offset               :  2.230776
```

WHERE: NORTH ADVANCE TEAM
TIME: 0845

Peak Analysis Report
Sample ID : TEAM 1 Acqusition Start : 3/21/11 2:39:19 PM

	Peak No.	It	Energy (keV)	Gross Peak Area	Continuum Counts	FWHM	Peak Centroid	PW	%Error	Fit	Peak Efficency
	1	0	230.15	506	70	1.10	457.77	10	10.19	0.00E+000	1.19E-001
	2	0	286.00	93	51	1.49	569.93	10	31.11	0.00E+000	1.02E-001
	3	0	365.96	864	59	1.20	730.53	11	7.34	0.00E+000	8.38E-002
	4	0	570.25	26	20	1.21	1140.84	7	60.51	0.00E+000	5.50E-002
	5	0	605.60	259	15	1.27	1211.84	11	13.27	0.00E+000	5.17E-002
M	6	8	631.34	21	16	1.17	1263.53	24	52.31	1.52E+000	4.95E-002
m	7	8	637.85	54	21	1.17	1276.60	24	31.27	1.52E+000	4.90E-002
M	8	4	662.46	222	15	1.22	1326.04	24	13.62	1.12E+000	4.71E-002
m	9	4	668.50	146	17	1.22	1338.16	24	16.96	1.12E+000	4.66E-002
	10	0	773.03	117	12	1.48	1548.10	11	20.68	0.00E+000	4.00E-002
	11	0	796.41	183	14	1.46	1595.06	11	16.04	0.00E+000	3.87E-002
	12	0	818.78	23	9	1.32	1639.99	8	55.24	0.00E+000	3.76E-002
	13	0	1460.53	28	0	1.07	2928.91	11	37.80	0.00E+000	2.12E-002

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

Peak.Efficiency Report Page 3
Sample ID : TEAM 1 Acqusition Start : 3/21/11 2:39:19 PM

Peak No.	Energy (keV)	Net Count Rate (cps)	Net Count Rate Uncert. (cps)	Peak Efficiency	Efficiency Uncertainty
1	230.15	5.059E-001	5.153E-002	1.19E-001	1.36E-002
2	286.00	9.282E-002	2.888E-002	1.02E-001	7.22E-003
3	365.96	8.639E-001	6.338E-002	8.38E-002	4.78E-003
4	570.25	2.636E-002	1.595E-002	5.50E-002	2.65E-003
5	605.60	2.586E-001	3.432E-002	5.17E-002	2.53E-003
M 6	631.34	2.120E-002	1.109E-002	4.95E-002	2.50E-003
m 7	637.85	5.397E-002	1.688E-002	4.90E-002	2.49E-003
M 8	662.46	2.220E-001	3.023E-002	4.71E-002	2.48E-003
m 9	668.50	1.462E-001	2.481E-002	4.66E-002	2.48E-003
10	773.03	1.168E-001	2.415E-002	4.00E-002	2.38E-003
11	796.41	1.832E-001	2.939E-002	3.87E-002	2.33E-003
12	818.78	2.318E-002	1.280E-002	3.76E-002	2.27E-003
13	1460.53	2.800E-002	1.058E-002	2.12E-002	1.50E-003

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

```
*****************************************************************
*****   N U C L I D E   I D E N T I F I C A T I O N   R E P O R T   *****
*****************************************************************
```

Sample Title: Crud Count #1
Nuclide Library Used: C:\GENIE2K\CAMFILES\STARTUP_05.NLB

.... IDENTIFIED NUCLIDES ....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/FILT)	Activity Uncertainty
I-131	0.703	80.18	2.62		
		284.30	6.14		
		364.49*	81.70	3.412E-004	3.171E-005
		636.99*	7.17	4.154E-004	1.316E-004
		722.91	1.77		
I-132	0.478	262.90	1.28		
		505.79	4.93		
		522.65	15.99		
		547.20	1.14		
		621.20	1.58		
		630.19*	13.32	9.057E-005	4.760E-005
		650.50	2.57		
		667.72*	98.70	8.957E-005	1.592E-005
		669.80	4.64		
		671.40	3.45		
		727.10	5.33		
		728.40	1.58		
		772.60*	75.60	1.089E-004	2.345E-005
		780.00	1.18		
		809.50	2.57		
		812.00	5.53		
		876.60	1.04		
		954.55	17.57		
		1143.30	1.35		
		1172.90	1.09		
		1290.80	1.13		
		1295.10	1.88		
		1372.07	2.47		
		1398.57	7.01		
		1442.56	1.40		
		1921.08	1.23		
		2002.20	1.14		
Cs-137	0.955	661.66*	85.10	1.498E-004	2.188E-005

* = Energy line found in the spectrum.
Energy Tolerance : 1.500 keV
Nuclide confidence index threshold = 0.10
Errors quoted at 2.000 sigma

********** U N I D E N T I F I E D   P E A K S **********

Peak Locate Performed on: 3/21/2011 2:56:02 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 4096

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	230.15	5.0592E-001	10.19		
2	286.00	9.2823E-002	31.11		
4	570.25	2.6364E-002	60.51		
5	605.60	2.5856E-001	13.27	Tol.	Br-82 Sb-125
11	796.41	1.8325E-001	16.04		
12	818.78	2.3180E-002	55.24		
13	1460.53	2.8000E-002	37.80		

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

Nuclide MDA Report
Sample ID : TEAM 1

Nuclide Name	Energy (keV)	Bkgd Sum	Yield (%)	Line MDA (uCi/FILTER)	Nuclide MDA (uCi/FILTER)	Activity (uCi/FILTER)	Act.Error (uCi/FILTER)	Act/ MDA
Co-60	1173.24	16	99.97	2.218E-005		5.186E-006	1.540E-005	2.3E-001
	1332.50	10	99.99	2.045E-005	2.045E-005	9.364E-006	9.261E-006	4.6E-001
Sb-125	35.49	158	4.29	1.541E-002		1.261E-002	9.415E-003	8.2E-001
	116.95	102	0.28	3.011E-003		-1.675E-004	1.841E-003	-5.6E-002
	172.72	128	0.20	5.223E-003		-7.380E-004	3.534E-003	-1.4E-001
	176.31	143	6.82	1.624E-004		2.687E-005	1.057E-004	1.7E-001
	204.14	114	0.33	3.370E-003		-1.084E-003	2.345E-003	-3.2E-001
	208.08	137	0.24	5.044E-003		-4.200E-004	3.394E-003	-8.3E-002
	227.89	578	0.13	1.988E-002		-3.848E-003	3.577E-003	-1.9E-001
	321.03	66	0.41	2.857E-003		7.909E-005	1.848E-003	2.8E-002
	380.45	68	1.52	9.037E-004		-2.669E-006	6.237E-004	-3.0E-003
	408.07	59	0.18	7.421E-003		-9.169E-004	5.169E-003	-1.2E-001
	427.88	72	29.60	5.281E-005	5.281E-005	8.933E-006	3.497E-005	1.7E-001
	443.55	68	0.30	5.218E-003		1.934E-003	3.297E-003	3.7E-001
	463.36	68	10.49	1.563E-004		-1.458E-005	1.096E-004	-9.3E-002
	600.60	47	17.86	1.004E-004		-1.748E-004	1.049E-004	-1.7E+000
	606.72	282	5.03	8.422E-004		2.537E-003	4.185E-004	3.0E+000
	635.95	107	11.31	2.473E-004		2.751E-004	1.452E-004	1.1E+000
	671.45	189	1.79	2.164E-003		-4.981E-004	6.374E-004	-2.3E-001
I-130	418.01	72	34.15	4.514E-005		6.343E-006	3.012E-005	1.4E-001
	536.09	49	99.00	1.656E-005	1.656E-005	1.411E-006	1.097E-005	8.5E-002
	539.10	41	1.40	1.088E-003		7.432E-005	7.256E-004	6.8E-002
	586.05	45	1.69	1.020E-003		-3.245E-004	8.064E-004	-3.2E-001
	668.54	189	96.13	4.053E-005		-4.813E-006	5.985E-006	-1.2E-001
	685.99	21	1.07	1.350E-003		-6.760E-004	1.141E-003	-5.0E-001
	739.48	24	82.27	2.016E-005		-4.101E-006	1.558E-005	-2.0E-001
	1157.47	11	11.29	1.663E-004		3.313E-005	1.016E-004	2.0E-001
I-131	80.18	94	2.62	5.608E-004	5.608E-004	-4.365E-004	3.803E-004	-7.8E-001
	284.30	154	6.14	2.601E-004		-2.754E-005	6.335E-005	-1.1E-001
	364.49*	0	81.70	1.647E-005	1.647E-005	3.412E-004	3.171E-005	2.1E+001
	636.99*	0	7.17	1.851E-004		4.154E-004	1.316E-004	2.2E+000
	722.91	30	1.77	1.002E-003		-2.059E-004	7.872E-004	-2.1E-001
I-132	262.90	83	1.28	9.138E-004	9.138E-004	3.129E-004	5.704E-004	3.4E-001
	505.79	52	4.93	3.332E-004		-2.656E-004	2.708E-004	-8.0E-001
	522.65	66	15.99	1.187E-004		7.570E-005	7.060E-005	6.4E-001
	547.20	41	1.14	1.406E-003		4.019E-004	8.748E-004	2.9E-001
	621.20	35	1.58	1.071E-003		4.967E-004	6.336E-004	4.6E-001
	630.19*	0	13.32	9.042E-005		9.057E-005	4.760E-005	1.0E+000
	650.50	30	2.57	6.452E-004		3.547E-005	4.459E-004	5.5E-002
	667.72*	0	98.70	1.345E-005	1.345E-005	8.957E-005	1.592E-005	6.7E+000
	669.80	188	4.64	8.684E-004		-1.440E-004	1.745E-004	-1.7E-001
	671.40	192	3.45	1.181E-003		-2.276E-004	3.183E-004	-1.9E-001

```
Sample ID        : TEAM ONE          Acquisition Start: 3/21/2011   2:20:48 PM

Report Generated On              : 3/21/2011   2:37:32 PM

Sample Description : TM 1 PAS 1 OF 2 03212011
Sample ID          : TEAM ONE              Sample Quantity :       1.000 FILTER
Sample Filename    : C:\PCNT2K\CAMFILES\CRISTART\CR100026.CNF
Sample Type        : CR1
Sample Requestor   :                       Barcode Number   :
Sample Analyst     : manager
Background File    : C:\PCNT2K\BKGFILES\G00D07B.CNF
Background Date    :
NID Library        : C:\GENIE2K\CAMFILES\STARTUP 05.NLB
NID Library Title  : STARTUP RADIOCHEMISTRY 2005
ASF Name           : Startup Sample Report (NO Bkg)

                     ---- Q2 Sample Information ----

Matrix Volume (Liters) :      0.000    Percent Full      :    0
Density                :      0.00     Dose Rate (mR/hr):       0.00

                     ---- Sample Deposition Information ----

Dep. Correction?       : No              Deposition End   : 3/21/2011   2:20:48 PM
Dep. Duration (minutes) :                Deposition Start :

                     ---- Sample Decay/Count Information ----

Acquisition Start: 3/21/2011   2:20:48 PM Sample Taken On   : 3/21/2011   2:20:48 PM
Elapsed Live Time:     1000.0 seconds     Elapsed Real Time:     1002.2 seconds
Decay Time (minutes) :        0.00        % Dead Time       :    0.22
Elapsed Time From Sample Time to Midpoint of Sample Count :       8.35 Minutes OR    0.14 Hours

                     ---- Detector Parameters ----

Detector Name    : CAN7252               Counting Geometry   : FB, 11/11
Energy Cal. Time: 3/21/2011    7:29:39 AM  Energy Cal. Operator:
Shape Cal. Time : 3/21/2011    7:29:39 AM  Shape Cal. Operator :
Eff. Cal. Time  : 1/11/2011    2:37:46 PM  Eff. Cal. Operator  :

                     ---- Processing Parameters ----

Start Channel    :    100           End Channel          :  4096
Start Energy     :   52.0           End Energy           : 2041.6
Sensitivity      :   3.00           MDA Width(FWHM)      :    0.00
Critical Level   : NO               MDA Confidence Level :  5.0000 %
Efficiency Type  : DUAL             Energy Tolerance     :    1.500 keV
keV/channel      :   0.497898       Offset               :    2.230776
```

WHERE: NORTH ADVANCE TEAM
TIME: 0900

Peak Analysis Report
Sample ID : TEAM ONE

Acqusition Start : 3/21/11 2:20:48 PM

Peak No.	It	Energy (keV)	Gross Peak Area	Continuum Counts	FWHM	Peak Centroid	PW	%Error	Fit	Peak Efficency
1	0	82.44	118	173	0.73	161.11	8	36.58	0.00E+000	9.39E-002
2	0	142.65	252	181	1.06	282.03	8	19.70	0.00E+000	1.62E-001
3	0	230.14	873	119	1.03	457.75	8	7.65	0.00E+000	1.19E-001
4	0	286.05	348	110	1.12	570.04	10	14.03	0.00E+000	1.02E-001
5	0	365.94	4429	99	1.26	730.49	11	3.08	0.00E+000	8.38E-002
6	0	523.60	58	52	1.28	1047.13	12	47.80	0.00E+000	6.00E-002
7	0	605.62	195	27	1.34	1211.87	12	16.60	0.00E+000	5.17E-002
8	0	637.72	255	30	1.44	1276.35	12	14.29	0.00E+000	4.90E-002
M 9	4	662.46	227	16	1.27	1326.03	24	13.52	1.03E+000	4.71E-002
m 10	4	668.48	239	34	1.27	1338.12	24	13.54	1.03E+000	4.66E-002
11	0	723.62	50	26	1.92	1448.86	10	42.69	0.00E+000	4.29E-002
12	0	773.10	200	21	1.56	1548.25	13	16.00	0.00E+000	3.99E-002
13	0	796.30	166	13	1.99	1594.85	12	17.05	0.00E+000	3.87E-002
14	0	954.84	37	13	0.89	1913.27	12	45.73	0.00E+000	3.20E-002
15	0	1460.85	20	9	1.82	2929.56	9	61.91	0.00E+000	2.12E-002

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

Peak Efficiency Report
Sample ID : TEAM ONE

Acqusition Start : 3/21/11 2:20:48 PM

Peak No.	Energy (keV)	Net Count Rate (cps)	Net Count Rate Uncert. (cps)	Peak Efficiency	Efficiency Uncertainty
1	82.44	1.181E-001	4.320E-002	9.39E-002	6.15E-003
2	142.65	2.518E-001	4.959E-002	1.62E-001	8.74E-003
3	230.14	8.734E-001	6.685E-002	1.19E-001	1.36E-002
4	286.05	3.480E-001	4.882E-002	1.02E-001	7.21E-003
5	365.94	4.429E+000	1.366E-001	8.38E-002	4.78E-003
6	523.60	5.761E-002	2.754E-002	6.00E-002	3.00E-003
7	605.62	1.951E-001	3.239E-002	5.17E-002	2.53E-003
8	637.72	2.547E-001	3.639E-002	4.90E-002	2.49E-003
M 9	662.46	2.268E-001	3.067E-002	4.71E-002	2.48E-003
m 10	668.48	2.386E-001	3.230E-002	4.66E-002	2.48E-003
11	723.62	5.026E-002	2.146E-002	4.29E-002	2.45E-003
12	773.10	1.999E-001	3.199E-002	3.99E-002	2.38E-003
13	796.30	1.655E-001	2.823E-002	3.87E-002	2.33E-003
14	954.84	3.661E-002	1.674E-002	3.20E-002	1.77E-003
15	1460.85	2.018E-002	1.249E-002	2.12E-002	1.50E-003

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

****
***** N U C L I D E   I D E N T I F I C A T I O N   R E P O R T *****
****

Sample Title: Crud Count #1
Nuclide Library Used: C:\GENIE2K\CAMFILES\STARTUP_05.NLB

.... IDENTIFIED NUCLIDES ....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/FILT)	Activity Uncertainty
I-131	0.727	80.18	2.62		
		284.30	6.14		
		364.49*	81.70	1.749E-003	1.135E-004
		636.99*	7.17	1.960E-003	2.972E-004
		722.91*	1.77	1.789E-003	7.705E-004
I-132	0.592	262.90	1.28		
		505.79	4.93		
		522.65*	15.99	1.692E-004	8.132E-005
		547.20	1.14		
		621.20	1.58		
		630.19	13.32		
		650.50	2.57		
		667.72*	98.70	1.461E-004	2.125E-005
		669.80	4.64		
		671.40	3.45		
		727.10	5.33		
		728.40	1.58		
		772.60*	75.60	1.865E-004	3.185E-005
		780.00	1.18		
		809.50	2.57		
		812.00	5.53		
		876.60	1.04		
		954.55*	17.57	1.837E-004	8.460E-005
		1143.30	1.35		
		1172.90	1.09		
		1290.80	1.13		
		1295.10	1.88		
		1372.07	2.47		
		1398.57	7.01		
		1442.56	1.40		
		1921.08	1.23		
		2002.20	1.14		
Xe-133	0.862	81.00*	38.00	8.953E-005	3.327E-005
Cs-137	0.956	661.66*	85.10	1.531E-004	2.222E-005

* = Energy line found in the spectrum.
Energy Tolerance : 1.500 keV
Nuclide confidence index threshold = 0.10
Errors quoted at 2.000 sigma

********** U N I D E N T I F I E D   P E A K S **********

Peak Locate Performed on: 3/21/2011 2:37:31 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 4096

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
2	142.65	2.5178E-001	19.70		
3	230.14	8.7336E-001	7.65		
4	286.05	3.4805E-001	14.03		
7	605.62	1.9512E-001	16.60	Sum	
13	796.30	1.6552E-001	17.05		
15	1460.85	2.0181E-002	61.91		

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

Nuclide MDA Report
Sample ID : TEAM ONE

Nuclide Name	Energy (keV)	Bkgd Sum	Yield (%)	Line MDA (uCi/FILTER)	Nuclide MDA (uCi/FILTER)	Activity (uCi/FILTER)	Act.Error (uCi/FILTER)	Act/ MDA
Co-60	1173.24	24	99.97	2.653E-005		1.968E-005	1.289E-005	7.4E-001
	1332.50	12	99.99	2.210E-005	2.210E-005	-1.027E-006	1.734E-005	-4.6E-002
Sb-125	35.49	334	4.29	2.210E-002		6.326E-003	1.333E-002	2.9E-001
	116.95	199	0.28	4.141E-003		-2.108E-003	2.614E-003	-5.1E-001
	172.72	322	0.20	8.134E-003		-2.555E-003	5.634E-003	-3.1E-001
	176.31	332	6.82	2.435E-004		-8.221E-005	1.694E-004	-3.4E-001
	204.14	353	0.33	5.798E-003		1.275E-003	3.859E-003	2.2E-001
	208.08	345	0.24	7.864E-003		1.094E-003	5.257E-003	1.4E-001
	227.89	1097	0.13	2.720E-002		-1.398E-001	3.103E-002	-5.1E+000
	321.03	117	0.41	3.741E-003		3.902E-004	2.439E-003	1.0E-001
	380.45	102	1.52	1.093E-003		-1.259E-004	7.710E-004	-1.2E-001
	408.07	89	0.18	8.995E-003		1.251E-003	6.123E-003	1.4E-001
	427.88	76	29.60	5.417E-005	5.417E-005	-7.676E-006	3.801E-005	-1.4E-001
	443.55	88	0.30	5.888E-003		2.139E-003	3.783E-003	3.6E-001
	463.36	109	10.49	1.952E-004		6.481E-005	1.294E-004	3.3E-001
	600.60	61	17.86	1.133E-004		4.302E-006	6.447E-005	3.8E-002
	606.72	230	5.03	7.633E-004		-9.702E-005	1.308E-004	-1.3E-001
	635.95	306	11.31	4.091E-004		-1.660E-005	6.781E-005	-4.1E-002
	671.45	318	1.79	2.780E-003		-5.173E-004	1.024E-003	-1.9E-001
I-130	418.01	106	34.15	5.416E-005		1.252E-006	3.734E-005	2.3E-002
	536.09	56	99.00	1.762E-005	1.762E-005	-6.109E-006	1.281E-005	-3.5E-001
	539.10	62	1.40	1.317E-003		3.814E-004	8.391E-004	2.9E-001
	586.05	54	1.69	1.110E-003		2.214E-005	7.798E-004	2.0E-002
	668.54	325	96.13	5.264E-005		5.043E-007	1.007E-005	9.6E-003
	685.99	41	1.07	1.825E-003		-1.651E-004	1.397E-003	-9.0E-002
	739.48	29	82.27	2.195E-005		-1.390E-006	1.598E-005	-6.3E-002
	1157.47	14	11.29	1.844E-004		1.244E-005	1.263E-004	6.7E-002
+ I-131	80.18	198	2.62	7.996E-004	7.996E-004	-1.863E-004	3.140E-004	-2.3E-001
	284.30	488	6.14	4.540E-004		-1.399E-005	8.210E-005	-3.1E-002
	364.49*	0	81.70	2.098E-005	2.098E-005	1.749E-003	1.135E-004	8.3E+001
	636.99*	0	7.17	2.421E-004		1.960E-003	2.972E-004	8.1E+000
	722.91*	0	1.77	1.039E-003		1.789E-003	7.705E-004	1.7E+000
+ I-132	262.90	156	1.28	1.232E-003	1.232E-003	-2.064E-004	8.431E-004	-1.7E-001
	505.79	91	4.93	4.328E-004		2.071E-004	2.738E-004	4.8E-001
	522.65*	0	15.99	1.190E-004		1.692E-004	8.132E-005	1.4E+000
	547.20	60	1.14	1.676E-003		2.334E-004	1.109E-003	1.4E-001
	621.20	44	1.58	1.190E-003		-3.264E-004	8.898E-004	-2.7E-001
	630.19	64	13.32	1.702E-004		6.483E-005	1.115E-004	3.8E-001
	650.50	43	2.57	7.602E-004		3.820E-004	4.654E-004	5.0E-001
	667.72*	0	98.70	1.821E-005	1.821E-005	1.461E-004	2.125E-005	8.0E+000
	669.80	318	4.64	1.119E-003		-6.934E-005	2.910E-004	-6.2E-002
	671.40	320	3.45	1.511E-003		-2.187E-004	5.169E-004	-1.4E-001

Nuclide MDA Report
Sample ID : TEAM ONE

Page 7
3/21/11 2:20:48 PM

Nuclide Name	Energy (keV)	Bkgd Sum	Yield (%)	Line MDA (uCi/FILTER)	Nuclide MDA (uCi/FILTER)	Activity (uCi/FILTER)	Act.Error (uCi/FILTER)	Act/ MDA
+ I-132	727.10	102	5.33	6.162E-004	6.162E-004	8.036E-005	1.927E-004	1.3E-001
	728.40	79	1.58	1.847E-003		-2.729E-004	8.182E-004	-1.5E-001
	772.60*	0	75.60	2.547E-005		1.865E-004	3.185E-005	7.3E+000
	780.00	46	1.18	2.060E-003		-3.443E-004	1.542E-003	-1.7E-001
	809.50	41	2.57	9.381E-004		3.357E-004	6.456E-004	3.6E-001
	812.00	41	5.53	4.370E-004		-5.731E-005	3.403E-004	-1.3E-001
	876.60	21	1.04	1.868E-003		-4.988E-004	1.465E-003	-2.7E-001
	954.55*	0	17.57	1.090E-004		1.837E-004	8.460E-005	1.7E+000
	1143.30	13	1.35	1.524E-003		-8.332E-004	1.362E-003	-5.5E-001
	1172.90	24	1.09	2.547E-003		1.889E-003	1.237E-003	7.4E-001
	1290.80	17	1.13	2.312E-003		1.087E-004	1.675E-003	4.7E-002
	1295.10	19	1.88	1.461E-003		6.482E-004	8.566E-004	4.4E-001
	1372.07	13	2.47	9.928E-004		-2.352E-005	8.357E-004	-2.4E-002
	1398.57	45	7.01	6.193E-004		6.491E-004	3.217E-004	1.0E+000
	1442.56	24	1.40	2.393E-003		1.263E-003	1.387E-003	5.3E-001
	1921.08	0	1.23	3.657E-004		0.000E+000	0.000E+000	0.0E+000
	2002.20	3	1.14	1.632E-003		1.895E-004	1.086E-003	1.2E-001
I-133	510.53	92	1.83	1.143E-003		3.655E-004	7.437E-004	3.2E-001
	529.87	69	87.00	2.177E-005	2.177E-005	-3.223E-006	1.427E-005	-1.5E-001
	706.58	26	1.51	1.085E-003		-1.026E-004	7.968E-004	-9.5E-002
	856.28	18	1.24	1.367E-003		2.452E-005	1.030E-003	1.8E-002
	875.33	23	4.51	4.305E-004		1.496E-006	3.049E-004	3.5E-003
	1236.44	20	1.51	1.717E-003		6.208E-004	1.065E-003	3.6E-001
	1298.22	17	2.35	1.073E-003		2.695E-004	7.071E-004	2.5E-001
I-134	135.40	202	4.29	2.952E-004		-2.610E-005	1.808E-004	-8.8E-002
	235.47	181	2.13	7.902E-004		-2.380E-003	8.983E-004	-3.0E+000
	405.45	75	7.35	2.301E-004		3.040E-005	1.534E-004	1.3E-001
	433.35	85	4.14	4.601E-004		-8.647E-005	3.258E-004	-1.9E-001
	458.92	117	1.31	1.789E-003		9.889E-004	1.139E-003	5.5E-001
	488.88	75	1.45	1.390E-003		3.760E-004	9.101E-004	2.7E-001
	514.40	86	2.23	1.013E-003		6.449E-004	6.341E-004	6.4E-001
	540.83	60	7.63	2.632E-004		6.801E-005	1.688E-004	2.6E-001
	595.36	46	11.07	1.771E-004		-2.585E-005	1.286E-004	-1.5E-001
	621.79	44	10.59	1.898E-004		-4.228E-005	1.414E-004	-2.2E-001
	627.96	59	2.21	1.051E-003		-5.964E-005	7.610E-004	-5.7E-002
	677.34	43	7.92	2.748E-004		-1.649E-004	2.620E-004	-6.0E-001
	730.74	39	1.82	1.238E-003		-1.551E-004	9.384E-004	-1.3E-001
	766.68	32	4.14	5.238E-004		3.399E-004	2.623E-004	6.5E-001
	847.03	15	95.40	1.804E-005		-6.094E-007	1.358E-005	-3.4E-002
	857.29	20	6.68	2.963E-004		2.992E-005	2.150E-004	1.0E-001
	884.09	15	64.87	2.776E-005		-9.176E-006	2.275E-005	-3.3E-001
	947.86	16	4.00	5.248E-004		4.676E-005	3.849E-004	8.9E-002
	974.67	14	4.77	4.057E-004		-1.008E-004	3.106E-004	-2.5E-001
	1040.25	15	2.02	1.054E-003		-1.296E-004	7.877E-004	-1.2E-001
	1072.55	12	14.88	1.341E-004		-4.840E-005	1.141E-004	-3.6E-001
	1136.16	14	9.06	2.493E-004		1.084E-005	1.803E-004	4.3E-002
	1455.24	25	2.29	1.607E-003		-5.603E-004	9.845E-004	-3.5E-001
	1613.80	5	4.29	4.731E-004		-1.804E-004	4.690E-004	-3.8E-001
	1741.49	4	2.56	7.748E-004		2.580E-004	2.586E-004	3.3E-001
	1806.84	4	5.53	3.687E-004	3.687E-004	1.228E-004	1.231E-004	3.3E-001
I-135	220.50	236	1.76	9.437E-004		-2.500E-004	6.521E-004	-2.6E-001

Nuclide MDA Report
Sample ID : TEAM ONE

	Nuclide Name	Energy (keV)	Bkgd Sum	Yield (%)	Line MDA (uCi/FILTER)	Nuclide MDA (uCi/FILTER)	Activity (uCi/FILTER)	Act.Error (uCi/FILTER)	Act/ MDA
	I-135	288.45	502	3.12	9.276E-004		-4.150E-004	3.191E-004	-4.5E-001
		417.63	107	3.55	5.258E-004		2.030E-006	3.627E-004	3.9E-003
		546.56	58	7.20	2.529E-004		-5.428E-005	1.804E-004	-2.1E-001
		836.80	19	6.73	2.549E-004		8.813E-005	1.502E-004	3.5E-001
		971.96	15	0.90	2.021E-003		2.275E-005	1.418E-003	1.1E-002
		972.62	15	1.21	1.493E-003		5.401E-005	1.007E-003	3.6E-002
		1038.76	17	8.01	2.557E-004		1.063E-004	1.478E-004	4.2E-001
		1101.58	14	1.62	1.233E-003		2.146E-004	7.905E-004	1.7E-001
		1124.00	16	3.64	5.925E-004		2.358E-004	3.325E-004	4.0E-001
		1131.51	16	22.74	9.548E-005		3.506E-005	5.585E-005	3.7E-001
		1169.04	23	0.88	2.986E-003		1.197E-003	1.803E-003	4.0E-001
		1240.47	21	0.91	2.940E-003		-2.447E-004	2.295E-003	-8.3E-002
		1260.41	14	28.90	7.872E-005	7.872E-005	9.783E-006	5.405E-005	1.2E-001
		1457.56	36	8.73	4.534E-004		-1.073E-004	1.787E-004	-2.4E-001
		1502.79	4	1.08	1.471E-003		-5.052E-004	1.331E-003	-3.4E-001
		1566.41	4	1.30	1.271E-003		4.231E-004	4.242E-004	3.3E-001
		1678.03	3	9.62	1.630E-004		-3.786E-006	1.233E-004	-2.3E-002
		1706.46	4	4.13	4.294E-004		1.117E-005	3.136E-004	2.6E-002
		1791.20	1	7.77	1.454E-004		-6.916E-005	2.548E-004	-4.8E-001
+	Cs-137	661.66*	0	85.10	1.449E-005	1.449E-005	1.531E-004	2.222E-005	1.1E+001
	Am-241	33.20	243	0.13	9.944E-001		-2.592E-001	5.842E-001	-2.6E-001
		59.54	195	35.90	1.475E-004	1.475E-004	2.529E-005	8.799E-005	1.7E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

Page : 1

ample ID : PAS ONSIGHT 1 Acquisition Start: 3/21/2011 1:34:06 PM

eport Generated On : 3/21/2011 1:50:51 PM

ample Description : PAS 1 OF 2 03212011
ample ID : PAS ONSIGHT 1 Sample Quantity : 1.000 FILTER
ample Filename : C:\PCNT2K\CAMFILES\CR1START\CR100024.CNF
ample Type : CR1
ample Requestor : Barcode Number :
ample Analyst : manager
ackground File : C:\PCNT2K\BKGFILES\G00D078.CNF
ackground Date :
ID Library : C:\GENIE2K\CAMFILES\STARTUP 05.NLB
ID Library Title : STARTUP RADIOCHEMISTRY 2005
SF Name : Startup Sample Report (NO Bkg)

---- Q2 Sample Information ----

atrix Volume (Liters) : 0.000 Percent Full : 0
ensity : 0.00 Dose Rate (mR/hr): 0.00

---- Sample Deposition Information ----

ep. Correction? : No Deposition End : 3/21/2011 1:34:06 PM
ep. Duration (minutes) : Deposition Start :

---- Sample Decay/Count Information ----

cquisition Start: 3/21/2011 1:34:06 PM Sample Taken On : 3/21/2011 1:34:06 PM
lapsed Live Time: 1000.0 seconds Elapsed Real Time: 1002.2 seconds
ecay Time (minutes) : 0.00 % Dead Time : 0.22
lapsed Time From Sample Time to Midpoint of Sample Count : 8.35 Minutes OR 0.14 Hours

---- Detector Parameters ----

etector Name : CAN7252 Counting Geometry : FP, 11/11
nergy Cal. Time: 3/21/2011 7:29:39 AM Energy Cal. Operator:
hape Cal. Time : 3/21/2011 7:29:39 AM Shape Cal. Operator :
ff. Cal. Time : 1/11/2011 2:37:46 PM Eff. Cal. Operator :

---- Processing Parameters ----

tart Channel : 100 End Channel : 4096
tart Energy : 52.0 End Energy : 2041.6
ensitivity : 3.00 MDA Width(FWHM) : 0.00
ritical Level : NO MDA Confidence Level : 5.0000 %
fficiency Type : DUAL Energy Tolerance : 1.500 keV
eV/channel : 0.497898 Offset : 2.230776

WHERE: NANA BAN TOWER
TIME: 1157

Peak Analysis Report
Sample ID : PAS ONSIGHT 1 Acqusition Start : 3/21/11 1:34:06 PM Page 2

	Peak No.	It	Energy (keV)	Gross Peak Area	Continuum Counts	FWHM	Peak Centroid	PW	%Error	Fit	Peak Efficency
	1	0	230.21	1745	172	1.15	457.89	10	5.29	0.00E+000	1.19E-001
	2	0	286.06	176	141	0.90	570.06	10	25.25	0.00E+000	1.02E-001
	3	0	342.10	72	101	1.30	682.61	9	47.10	0.00E+000	8.87E-002
	4	0	365.95	1882	113	1.27	730.51	11	4.93	0.00E+000	8.38E-002
	5	0	460.50	37	112	0.78	920.41	10	91.77	0.00E+000	6.81E-002
	6	0	523.84	45	76	1.08	1047.61	9	65.30	0.00E+000	6.00E-002
M	7	4	564.20	61	64	1.19	1128.68	20	33.12	1.16E+000	5.56E-002
m	8	4	570.27	67	60	1.20	1140.88	20	30.75	1.16E+000	5.50E-002
	9	0	605.63	729	79	1.52	1211.90	12	8.35	0.00E+000	5.17E-002
	10	0	630.99	78	51	1.22	1262.82	12	36.48	0.00E+000	4.95E-002
	11	0	638.01	109	52	1.58	1276.93	12	28.53	0.00E+000	4.90E-002
M	12	3	662.41	684	53	1.36	1325.94	24	8.11	1.16E+000	4.71E-002
m	13	3	668.42	504	75	1.37	1338.01	24	9.60	1.16E+000	4.66E-002
	14	0	773.24	342	31	1.49	1548.53	13	12.04	0.00E+000	3.99E-002
M	15	5	796.38	519	15	1.46	1595.01	23	9.20	1.02E+000	3.87E-002
m	16	5	802.37	48	24	1.47	1607.04	23	33.38	1.02E+000	3.84E-002
	17	0	819.13	104	18	1.33	1640.69	13	23.53	0.00E+000	3.76E-002
	18	0	955.10	62	26	1.28	1913.78	11	36.23	0.00E+000	3.20E-002
	19	0	1048.18	52	25	1.20	2100.74	12	41.39	0.00E+000	2.91E-002

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

Peak Efficiency Report
Sample ID : PAS ONSIGHT 1

Acqusition Start : 3/21/11 1:34:06 PM

Peak No.	Energy (keV)	Net Count Rate (cps)	Net Count Rate Uncert. (cps)	Peak Efficiency	Efficiency Uncertainty
1	230.21	1.745E+000	9.233E-002	1.19E-001	1.36E-002
2	286.06	1.760E-001	4.445E-002	1.02E-001	7.21E-003
3	342.10	7.220E-002	3.400E-002	8.87E-002	4.99E-003
4	365.95	1.882E+000	9.273E-002	8.38E-002	4.78E-003
5	460.50	3.739E-002	3.431E-002	6.81E-002	3.78E-003
6	523.84	4.501E-002	2.939E-002	6.00E-002	3.00E-003
M 7	564.20	6.099E-002	2.020E-002	5.56E-002	2.69E-003
m 8	570.27	6.746E-002	2.075E-002	5.50E-002	2.65E-003
9	605.63	7.292E-001	6.086E-002	5.17E-002	2.53E-003
10	630.99	7.849E-002	2.863E-002	4.95E-002	2.50E-003
11	638.01	1.086E-001	3.100E-002	4.90E-002	2.49E-003
M 12	662.41	6.842E-001	5.552E-002	4.71E-002	2.48E-003
m 13	668.42	5.039E-001	4.836E-002	4.66E-002	2.48E-003
14	773.24	3.420E-001	4.118E-002	3.99E-002	2.38E-003
M 15	796.38	5.187E-001	4.771E-002	3.87E-002	2.33E-003
m 16	802.37	4.775E-002	1.594E-002	3.84E-002	2.31E-003
17	819.13	1.043E-001	2.455E-002	3.76E-002	2.27E-003
18	955.10	6.167E-002	2.234E-002	3.20E-002	1.77E-003
19	1048.18	5.184E-002	2.146E-002	2.91E-002	1.47E-003

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

****
***** N U C L I D E   I D E N T I F I C A T I O N   R E P O R T *****
****

Sample Title: Crud Count #1
Nuclide Library Used: C:\GENIE2K\CAMFILES\STARTUP_05.NLB

.... IDENTIFIED NUCLIDES ....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/FILT)	Activity Uncertainty
Sb-122	0.914	564.12*	70.67	4.198E-005	1.405E-005
		692.79	3.85		
		1256.90	0.80		
I-131	0.703	80.18	2.62		
		284.30	6.14		
		364.49*	81.70	7.433E-004	5.604E-005
		636.99*	7.17	8.363E-004	2.424E-004
		722.91	1.77		
I-132	0.669	262.90	1.28		
		505.79	4.93		
		522.65*	15.99	1.322E-004	8.659E-005
		547.20	1.14		
		621.20	1.58		
		630.19*	13.32	3.351E-004	1.234E-004
		650.50	2.57		
		667.72*	98.70	3.086E-004	3.386E-005
		669.80	4.64		
		671.40	3.45		
		727.10	5.33		
		728.40	1.58		
		772.60*	75.60	3.192E-004	4.288E-005
		780.00	1.18		
		809.50	2.57		
		812.00	5.53		
		876.60	1.04		
		954.55*	17.57	3.094E-004	1.134E-004
		1143.30	1.35		
		1172.90	1.09		
		1290.80	1.13		
		1295.10	1.88		
		1372.07	2.47		
		1398.57	7.01		
		1442.56	1.40		
		1921.08	1.23		
		2002.20	1.14		
Cs-137	0.960	661.66*	85.10	4.616E-004	4.467E-005

* = Energy line found in the spectrum.
Energy Tolerance : 1.500 keV
Nuclide confidence index threshold = 0.10
Errors quoted at 2.000 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 3/21/2011 1:50:49 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 4096

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	230.21	1.7453E+000	5.29		
2	286.06	1.7604E-001	25.25		
3	342.10	7.2199E-002	47.10		
5	460.50	3.7389E-002	91.77		
m 8	570.27	6.7462E-002	30.75		
9	605.63	7.2925E-001	8.35	Tol.	Br-82 Sb-125
M 15	796.38	5.1871E-001	9.20		
m 16	802.37	4.7753E-002	33.38		
17	819.13	1.0433E-001	23.53		
19	1048.18	5.1841E-002	41.39	Sum	

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

Nuclide MDA Report
Sample ID : PAS ONSIGHT 1

Nuclide Name	Energy (keV)	Bkgd Sum	Yield (%)	Line MDA (uCi/FILTER)	Nuclide MDA (uCi/FILTER)	Activity (uCi/FILTER)	Act.Error (uCi/FILTER)	Act/ MDA
Co-60	1173.24	49	99.97	3.670E-005		-1.120E-006	2.807E-005	-3.1E-002
	1332.50	12	99.99	2.210E-005	2.210E-005	-3.743E-006	1.844E-005	-1.7E-001
Sb-125	35.49	291	4.29	2.067E-002		6.945E-003	1.247E-002	3.4E-001
	116.95	238	0.28	4.513E-003		-1.471E-003	2.811E-003	-3.3E-001
	172.72	291	0.20	7.746E-003		9.135E-004	5.171E-003	1.2E-001
	176.31	323	6.82	2.403E-004		9.386E-005	1.570E-004	3.9E-001
	204.14	292	0.33	5.289E-003		-3.573E-004	3.598E-003	-6.8E-002
	208.08	293	0.24	7.265E-003		-1.556E-003	5.038E-003	-2.1E-001
	227.89	1928	0.13	3.591E-002		-1.758E-002	7.108E-003	-4.9E-001
	321.03	157	0.41	4.303E-003		3.831E-004	2.864E-003	8.9E-002
	380.45	167	1.52	1.382E-003		1.018E-004	9.703E-004	7.4E-002
	408.07	175	0.18	1.240E-002		2.060E-003	8.513E-003	1.7E-001
	427.88	168	29.60	7.888E-005	7.888E-005	-9.389E-007	5.517E-005	-1.2E-002
	443.55	157	0.30	7.750E-003		-2.868E-003	5.652E-003	-3.7E-001
	463.36	195	10.49	2.576E-004		2.118E-005	1.105E-004	8.2E-002
	600.60	132	17.86	1.629E-004		-6.064E-005	9.728E-005	-3.7E-001
	606.72	837	5.03	1.431E-003		-3.093E-004	2.190E-004	-2.2E-001
	635.95	200	11.31	3.333E-004		-4.257E-006	3.302E-005	-1.3E-002
	671.45	631	1.79	3.881E-003		-9.788E-004	1.345E-003	-2.5E-001
I-130	418.01	142	34.15	6.223E-005		-2.076E-005	4.519E-005	-3.3E-001
	536.09	115	99.00	2.469E-005	2.469E-005	2.653E-006	1.697E-005	1.1E-001
	539.10	112	1.40	1.739E-003		-3.636E-004	1.249E-003	-2.1E-001
	586.05	132	1.69	1.689E-003		6.488E-005	1.220E-003	3.8E-002
	668.54	641	96.13	7.326E-005		-6.929E-006	1.212E-005	-9.5E-002
	685.99	65	1.07	2.259E-003		-7.306E-004	1.790E-003	-3.2E-001
	739.48	46	82.27	2.709E-005		5.246E-006	1.874E-005	1.9E-001
	1157.47	39	11.29	2.912E-004		-9.943E-005	2.391E-004	-3.4E-001
I-131	80.18	208	2.62	8.188E-004	8.188E-004	-3.309E-004	5.296E 004	-4.0E-001
	284.30	364	6.14	3.937E-004		-6.361E-005	9.819E-005	-1.6E-001
	364.49*	0	81.70	2.231E-005	2.231E-005	7.433E-004	5.604E-005	3.3E+001
	636.99*	0	7.17	3.113E-004		8.363E-004	2.424E-004	2.7E+000
	722.91	75	1.77	1.529E-003		-3.939E-004	1.214E-003	-2.6E-001
I-132	262.90	190	1.28	1.354E-003	1.354E-003	6.560E-004	8.609E-004	4.8E-001
	505.79	158	4.93	5.624E-004		2.114E-004	3.735E-004	3.8E-001
	522.65*	0	15.99	1.343E-004		1.322E-004	8.659E-005	9.8E-001
	547.20	115	1.14	2.275E-003		-2.118E-004	1.595E-003	-9.3E-002
	621.20	68	1.58	1.456E-003		-1.117E-003	1.189E-003	-7.7E-001
	630.19*	0	13.32	1.695E-004		3.351E-004	1.234E-004	2.0E+000
	650.50	84	2.57	1.038E-003		8.087E-004	6.291E-004	7.8E-001
	667.72*	0	98.70	2.630E-005	2.630E-005	3.086E-004	3.386E-005	1.2E+001
	669.80	637	4.64	1.569E-003		-2.127E-004	3.583E-004	-1.4E-001
	671.40	633	3.45	2.106E-003		-4.767E-004	6.828E-004	-2.3E-001

Nuclide MDA Report Page 7
Sample ID : PAS ONSIGHT 1 3/21/11 1:34:06 PM

Nuclide Name	Energy (keV)	Bkgd Sum	Yield (%)	Line MDA (uCi/FILTER)	Nuclide MDA (uCi/FILTER)	Activity (uCi/FILTER)	Act.Error (uCi/FILTER)	Act./ MDA
+ I-132	727.10	94	5.33	5.929E-004	5.929E-004	5.343E-004	3.653E-004	9.0E-001
	728.40	83	1.58	1.890E-003		3.388E-004	1.365E-003	1.8E-001
	772.60*	0	75.60	3.031E-005		3.192E-004	4.288E-005	1.1E+001
	780.00	38	1.18	1.887E-003		-6.485E-004	1.423E-003	-3.4E-001
	809.50	83	2.57	1.302E-003		1.756E-004	1.034E-003	1.3E-001
	812.00	80	5.53	5.959E-004		4.094E-004	3.512E-004	6.9E-001
	876.60	36	1.04	2.381E-003		1.322E-003	1.406E-003	5.6E-001
	954.55*	0	17.57	1.447E-004		3.094E-004	1.134E-004	2.1E+000
	1143.30	42	1.35	2.570E-003		1.435E-003	1.629E-003	5.6E-001
	1172.90	49	1.09	3.523E-003		-1.075E-004	2.694E-003	-3.1E-002
	1290.80	23	1.13	2.643E-003		4.340E-004	1.846E-003	1.6E-001
	1295.10	29	1.88	1.765E-003		1.478E-003	8.626E-004	8.4E-001
	1372.07	12	2.47	9.593E-004		-2.760E-003	1.914E-003	-2.9E+000
	1398.57	53	7.01	6.679E-004		6.513E-004	3.670E-004	9.8E-001
	1442.56	45	1.40	3.183E-003		3.144E-003	1.687E-003	9.9E-001
	1921.08	8	1.23	2.144E-003		6.377E-004	1.214E-003	3.0E-001
	2002.20	8	1.14	2.405E-003		1.213E-003	8.783E-004	5.0E-001
I-133	510.53	168	1.83	1.521E-003		8.868E-004	9.872E-004	5.8E-001
	529.87	121	87.00	2.836E-005	2.836E-005	4.900E-006	1.861E-005	1.7E-001
	706.58	45	1.51	1.392E-003		-3.169E-004	1.080E-003	-2.3E-001
	856.28	35	1.24	1.841E-003		3.501E-004	1.287E-003	1.9E-001
	875.33	36	4.51	5.268E-004		2.884E-004	3.138E-004	5.5E-001
	1236.44	30	1.51	2.059E-003		4.796E-004	1.461E-003	2.3E-001
	1298.22	29	2.35	1.361E-003		8.576E-004	7.861E-004	6.3E-001
I-134	135.40	193	4.29	2.889E-004		-2.407E-005	1.759E-004	-8.3E-002
	235.47	214	2.13	8.564E-004		-7.278E-003	1.705E-003	-8.5E+000
	405.45	171	7.35	3.401E-004		-1.393E-004	2.514E-004	-4.1E-001
	433.35	174	4.14	6.465E-004		-5.677E-005	4.568E-004	-8.8E-002
	458.92	198	1.31	2.300E-003		-5.665E-004	6.519E-004	-2.5E-001
	488.88	142	1.45	1.880E-003		7.757E-004	1.249E-003	4.1E-001
	514.40	131	2.23	1.236E-003		5.781E-004	8.082E-004	4.7E-001
	540.83	108	7.63	3.468E-004		-8.745E-005	2.514E-004	-2.5E-001
	595.36	105	11.07	2.605E-004		-2.053E-004	2.110E-004	-7.9E-001
	621.79	70	10.59	2.354E-004		-1.186E-004	1.840E-004	-5.0E-001
	627.96	142	2.21	1.589E-003		-5.535E-004	5.459E-004	-3.5E-001
	677.34	73	7.92	3.513E-004		-1.751E-004	3.094E-004	-5.0E-001
	730.74	76	1.82	1.686E-003		1.179E-003	1.086E-003	7.0E-001
	766.68	36	4.14	5.526E-004		-1.080E-004	3.729E-004	-2.0E-001
	847.03	35	95.40	2.632E-005		1.423E-005	1.554E-005	5.4E-001
	857.29	35	6.68	3.809E-004		2.065E-004	2.274E-004	5.4E-001
	884.09	25	64.87	3.479E-005		-4.210E-005	3.454E-005	-1.2E+000
	947.86	37	4.00	7.250E-004		-3.215E-004	5.399E-004	-4.4E-001
	974.67	29	4.77	5.599E-004		-1.266E-004	4.309E-004	-2.3E-001
	1040.25	43	2.02	1.689E-003		5.770E-004	1.125E-003	3.4E-001
	1072.55	30	14.88	2.009E-004		6.295E-005	1.351E-004	3.1E-001
	1136.16	38	9.06	3.890E-004		1.463E-004	2.569E-004	3.8E-001
	1455.24	23	2.29	1.548E-003		3.249E-004	1.080E-003	2.1E-001
	1613.80	4	4.29	4.335E-004		-7.985E-004	9.921E-004	-1.8E+000
	1741.49	11	2.56	1.170E-003		0.000E+000	9.916E-004	0.0E+000
	1806.84	6	5.53	4.329E-004	4.329E-004	-6.344E-004	6.381E-004	-1.5E+000
I-135	220.50	275	1.76	1.016E-003		3.272E-004	6.653E-004	3.2E-001

Nuclide MDA Report
Sample ID : PAS ONSIGHT 1

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Nuclide Name	Energy (keV)	Bkgd Sum	Yield (%)	Line MDA (uCi/FILTER)	Nuclide MDA (uCi/FILTER)	Activity (uCi/FILTER)	Act.Error (uCi/FILTER)	Act/ MDA
I-135	288.45	343	3.12	7.708E-004		-2.275E-004	2.299E-004	-3.0E-001
	417.63	155	3.55	6.271E-004		1.681E-004	4.217E-004	2.7E-001
	546.56	123	7.20	3.601E-004		2.940E-005	2.472E-004	8.2E-002
	836.80	47	6.73	3.837E-004		2.194E-004	2.404E-004	5.7E-001
	971.96	35	0.90	2.948E-003		6.338E-004	1.985E-003	2.2E-001
	972.62	32	1.21	2.090E-003		2.521E-004	1.441E-003	1.2E-001
	1038.76	44	8.01	3.921E-004		2.643E-004	2.280E-004	6.7E-001
	1101.58	25	1.62	1.592E-003		2.568E-004	1.099E-003	1.6E-001
	1124.00	39	3.64	8.829E-004		3.997E-004	5.694E-004	4.5E-001
	1131.51	38	22.74	1.406E-004		7.615E-005	8.660E-005	5.4E-001
	1169.04	49	0.88	4.210E-003		-7.033E-004	3.369E-003	-1.7E-001
	1240.47	31	0.91	3.501E-003		9.789E-004	2.474E-003	2.8E-001
	1260.41	28	28.90	1.069E-004	1.069E-004	5.290E-005	6.568E-005	4.9E-001
	1457.56	29	8.73	4.110E-004		2.919E-004	2.199E-004	7.1E-001
	1502.79	12	1.08	2.305E-003		5.230E-004	1.454E-003	2.3E-001
	1566.41	3	1.30	1.139E-003		3.173E-004	3.671E-004	2.8E-001
	1678.03	4	9.62	1.819E-004		-3.407E-005	1.546E-004	-1.9E-001
	1706.46	4	4.13	4.294E-004		1.430E-004	1.433E-004	3.3E-001
	1791.20	4	7.77	2.373E-004		-1.136E-004	3.049E-004	-4.8E-001
+ Cs-137	661.66*	0	85.10	2.461E-005	2.461E-005	4.616E-004	4.467E-005	1.9E+001
Am-241	33.20	242	0.13	9.924E-001		5.030E-001	5.800E-001	5.1E-001
	59.54	187	35.90	1.446E-004	1.446E-004	-3.091E-005	8.931E-005	-2.1E-001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

Page : 1

Sample ID : PAS ONSIGHT 2 Acquisition Start: 3/21/2011 1:57:28 PM

Report Generated On : 3/21/2011 2:14:13 PM

```
Sample Description : PAS 2 OF 2 03212011
Sample ID          : PAS ONSIGHT 2        Sample Quantity :      1.000 FILTER
Sample Filename    : C:\PCNT2K\CAMFILES\CR1START\CR100025.CNF
Sample Type        : CR1
Sample Requestor   :                      Barcode Number  :
Sample Analyst     : manager
Background File    : C:\PCNT2K\BKGFILES\G00D07B.CNF
Background Date    :
NID Library        : C:\GENIE2K\CAMFILES\STARTUP 05.NLB
NID Library Title  : STARTUP RADIOCHEMISTRY 2005
ASF Name           : Startup Sample Report (NO Bkg)

                ---- Q2 Sample Information ----

Matrix Volume (Liters) :    0.000     Percent Full      :    0
Density                :    0.00      Dose Rate (mR/hr):       0.00

                ---- Sample Deposition Information ----

Dep. Correction?      : No              Deposition End    : 3/21/2011   1:57:28 PM
Dep. Duration (minutes) :               Deposition Start  :

                ---- Sample Decay/Count Information ----

Acquisition Start: 3/21/2011   1:57:28 PM Sample Taken On  : 3/21/2011   1:57:28 PM
Elapsed Live Time:    1000.0 seconds      Elapsed Real Time:    1002.1 seconds
Decay Time (minutes) :       0.00         % Dead Time       :   0.21
Elapsed Time From Sample Time to Midpoint of Sample Count :       8.35 Minutes OR    0.14 Hours

                ---- Detector Parameters ----

Detector Name    : CAN7252              Counting Geometry    : FP, 11/11
Energy Cal. Time: 3/21/2011   7:29:39 AM  Energy Cal. Operator:
Shape Cal. Time : 3/21/2011   7:29:39 AM  Shape Cal. Operator :
Eff. Cal. Time  : 1/11/2011   2:37:46 PM  Eff. Cal. Operator  :

                ---- Processing Parameters ----

Start Channel    :   100             End Channel           :  4096
Start Energy     :  52.0             End Energy            : 2041.6
Sensitivity      :  3.00             MDA Width(FWHM)     :    0.00
Critical Level   : NO                MDA Confidence Level :  5.0000 %
Efficiency Type  : DUAL              Energy Tolerance     :   1.500 keV
keV/channel      :   0.497898        Offset               :   2.230776
```

WHERE: NANABAN TOWER

TIME: 1135

Peak Analysis Report
Sample ID : PAS ONSIGHT 2 Acquisition Start : 3/21/11 1:57:28 PM

	Peak No.	It	Energy (keV)	Gross Peak Area	Continuum Counts	FWHM	Peak Centroid	PW	%Error	Fit	Peak Efficency
	1	0	230.16	1722	152	1.12	457.78	10	5.27	0.00E+000	1.19E-001
	2	0	286.13	126	114	1.00	570.19	9	30.54	0.00E+000	1.02E-001
	3	0	342.06	64	133	1.16	682.53	11	61.06	0.00E+000	8.87E-002
	4	0	365.95	1262	122	1.28	730.50	11	6.25	0.00E+000	8.38E-002
	5	0	449.86	36	111	0.92	899.03	12	99.65	0.00E+000	6.96E-002
	6	0	523.83	67	89	1.16	1047.61	11	49.92	0.00E+000	6.00E-002
M	7	5	564.07	46	47	1.05	1128.43	21	37.35	1.15E+000	5.57E-002
m	8	5	570.28	83	58	1.05	1140.89	21	26.34	1.15E+000	5.50E-002
	9	0	605.57	637	59	1.28	1211.77	12	8.79	0.00E+000	5.17E-002
	10	0	630.97	54	44	1.18	1262.78	11	46.64	0.00E+000	4.95E-002
	11	0	637.88	65	55	1.30	1276.66	12	44.71	0.00E+000	4.90E-002
M	12	3	662.38	593	43	1.32	1325.87	24	8.68	1.50E+000	4.71E-002
m	13	3	668.44	436	62	1.33	1338.04	24	10.33	1.50E+000	4.66E-002
	14	0	773.18	351	29	1.51	1548.42	13	11.80	0.00E+000	3.99E-002
	15	0	796.39	428	24	1.58	1595.03	12	10.32	0.00E+000	3.87E-002
	16	0	819.10	56	31	1.40	1640.64	10	40.04	0.00E+000	3.76E-002
	17	0	954.93	36	17	1.68	1913.44	9	46.95	0.00E+000	3.20E-002
	18	0	1048.48	55	18	1.12	2101.33	11	35.72	0.00E+000	2.91E-002
	19	0	1460.36	20	3	1.37	2928.57	9	52.59	0.00E+000	2.12E-002

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

Peak Efficiency Report
Sample ID : PAS ONSIGHT 2

Acqusition Start : 3/21/11 1:57:28 PM

Peak No.	Energy (keV)	Net Count Rate (cps)	Net Count Rate Uncert. (cps)	Peak Efficiency	Efficiency Uncertainty
1	230.16	1.722E+000	9.084E-002	1.19E-001	1.36E-002
2	286.13	1.258E-001	3.842E-002	1.02E-001	7.21E-003
3	342.06	6.389E-002	3.901E-002	8.87E-002	4.98E-003
4	365.95	1.262E+000	7.880E-002	8.38E-002	4.78E-003
5	449.86	3.563E-002	3.551E-002	6.96E-002	3.93E-003
6	523.83	6.717E-002	3.353E-002	6.00E-002	3.00E-003
M 7	564.07	4.553E-002	1.701E-002	5.57E-002	2.69E-003
m 8	570.28	8.278E-002	2.181E-002	5.50E-002	2.65E-003
9	605.57	6.374E-001	5.601E-002	5.17E-002	2.53E-003
10	630.97	5.400E-002	2.519E-002	4.95E-002	2.50E-003
11	637.88	6.455E-002	2.886E-002	4.90E-002	2.49E-003
M 12	662.38	5.930E-001	5.148E-002	4.71E-002	2.48E-003
m 13	668.44	4.358E-001	4.503E-002	4.66E-002	2.48E-003
14	773.18	3.506E-001	4.138E-002	3.99E-002	2.38E-003
15	796.39	4.281E-001	4.419E-002	3.87E-002	2.33E-003
16	819.10	5.602E-002	2.243E-002	3.76E-002	2.27E-003
17	954.93	3.614E-002	1.697E-002	3.20E-002	1.77E-003
18	1048.40	5.529E-002	1.975E-002	2.91E-002	1.47E-003
19	1460.36	1.977E-002	1.040E-002	2.12E-002	1.50E-003

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

***** N U C L I D E   I D E N T I F I C A T I O N   R E P O R T *****

Sample Title: Crud Count #1
Nuclide Library Used: C:\GENIE2K\CAMFILES\STARTUP_05.NLB

.... IDENTIFIED NUCLIDES ....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/FILT)	Activity Uncertainty
Sb-122	0.914	564.12*	70.67	3.133E-005	1.180E-005
		692.79	3.85		
		1256.90	0.80		
I-131	0.704	80.18	2.62		
		284.30	6.14		
		364.49*	81.70	4.983E-004	4.216E-005
		636.99*	7.17	4.968E-004	2.236E-004
		722.91	1.77		
I-132	0.671	262.90	1.28		
		505.79	4.93		
		522.65*	15.99	1.973E-004	9.899E-005
		547.20	1.14		
		621.20	1.58		
		630.19*	13.32	2.305E-004	1.081E-004
		650.50	2.57		
		667.72*	98.70	2.669E-004	3.102E-005
		669.80	4.64		
		671.40	3.45		
		727.10	5.33		
		728.40	1.58		
		772.60*	75.60	3.272E-004	4.327E-005
		780.00	1.18		
		809.50	2.57		
		812.00	5.53		
		876.60	1.04		
		954.55*	17.57	1.813E-004	8.569E-005
		1143.30	1.35		
		1172.90	1.09		
		1290.80	1.13		
		1295.10	1.88		
		1372.07	2.47		
		1398.57	7.01		
		1442.56	1.40		
		1921.08	1.23		
		2002.20	1.14		
Cs-137	0.964	661.66*	85.10	4.001E-004	4.064E-005

* = Energy line found in the spectrum.
Energy Tolerance : 1.500 keV
Nuclide confidence index threshold = 0.10
Errors quoted at 2.000 sigma

********** UNIDENTIFIED PEAKS **********

Peak Locate Performed on: 3/21/2011 2:14:11 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 4096

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
	1	230.16	1.7225E+000	5.27		
	2	286.13	1.2577E-001	30.54		
	3	342.06	6.3887E-002	61.06		
	5	449.86	3.5633E-002	99.65		
m	8	570.28	8.2783E-002	26.34		
	9	605.57	6.3743E-001	8.79	Tol.	Br-82 Sb-125
	15	796.39	4.2810E-001	10.32		
	16	819.10	5.6017E-002	40.04		
	18	1048.48	5.5291E-002	35.72	Sum	
	19	1460.36	1.9772E-002	52.59		

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

Nuclide MDA Report
Sample ID : PAS ONSIGHT 2

Nuclide Name	Energy (keV)	Bkgd Sum	Yield (%)	Line MDA (uCi/FILTER)	Nuclide MDA (uCi/FILTER)	Activity (uCi/FILTER)	Act.Error (uCi/FILTER)	Act/ MDA
Co-60	1173.24	38	99.97	3.266E-005		9.193E-006	2.246E-005	2.8E-001
	1332.50	15	99.99	2.434E-005	2.434E-005	-5.440E-006	1.994E-005	-2.2E-001
Sb-125	35.49	278	4.29	2.022E-002		-3.142E-003	1.246E-002	-1.6E-001
	116.95	207	0.28	4.220E-003		-1.739E-004	2.560E-003	-4.1E-002
	172.72	269	0.20	7.457E-003		5.418E-003	4.702E-003	7.3E-001
	176.31	311	6.82	2.359E-004		1.914E-004	1.488E-004	8.1E-001
	204.14	264	0.33	5.038E-003		-1.373E-003	3.479E-003	-2.7E-001
	208.08	298	0.24	7.325E-003		3.066E-003	4.771E-003	4.2E-001
	227.89	1888	0.13	3.554E-002		-1.186E-002	6.164E-003	-3.3E-001
	321.03	140	0.41	4.074E-003		-1.067E-003	2.813E-003	-2.6E-001
	380.45	152	1.52	1.322E-003		-2.407E-004	9.440E-004	-1.8E-001
	408.07	146	0.18	1.137E-002		5.222E-004	7.990E-003	4.6E-002
	427.88	161	29.60	7.729E-005	7.729E-005	-7.791E-006	5.520E-005	-1.0E-001
	443.55	159	0.30	7.797E-003		-1.080E-003	5.234E-003	-1.4E-001
	463.36	156	10.49	2.315E-004		1.554E-005	1.626E-004	6.7E-002
	600.60	117	17.86	1.538E-004		-3.026E-005	9.329E-005	-2.0E-001
	606.72	721	5.03	1.330E-003		-3.035E-004	2.107E-004	-2.3E-001
	635.95	153	11.31	2.931E-004		-2.864E-005	4.212E-005	-9.8E-002
	671.45	357	1.79	3.651E-003		-1.129E-003	1.253E-003	-3.1E-001
I-130	418.01	183	34.15	7.025E-005		3.212E-005	4.668E-005	4.6E-001
	536.09	85	99.00	2.141E-005	2.141E-005	-7.228E-006	1.557E-005	-3.4E-001
	539.10	84	1.40	1.519E-003		-3.265E-004	1.080E-003	-2.1E-001
	586.05	111	1.69	1.556E-003		6.125E-004	1.060E-003	3.9E-001
	668.54	562	96.13	6.871E-005		-6.511E-006	1.189E-005	-9.5E-002
	685.99	58	1.07	2.142E-003		1.223E-003	1.370E-003	5.7E-001
	739.48	63	82.27	2.892E-005		5.930E-007	2.120E-005	2.1E-002
	1157.47	33	11.29	2.698E-004		6.188E-005	1.858E-004	2.3E-001
I-131	80.18	193	2.62	7.898E-004	7.898E-004	-5.681E-004	5.107E-004	-7.2E-001
	284.30	288	6.14	3.515E-004		-6.477E-005	1.063E-004	-1.8E-001
	364.49*	0	81.70	2.322E-005	2.322E-005	4.983E-004	4.216E-005	2.1E+001
	636.99*	0	7.17	3.244E-004		4.968E-004	2.236E-004	1.5E+000
	722.91	68	1.77	1.460E-003		-5.995E-004	1.223E-003	-4.1E-001
I-132	262.90	164	1.28	1.262E-003	1.262E-003	1.604E-004	8.295E-004	1.3E-001
	505.79	134	4.93	5.199E-004		2.850E-005	3.582E-004	5.5E-002
	522.65*	0	15.99	1.493E-004		1.973E-004	9.899E-005	1.3E+000
	547.20	99	1.14	2.119E-003		2.271E-004	1.436E-003	1.1E-001
	621.20	84	1.58	1.607E-003		1.152E-004	1.137E-003	7.2E-002
	630.19*	0	13.32	1.552E-004		2.305E-004	1.081E-004	1.5E+000
	650.50	61	2.57	8.936E-004		-6.294E-005	6.418E-004	-7.0E-002
	667.72*	0	98.70	2.418E-005	2.418E-005	2.669E-004	3.102E-005	1.1E+001
	669.80	551	4.64	1.462E-003		-2.749E-004	3.446E-004	-1.9E-001
	671.40	551	3.45	1.968E-003		-5.818E-004	6.347E-004	-3.0E-001

Nuclide MDA Report
Sample ID : PAS ONSIGHT 2

	Nuclide Name	Energy (keV)	Bkgd Sum	Yield (%)	Line MDA (uCi/FILTER)	Nuclide MDA (uCi/FILTER)	Activity (uCi/FILTER)	Act.Error (uCi/FILTER)	Act/ MDA
+	I-132	727.10	100	5.33	6.104E-004	6.104E-004	4.131E-004	4.000E-004	6.8E-001
		728.40	94	1.58	2.005E-003		9.653E-004	1.368E-003	4.8E-001
		772.60*	0	75.60	2.954E-005		3.272E-004	4.327E-005	1.1E+001
		780.00	57	1.18	2.275E-003		-9.974E-004	1.886E-003	-4.4E-001
		809.50	67	2.57	1.177E-003		-9.365E-004	1.070E-003	-8.0E-001
		812.00	65	5.53	5.408E-004		2.342E-004	3.547E-004	4.3E-001
		876.60	46	1.04	2.664E-003		2.420E-003	1.440E-003	9.1E-001
		954.55*	0	17.57	1.124E-004		1.813E-004	8.569E-005	1.6E+000
		1143.30	38	1.35	2.455E-003		4.754E-004	1.811E-003	1.9E-001
		1172.90	38	1.09	3.135E-003		8.824E-004	2.156E-003	2.8E-001
		1290.80	29	1.13	2.932E-003		9.898E-004	1.959E-003	3.4E-001
		1295.10	30	1.88	1.792E-003		1.044E-003	1.066E-003	5.8E-001
		1372.07	20	2.47	1.198E-003		-1.804E-003	1.658E-003	-1.5E+000
		1398.57	60	7.01	7.075E-004		1.047E-003	3.075E-004	1.5E+000
		1442.56	37	1.40	2.910E-003		2.933E-003	1.397E-003	1.0E+000
		1921.08	8	1.23	2.144E-003		7.643E-004	1.064E-003	3.6E-001
		2002.20	6	1.14	2.138E-003		9.095E-004	7.562E-004	4.3E-001
	I-133	510.53	150	1.83	1.441E-003		3.128E-004	9.767E-004	2.2E-001
		529.87	112	87.00	2.734E-005	2.734E-005	-1.368E-006	1.827E-005	-5.0E-002
		706.58	66	1.51	1.662E-003		-5.032E-004	1.308E-003	-3.0E-001
		856.28	48	1.24	2.128E-003		4.624E-004	1.462E-003	2.2E-001
		875.33	45	4.51	5.835E-004		2.839E-004	3.657E-004	4.9E-001
		1236.44	32	1.51	2.120E-003		8.314E-004	1.423E-003	3.9E-001
		1298.22	22	2.35	1.202E-003		2.896E-004	8.582E-004	2.4E-001
	I-134	135.40	169	4.29	2.710E-004		5.218E-005	1.608E-004	1.9E-001
		235.47	189	2.13	8.068E-004		-7.153E-003	1.609E-003	-8.9E+000
		405.45	167	7.35	3.363E-004		1.533E-004	2.218E-004	6.6E-001
		433.35	148	4.14	5.984E-004		-7.860E-005	4.241E-004	-1.3E-001
		458.92	191	1.31	2.261E-003		2.961E-003	1.334E-003	1.3E+000
		488.88	120	1.45	1.735E-003		-2.344E-005	1.210E-003	-1.4E-002
		514.40	126	2.23	1.213E-003		2.004E-004	8.251E-004	1.7E-001
		540.83	91	7.63	3.199E-004		4.141E-005	2.160E-004	1.3E-001
		595.36	94	11.07	2.472E-004		-8.718E-005	1.885E-004	-3.5E-001
		621.79	83	10.59	2.550E-004		4.108E-005	1.769E-004	1.6E-001
		627.96	120	2.21	1.467E-003		-3.580E-004	5.245E-004	-2.4E-001
		677.34	62	7.92	3.255E-004		-1.856E-004	2.936E-004	-5.7E-001
		730.74	93	1.82	1.854E-003		2.175E-003	1.060E-003	1.2E+000
		766.68	36	4.14	5.526E-004		-3.253E-004	3.982E-004	-5.9E-001
		847.03	47	95.40	3.012E-005		8.678E-006	2.031E-005	2.9E-001
		857.29	47	6.68	4.360E-004		-1.200E-005	3.223E-004	-2.8E-002
		884.09	38	64.87	4.204E-005		-1.909E-005	3.419E-005	-4.5E-001
		947.86	25	4.00	6.072E-004		-4.400E-004	5.587E-004	-7.2E-001
		974.67	26	4.77	5.331E-004		-1.005E-004	4.038E-004	-1.9E-001
		1040.25	43	2.02	1.689E-003		7.372E-004	1.076E-003	4.4E-001
		1072.55	24	14.88	1.817E-004		-4.929E-005	1.618E-004	-2.7E-001
		1136.16	32	9.06	3.597E-004		-6.061E-005	2.828E-004	-1.7E-001
		1455.24	22	2.29	1.518E-003		-2.259E-004	6.504E-004	-1.5E-001
		1613.80	7	4.29	5.419E-004		-5.027E-004	6.318E-004	-9.3E-001
		1741.49	8	2.56	1.023E-003		3.366E-004	5.278E-004	3.3E-001
		1806.84	6	5.53	4.329E-004	4.329E-004	7.930E-005	2.720E-004	1.8E-001
	I-135	220.50	225	1.76	9.223E-004		-3.120E-004	6.428E-004	-3.4E-001

Nuclide MDA Report
Sample ID : PAS ONSIGHT 2

Nuclide Name	Energy (keV)	Bkgd Sum	Yield (%)	Line MDA (uCi/FILTER)	Nuclide MDA (uCi/FILTER)	Activity (uCi/FILTER)	Act.Error (uCi/FILTER)	Act/ MDA
I-135	288.45	296	3.12	7.177E-004		-1.458E-004	2.257E-004	-2.0E-001
	417.63	178	3.55	6.701E-004		2.465E-004	4.483E-004	3.7E-001
	546.56	99	7.20	3.249E-004		4.377E-005	2.199E-004	1.3E-001
	836.80	32	6.73	3.219E-004		-6.862E-005	2.491E-004	-2.1E-001
	971.96	26	0.90	2.577E-003		9.207E-004	1.578E-003	3.6E-001
	972.62	26	1.21	1.903E-003		1.427E-004	1.327E-003	7.5E-002
	1038.76	42	8.01	3.838E-004		1.535E-004	2.478E-004	4.0E-001
	1101.58	28	1.62	1.675E-003		2.753E-004	1.162E-003	1.6E-001
	1124.00	30	3.64	7.836E-004		-4.170E-005	5.950E-004	-5.3E-002
	1131.51	31	22.74	1.282E-004		-5.458E-005	1.153E-004	-4.3E-001
	1169.04	42	0.88	3.922E-003		3.850E-003	1.978E-003	9.8E-001
	1240.47	30	0.91	3.449E-003		1.560E-003	2.212E-003	4.5E-001
	1260.41	16	28.90	8.342E-005	8.342E-005	4.011E-005	4.474E-005	4.8E-001
	1457.56	28	8.73	4.046E-004		3.040E-004	2.110E-004	7.5E-001
	1502.79	4	1.08	1.471E-003		1.990E-004	1.288E-003	1.4E-001
	1566.41	10	1.30	1.843E-003		-2.010E-004	1.673E-003	-1.1E-001
	1678.03	8	9.62	2.402E-004		-2.744E-005	1.951E-004	-1.1E-001
	1706.46	3	4.13	3.848E-004		8.936E-005	2.702E-004	2.3E-001
	1791.20	5	7.77	2.590E-004		9.880E-005	8.866E-005	3.8E-001
+ Cs-137	661.66*	0	85.10	2.241E-005	2.241E-005	4.001E-004	4.064E-005	1.8E+001
Am-241	33.20	232	0.13	9.724E-001		2.136E-001	5.528E-001	2.2E-001
	59.54	179	35.90	1.416E-004	1.416E-004	-9.932E-006	8.579E-005	-7.0E-002

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

Nuclide MDA Report
Sample ID : TEAM 1

Nuclide Name	Energy (keV)	Bkgd Sum	Yield (%)	Line MDA (uCi/FILTER)	Nuclide MDA (uCi/FILTER)	Activity (uCi/FILTER)	Act.Error (uCi/FILTER)	Act/ MDA
I-132	727.10	45	6.33	4.205E-004	4.205E-004	8.638E-005	2.907E-004	2.1E-001
	728.40	43	1.58	1.393E-003		2.164E-004	9.958E-004	1.6E-001
	772.60*	0	75.60	1.807E-005		1.089E-004	2.345E-005	5.7E+000
	780.00	13	1.18	1.171E-003		-3.154E-003	2.269E-003	-2.7E+000
	809.50	32	2.57	8.379E-004		-3.017E-004	6.978E-004	-3.6E-001
	812.00	29	5.53	3.733E-004		-4.497E-005	2.822E-004	-1.2E-001
	876.60	22	1.04	1.907E-003		-4.532E-004	1.569E-003	-2.4E-001
	954.55	33	17.57	1.476E-004		1.155E-004	7.699E-005	7.8E-001
	1143.30	8	1.35	1.241E-003		6.843E-005	9.229E-004	5.5E-002
	1172.90	16	1.09	2.129E-003		4.976E-004	1.479E-003	2.3E-001
	1290.80	18	1.13	2.371E-003		4.783E-004	1.698E-003	2.0E-001
	1295.10	20	1.88	1.495E-003		5.149E-004	1.008E-003	3.4E-001
	1372.07	5	2.47	6.681E-004		-5.478E-004	9.161E-004	-8.2E-001
	1398.57	17	7.01	3.997E-004		2.640E-004	1.798E-004	6.6E-001
	1442.56	16	1.40	2.001E-003		4.223E-004	1.331E-003	2.1E-001
	1921.08	3	1.23	1.455E-003		4.054E-004	4.703E-004	2.8E-001
	2002.20	2	1.14	1.408E-003		3.032E-004	4.314E-004	2.2E-001
I-133	510.53	59	1.83	9.282E-004		2.974E-004	5.860E-004	3.2E-001
	529.87	34	87.00	1.570E-005	1.570E-005	-2.564E-005	1.544E-005	-1.6E+000
	706.58	15	1.51	8.506E-004		-6.991E-004	9.569E-004	-8.2E-001
	856.28	25	1.24	1.581E-003		1.095E-003	7.884E-004	6.9E-001
	875.33	22	4.51	4.220E-004		3.441E-005	3.027E-004	8.2E-002
	1236.44	8	1.51	1.159E-003		1.598E-005	8.239E-004	1.4E-002
	1298.22	20	2.35	1.152E-003		6.273E-004	6.389E-004	5.4E-001
I-134	135.40	85	4.29	1.936E-004		-3.937E-005	1.191E-004	-2.0E-001
	235.47	89	2.13	5.639E-004		-1.971E-003	7.590E-004	-3.5E+000
	405.45	63	7.35	2.121E-004		6.626E-006	1.432E-004	3.1E-002
	433.35	69	4.14	4.172E-004		5.425E-005	2.770E-004	1.3E-001
	458.92	66	1.31	1.367E-003		-3.159E-004	9.763E-004	-2.3E-001
	488.88	50	1.45	1.151E-003		-2.622E-004	8.478E-004	-2.3E-001
	514.40	53	2.23	8.078E-004		1.573E-004	5.241E-004	1.9E-001
	540.83	37	7.63	2.108E-004		-2.841E-005	1.473E-004	-1.3E-001
	595.36	49	11.07	1.824E-004		1.163E-005	1;262E-004	6.4E-002
	621.79	35	10.59	1.709E-004		5.666E-005	1.064E-004	3.3E-001
	627.86	50	2.21	9.731E-004		-1.936E-004	4.054E-004	-2.0E-001
	677.34	31	7.52	2.367E-004		6.085E-005	1.576E-004	2.6E-001
	730.74	43	1.82	1.295E-003		9.992E-004	7.416E-004	7.7E-001
	766.68	21	4.14	4.336E-004		-2.249E-004	3.673E-004	-5.2E-001
	847.03	17	95.40	1.906E-005		-5.351E-006	1.489E-005	-2.8E-001
	857.29	25	6.68	3.272E-004		1.160E-004	2.138E-004	3.5E-001
	884.09	22	64.87	3.286E-005		1.309E-006	2.282E-005	4.0E-002
	947.86	9	4.00	3.896E-004		-1.552E-004	3.335E-004	-4.0E-001
	974.67	14	4.77	4.087E-004		-2.240E-004	3.671E-004	-5.5E-001
	1040.25	14	2.02	1.023E-003		-1.144E-004	7.419E-004	-1.1E-001
	1072.55	6	14.88	1.005E-004		-1.782E-006	7.204E-005	-1.8E-002
	1136.16	2	9.06	1.151E-004		-6.196E-006	8.365E-005	-5.4E-002
	1455.24	23	2.29	1.548E-003		-4.022E-004	5.628E-004	-2.6E-001
	1613.80	4	4.29	4.335E-004		1.444E-004	1.447E-004	3.3E-001
	1741.49	7	2.56	9.686E-004		4.515E-004	3.427E-004	4.7E-001
	1806.84	5	5.53	4.024E-004	4.024E-004	1.535E-004	1.378E-004	3.8E-001
I-135	220.50	112	1.76	6.608E-004		-1.418E-004	4.512E-004	-2.1E-001

.uclide MDA Report
ample ID : TEAM 1

3/21/11 2:39:19 PM

Nuclide Name	Energy (keV)	Bkgd Sum	Yield (%)	Line MDA (uCi/FILTER)	Nuclide MDA (uCi/FILTER)	Activity (uCi/FILTER)	Act.Error (uCi/FILTER)	Act/ MDA
I-135	288.45	156	3.12	5.273E-004		-2.483E-004	1.713E-004	-4.7E-001
	417.63	72	3.55	4.363E-004		8.533E-005	2.864E-004	2.0E-001
	546.56	39	7.20	2.106E-004		1.020E-006	1.410E-004	4.8E-003
	836.80	16	6.73	2.364E-004		-1.128E-004	2.002E-004	-4.8E-001
	971.96	14	0.90	1.961E-003		-7.539E-004	1.610E-003	-3.8E-001
	972.62	16	1.21	1.535E-003		-6.414E-005	1.094E-003	-4.2E-002
	1038.76	16	8.01	2.490E-004		4.216E-005	1.827E-004	1.7E-001
	1101.58	13	1.62	1.194E-003		9.313E-005	8.640E-004	7.8E-002
	1124.00	13	3.64	5.415E-004		1.390E-005	4.263E-004	2.6E-002
	1131.51	3	22.74	4.822E-005		-4.927E-005	1.045E-004	-1.0E+000
	1169.04	19	0.88	2.743E-003		1.655E-003	1.388E-003	6.0E-001
	1240.47	7	0.91	1.837E-003		-1.835E-004	1.393E-003	-1.0E-001
	1260.41	9	28.90	6.521E-005	6.521E-005	1.272E-005	3.980E-005	2.0E-001
	1457.56	30	8.73	4.174E-004		-2.221E-005	1.120E-004	-5.3E-002
	1502.79	6	1.08	1.727E-003		3.062E-005	1.163E-003	1.8E-002
	1566.41	3	1.30	1.139E-003		-3.438E-004	1.150E-003	-3.0E-001
	1678.03	4	9.62	1.819E-004		-9.464E-006	1.665E-004	-5.2E-002
	1706.46	2	4.13	3.319E-004		4.915E-005	1.154E-004	1.5E-001
	1791.20	0	7.77	5.347E-005		0.000E+000	0.000E+000	0.0E+000
Cs-137	661.66*	0	85.10	1.405E-005	1.405E-005	1.498E-004	2.188E-005	1.1E+001
Am-241	33.20	110	0.13	6.807E-001		-1.003E-002	3.822E-001	-1.5E-002
	59.54	84	35.90	9.883E-005	9.883E-005	-2.703E-005	6.129E-005	-2.7E-001

+ - Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction

Ref: NPM 1H1-7

RADIOLOGICAL ANALYSIS REQUEST AND COUNTING RESULTS (RARCR)

SHIP/PROJECT: PSNS	# OF SAMPLES: 2	C/105.5 CONTROL NUMBER(S): 2011-00428, 00429
SAMPLE LOCATION(S): SEAHAWK 623	☐ Description on back or attached	
TECHNICAL WORK DOCUMENT:	☐ Appendix ... attached	ORIGINATOR (Signature/Badge): [signature] 178763 — DATE: 3/14/11
SHOP/PHONE: VOIP 7381	C/105.3 PHONE: VOIP 7358	PROJECT C/105.3 (Signature/Badge): [signature] 178763 — DATE: 3/14/11
WASTE STREAM # (Controlled): NA	WASTE STREAM # (Released): NA	TRANSPORTED BY (Signature/Badge): [signature] 178763 — DATE: 3/14/11

SAMPLE CONTROL LIMIT	DLC	TYPE	
☐ 10 pCi/g	☐ 2.5 pCi/g	☐ PAINT	105 HP/RCT RECEIVED BY (Signature/Badge): [signature] 178763 — DATE: 3/14/11
☐ 3 pCi/g	☐ 1 pCi/g	☐ SOLID MATERIAL	105 HP/RCT FORM COMPLETED BY (Signature/Badge): [signature] 178763 — DATE: 3/14/11
☐ 1 pCi/g	☐ 0.75 pCi/g	☒ LANGWIPE	105 HP REVIEWED BY (Signature/Badge): [signature] 166972 — DATE: 3/13/11
☐ 1E-06 µCi/ml	☐ 0.25 pCi/g	☐ AIR SAMPLE FILTER	TRANSPORTED BY (Signature/Badge): — DATE:
☐ 2E-08 µCi/ml	☐ 1E-08 µCi/ml	☐ LIQUID	RELEASED SAMPLES IN WASTE STREAM: — DATE:
☐ Detectable NNPP Activity (Act 2000)	☐ 2E-08 µCi/ml	☐ LEAK TEST	CONTROLLED SAMPLES IN WASTE STREAM: — DATE:
☒ TOTAL ACTIVITY 4450	☒ TOTAL ACTIVITY 4452	☐ OTHER (SPECIFY)	C/105.3 SUPERVISOR (Signature/Badge): — DATE:
☐ OTHER (SPECIFY)	☐ OTHER (SPECIFY)		

03/13/11

SAMPLE/GRID#	C/105.5 CONTROL#	Gross Sample Weight (g)	Net Sample Weight (g)	Sample Geometry	NNPP Activity Detectable NO	NNPP Activity Detectable YES	Sample Controlled? (yes or no)	Specific Activity (pCi/g)
1-Door	00428	NA	NA	BT		X	YES*	7300 pCi
2-Stabilizer	00429	NA	NA	BT		X	YES*	2860 pCi

Analysis Remarks
* Activity fm Plume. Sple #1 I-131, I-132, Te-132, I-133, Cs-134, Cs-137
Sple #2 I-132, Te-132

PSNS&IMF 6470/105 (Rev. 11-08) (Front)

****
* SAMPLE GAMMA ANALYSIS REPORT - JAPAN *
****

Report Generated On	: 03/14/2011 4:21:01 AM
Sample Description	: Seahawk 623 Door
Sample Number	: 1
Control Number	: 2011-00428
Sample Type/Filename	: WFT C:\PCNT2K\CAMFILES\WFNoDLC\W1100428.CNF
Detector Name	: GIANT
Sample Quantity	: 1.000 Ea
Sample Taken On	: 03/14/2011
Acquisition Started	: 03/14/2011 3:11:49 AM
Live Time	: 300.0 seconds
Calibration File	: 500_ML_BOTTLE
Energy Cal Date	:
Efficiency Cal Date	: 07/16/2008
Nuclide Library	: C:\GENIE2K\CAMFILES\Rxplume.NLB
BKG	: C:\PCNT2K\BKGFILES\G02D03B.CNF

A N A L Y S I S R E S U L T S

.... IDENTIFIED NUCLIDES ....

Nuclide Name	Wt mean Activity (pCi /Ea)	Wt mean Activity Uncertainty	Nuclide DLC (pCi /Ea)
I-131	2.872E+003	3.5E+002	9.8E+001
I-132	1.477E+003	1.5E+002	8.7E+001
TE-132	1.727E+003	2.9E+002	1.0E+002
I-133	9.920E+002	1.9E+002	7.1E+001
CS-134	7.571E+001	5.7E+001	6.0E+001
CS-137	1.585E+002	7.3E+001	5.2E+001

.... UNIDENTIFIED NUCLIDES ....

Nuclide Name	Activity (pCi /Ea)	Activity Uncertainty	Nuclide DLC (pCi /Ea)
BE-7	-7.271E+001	5.8E+002	5.6E+002
K-40	1.761E+002	2.5E+002	5.0E+002
CR-51	4.062E+002	5.3E+002	5.7E+002
MN-54	6.911E+000	2.8E+001	3.2E+001
CO-58	9.701E+001	6.1E+001	8.2E+001
FE-59	0.000E+000	0.0E+000	3.3E+001
CO-60	4.457E+000	3.7E+001	4.2E+001
ZN-65	1.195E+001	6.7E+001	9.0E+001
NB-95	-2.809E+001	3.4E+001	3.1E+001
ZR-95	1.482E+001	6.2E+001	8.3E+001
SB-124	6.575E-001	3.9E+001	7.1E+001
SB-125	-2.888E+001	2.0E+002	1.9E+002
TL-208	-4.487E+000	6.5E+001	6.5E+001
BI-212	3.336E+002	8.6E+002	1.0E+003
PB-212	7.246E+001	1.1E+002	1.2E+002
BI-214	-6.557E+001	1.4E+002	1.2E+002
PB-214	6.596E+000	1.7E+002	1.6E+002
RA-226	2.289E+003	1.9E+003	2.0E+003
AC-228	-2.722E+001	2.0E+002	1.1E+002

FA-234M	3.024E+003	3.9E+003	6.3E+003

Sample 2011-00428 03/14/2011 4:21:01 AM Page 3

Nuclide Name	Activity (pCi /Ea)	Activity Uncertainty	Nuclide DLC (pCi /Ea)
U-235	2.909E+002	5.0E+002	1.2E+002

SAMPLE GAMMA ANALYSIS EQUIPMENT

DET NAME	HPGE DET S/N	MCA	MCA S/N
JAPAN	09079312	DSA 1000	07077176
PCP	12089491	DSA 1000	07077177
GIANT	10079336		

U N I D E N T I F I E D P E A K S

	Peak No.		Energy (keV)	Peak Size (CPS)	Peak CPS % Uncertainty
	2	I-131	284.4	1.7E-001	48
m	8	I-131	636.8	1.0E-001	41

N U C L I D E I D E N T I F I C A T I O N R E P O R T

Nuclide Name	Energy (keV)	Yield (%)	Activity (pCi/Ea)	Activity Uncertainty
I-131	364.5*	81.20	2.87E+003	3.5E+002
I-132	522.7*	16.10	9.85E+002	4.7E+002
	630.2*	13.70	1.45E+003	5.8E+002
	667.7*	98.70	1.55E+003	2.2E+002
	772.6*	76.20	1.67E+003	2.8E+002
	954.5*	18.10	1.04E+003	5.3E+002
	1398.6*	7.10	1.44E+003	8.8E+002
TE-132	228.2*	88.20	1.73E+003	2.9E+002
I-133	529.9*	87.00	9.92E+002	1.9E+002
CS-134	569.3	15.43		
	604.7*	97.60	7.13E+001	9.3E+001
	795.8*	85.40	7.83E+001	7.1E+001
CS-137	661.7*	85.21	1.59E+002	7.3E+001

* denotes radioisotopes identified by photopeak analysis

Analysis by CDR [signature] Badge No. 178263 Date 3/14/11

Reviewed by DMO [signature] Badge No. 16872 Date 3/13/11

ALL ERRORS ARE QUOTED AT 2.000 sigma

SAMPLE GAMMA ANALYSIS REPORT - JAPAN

Report Generated On	: 03/14/2011 4:23:56 AM
Sample Description	: Seahawk 623 Stabilizer
Sample Number	: 2
Control Number	: 2011-00429
Sample Type/Filename	: WFT C:\PCNT2K\CAMFILES\WFNoDLC\W1100429.CNF
Detector Name	: GIANT
Sample Quantity	: 1.000 Ea
Sample Taken On	: 03/14/2011
Acquisition Started	: 03/14/2011 3:19:28 AM
Live Time	: 300.0 seconds
Calibration File	: 500_ML_BOTTLE
Energy Cal Date	:
Efficiency Cal Date	: 07/16/2008
Nuclide Library	: C:\GENIE2K\CAMFILES\Rxplume.NLB
BKG	: C:\PCNT2K\BKGFILES\G02D03B.CNF

ANALYSIS RESULTS

IDENTIFIED NUCLIDES

Nuclide Name	Wt mean Activity (pCi /Ea)	Wt mean Activity Uncertainty	Nuclide DLC (pCi /Ea)
I-132	1.289E+003	1.5E+002	9.5E+001
TE-132	1.566E+003	2.5E+002	6.2E+001

UNIDENTIFIED NUCLIDES

Nuclide Name	Activity (pCi /Ea)	Activity Uncertainty	Nuclide DLC (pCi /Ea)
BE-7	1.085E+001	4.4E+002	4.6E+002
K-40	4.403E+001	2.2E+002	4.1E+002
CR-51	-7.869E+001	4.5E+002	4.0E+002
MN-54	-5.183E+000	2.3E+001	3.2E+001
CO-58	5.536E+001	6.0E+001	7.6E+001
FE-59	-3.544E+000	4.8E+001	6.6E+001
CO-60	8.913E+000	1.8E+001	4.2E+001
ZN-65	0.000E+000	0.0E+000	3.7E+001
NB-95	-1.928E+001	4.9E+001	4.2E+001
ZR-95	7.408E+000	7.0E+001	8.3E+001
SB-124	-3.501E+001	5.1E+001	4.1E+001
SB-125	-1.169E+002	1.6E+002	1.1E+002
I-131	5.802E+001	7.6E+001	7.9E+001
I-133	2.586E+001	7.3E+001	6.9E+001
CS-134	-1.387E+001	4.5E+001	4.2E+001
CS-137	-2.003E+001	5.0E+001	5.4E+001
TL-208	2.243E+001	5.1E+001	6.0E+001
BI-212	1.274E+003	8.4E+002	1.1E+003
PB-212	3.310E+001	7.0E+001	8.4E+001
BI-214	4.769E+001	7.8E+001	1.0E+002
PB-214	7.187E+001	1.1E+002	1.3E+002
RA-226	6.879E+002	1.3E+003	1.4E+003
AC-228	7.486E+001	1.3E+002	1.9E+002

PA-234M	1.866E+003	3.6E+003	5.7E+003

Sample 2011-00429 03/14/2011 4:23:56 AM Page 3

Nuclide Name	Activity (pCi /Ea)	Activity Uncertainty	Nuclide DLC (pCi /Ea)
U-235	8.140E+001	3.0E+002	9.3E+001

SAMPLE GAMMA ANALYSIS EQUIPMENT

DET NAME	HPGE DET S/N	MCA	MCA S/N
JAPAN	09079312	DSA 1000	07077176
PCF	12089491	DSA 1000	07077177
GIANT	10079336		

UNIDENTIFIED PEAKS

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS % Uncertainty

All peaks were identified.

NUCLIDE IDENTIFICATION REPORT

Nuclide Name	Energy (keV)	Yield (%)	Activity (pCi/Ea)	Activity Uncertainty
I-132	522.7*	16.10	1.47E+003	6.7E+002
	630.2*	13.70	1.45E+003	6.3E+002
	667.7*	98.70	1.37E+003	2.2E+002
	772.6*	76.20	1.15E+003	2.4E+002
	954.5*	18.10	1.32E+003	5.5E+002
	1398.6	7.10		
TE-132	228.2*	88.20	1.57E+003	2.5E+002

* denotes radioisotopes identified by photopeak analysis

Analysis by [signature] Badge No. 178763 Date 3/14/11

Reviewed by [signature] Badge No. 164972 Date 3/13/11

ALL ERRORS ARE QUOTED AT 2.000 sigma

Ref. NPM 1H1-7

RADIOLOGICAL ANALYSIS REQUEST AND COUNTING RESULTS (RARCR)

SHIP/PROJECT: PSNS	# OF SAMPLES: 1	C/106.3 CONTROL NUMBER(S): 2011-00430
SAMPLE LOCATION(S): P-3 DRION 775	☐ Specification as built or attached	
TECHNICAL WORK DOCUMENT:	☐	ORIGINATOR (Signature/Badge): [signature] 178763 — DATE: 3/14/11
SHOP/PHONE: VOIP 7381	C/106.3 PHONE: VOIP 7358	PROJECT C/106.3 (Signature/Badge): [signature] 178763 — DATE: 3/14/11
WASTE STREAM # (Controlled)	WASTE STREAM # (Released)	TRANSPORTED BY (Signature/Badge): [signature] 178763 — DATE: 3/14/11

SAMPLE CONTROL LIMIT	DLC	TYPE		DATE
☐ 10 pCi/g	☐ 2.5 pCi/g	☐ PAINT	105 HP/RCT RECEIVED BY (Signature/Badge): [signature] 178763	3/14/11
☐ 3 pCi/g	☐ 1 pCi/g	☐ SOLID MATERIAL	105 HP/RCT FORM COMPLETED BY (Signature/Badge): [signature] 178763	3/14/11
☐ 1 pCi/g	☐ 0.75 pCi/g	☒ LARGEWIPE	105 HP REVIEWED BY (Signature/Badge): [signature] 06772	3/13/11
☐ 1E-09 µCi/ml	☐ 0.25 pCi/g	☐ AIR SAMPLE FILTER	TRANSPORTED BY (Signature/Badge):	
☐ 2E-08 µCi/ml	☐ 1E-08 µCi/ml	☐ LIQUID	RELEASED SAMPLES IN WASTE STREAM:	
☐ Detectable NNPP Activity	☐ 2E-08 µCi/ml	☐ LEAK TEST	CONTROLLED SAMPLES IN WASTE STREAM:	
☒ TOTAL ACTIVITY 4920	☒ TOTAL ACTIVITY 4920	☐ OTHER (SPECIFY)	C106.3 SUPERVISOR (Signature/Badge):	
☐ OTHER (SPECIFY)	☐ OTHER (SPECIFY)			

03/13/11

SAMPLE GRID#	C/106.3 CONTROL#	Gross Sample Weight (g)	Net Sample Weight (g)	Sample Geometry	NNPP Activity Detectable NO	NNPP Activity Detectable YES	Sample Controlled? (Yes or No)	Specific Activity (pCi/g) (When Performed)
1-Prop	00430	NA	NA	85		X	YES*	691 pCi I-132 / Te-132

Analysis Remarks:
*Activity Fr Plume I-132, Te-132

PSNSIMF 6470/106 (Rev. 11-00) (Front)

****

SAMPLE GAMMA ANALYSIS REPORT - JAPAN

****

Report Generated On	: 03/14/2011 4:25:41 AM
Sample Description	: P-3 Orion 775
Sample Number	: 1
Control Number	: 2011-00430
Sample Type/Filename	: WFT C:\PCNT2K\CAMFILES\WFNoDLC\W1100430.CNF
Detector Name	: GIANT
Sample Quantity	: 1.000 Ea
Sample Taken On	: 03/14/2011
Acquisition Started	: 03/14/2011 3:27:42 AM
Live Time	: 300.0 seconds
Calibration File	: 500_ML_BOTTLE
Energy Cal Date	:
Efficiency Cal Date	: 07/16/2008
Nuclide Library	: C:\GENIE2K\CAMFILES\Rxplume.NLB
BKG	: C:\PCNT2K\BKGFILES\G02D03B.CNF

A N A L Y S I S R E S U L T S

IDENTIFIED NUCLIDES

Nuclide Name	Wt mean Activity (pCi /Ea)	Wt mean Activity Uncertainty	Nuclide DLC (pCi /Ea)
I-132	3.106E+002	7.6E+001	5.0E+001
TE-132	3.806E+002	9.5E+001	3.5E+001

UNIDENTIFIED NUCLIDES

Nuclide Name	Activity (pCi /Ea)	Activity Uncertainty	Nuclide DLC (pCi /Ea)
BE-7	0.000E+000	2.4E+002	2.7E+002
K-40	8.806E+001	1.8E+002	4.1E+002
CR-51	-1.081E+002	3.6E+002	3.3E+002
MN-54	0.000E+000	0.0E+000	1.6E+001
CO-58	-3.422E+000	2.5E+001	3.2E+001
FE-59	1.418E+001	2.8E+001	6.6E+001
CO-60	0.000E+000	0.0E+000	2.1E+001
ZN-65	2.389E+001	5.6E+001	9.0E+001
NB-95	5.783E+000	2.5E+001	3.7E+001
ZR-95	2.371E+001	3.4E+001	6.7E+001
SB-124	-1.972E+000	3.3E+001	3.3E+001
SB-125	-1.087E+001	1.0E+002	1.1E+002
I-131	-1.180E+001	4.6E+001	4.6E+001
I-133	2.524E+001	3.1E+001	4.7E+001
CS-134	3.963E+000	2.9E+001	3.7E+001
CS-137	1.788E+000	3.1E+001	4.0E+001
TL-208	3.365E+000	2.9E+001	3.8E+001
BI-212	2.171E+002	4.6E+002	6.7E+002
PB-212	2.040E+001	4.3E+001	6.1E+001
BI-214	-5.202E+001	1.0E+002	6.1E+001
PB-214	-3.993E+001	8.5E+001	6.7E+001
RA-226	1.560E+003	1.1E+003	1.3E+003
AC-228	3.403E+001	1.2E+002	1.7E+002

PA-234M	2.688E+003	4.1E+003	6.3E+003

Sample 2011-00430 03/14/2011 4:25:41 AM Page 3

Nuclide Name	Activity (pCi /Ea)	Activity Uncertainty	Nuclide DLC (pCi /Ea)
U-235	1.691E+002	2.2E+002	7.7E+001

SAMPLE GAMMA ANALYSIS EQUIPMENT

DET NAME	HPGE DET S/N	MCA	MCA S/N
JAPAN	09079312	DSA 1000	07077176
PCF	12089491	DSA 1000	07077177
GIANT	10079336		

U N I D E N T I F I E D P E A K S

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS % Uncertainty

All peaks were identified.

N U C L I D E I D E N T I F I C A T I O N R E P O R T

Nuclide Name	Energy (keV)	Yield (%)	Activity (pCi/Ea)	Activity Uncertainty
I-132	522.7	16.10		
	630.2	13.70		
	667.7*	98.70	3.25E+002	1.0E+002
	772.6*	76.20	2.94E+002	1.1E+002
	954.5	18.10		
	1398.6	7.10		
TE-132	228.2*	88.20	3.81E+002	9.5E+001

* denotes radioisotopes identified by photopeak analysis

Analysis by [signature] Badge No. 178763 Date 3/14/11

Reviewed by [signature] Badge No. 166972 Date 3/13/11

ALL ERRORS ARE QUOTED AT 2.000 sigma

****
* SAMPLE GAMMA ANALYSIS REPORT - JAPAN *
****

Report Generated On	: [redacted] 6:49:15 AM
Sample Description	: [redacted]
Sample Number	: 1
Control Number	: 2011-00450
Sample Type/Filename	: WFT C:\PCNT2K\CAMFILES\WFNoDLC\W1100450.CNF
Detector Name	: GIANT
Sample Quantity	: 1.000 EA
Sample Taken On	: 03/15/2011
Acquisition Started	: 03/15/2011 6:38:59 AM
Live Time	: 300.0 seconds
Calibration File	: [redacted]
Energy Cal Date	:
Efficiency Cal Date	: 07/15/2008
Nuclide Library	: C:\GENIE2K\CAMFILES\Rxplume.NLB
BKG	: C:\PCNT2K\BKGFILES\G01D03B.CNF

1st pit of Barge

A N A L Y S I S R E S U L T S

.... IDENTIFIED NUCLIDES ....

	Nuclide Name	Wt mean Activity (pCi /EA)	Wt mean Activity Uncertainty	Nuclide DLC (pCi /EA)
X	CO-60			
	I-131	3.939E+003	2.6E+002	4.2E+001
	I-132	2.125E+003	9.4E+001	2.3E+001
	TE-132	3.501E+003	3.9E+002	3.3E+001
	I-133	5.627E+002	7.2E+001	2.9E+001
	CS-134	4.277E+002	4.1E+001	2.8E+001
	CS-137	5.561E+002	6.1E+001	2.7E+001
X	BI-212			

.... UNIDENTIFIED NUCLIDES ....

Nuclide Name	Activity (pCi /EA)	Activity Uncertainty	Nuclide DLC (pCi /EA)
BE-7	-1.904E+002	2.5E+002	2.0E+002
K-40	-4.791E+001	1.3E+002	1.3E+002
CR-51	-9.746E+001	2.1E+002	1.7E+002
MN-54	7.461E+000	1.7E+001	1.8E+001
CO-58	5.892E+001	3.0E+001	3.0E+001
FE-59	1.361E+001	3.0E+001	3.2E+001
CO-60	5.910E+000	1.4E+001	1.6E+001
ZN-65	-3.081E-001	3.3E+001	3.4E+001
NB-95	-9.592E+000	1.8E+001	1.7E+001
ZR-95	-2.715E+001	3.2E+001	2.9E+001
SB-124	-1.308E+002	5.3E+001	2.9E+001
SB-125	-3.762E+001	8.0E+001	6.7E+001
TL-208	-3.572E+001	2.7E+001	2.1E+001
BI-212	1.643E+003	3.8E+002	2.9E+002
PB-212	-7.866E+000	3.5E+001	3.2E+001
BI-214	7.469E+001	4.6E+001	4.9E+001
PB-214	-2.101E+001	6.5E+001	5.4E+001

RA-226	4.373E+002	5.5E+002	5.1E+002

Sample 2011-00450 03/15/2011 6:49:15 AM Page 3

Nuclide Name	Activity (pCi /EA)	Activity Uncertainty	Nuclide DLC (pCi /EA)
AC-228	1.141E+002	7.5E+001	8.3E+001
PA-234M	1.732E+002	2.3E+003	2.3E+003
U-235	-6.794E+000	1.3E+003	3.1E+001

SAMPLE GAMMA ANALYSIS EQUIPMENT

DET NAME	HPGE DET S/N	MCA	MCA S/N
JAPAN	09079312	DSA 1000	07077176
PCF	12089491	DSA 1000	07077177
GIANT	10079336		

U N I D E N T I F I E D   P E A K S

	Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS % Uncertainty
	3	140.7	9.0E-001	25
	4	149.8	4.0E-001	102
	8	341.1	2.3E-001	77
m	26	801.9	1.4E-001	42
m	28	818.6	2.2E-001	34
	30	1048.5	1.1E-001	86
	31	1126.4	9.6E-002	69
	34	1191.1	1.3E-001	59
	35	1295.7	2.5E-001	37
	37	1441.4	5.8E-001	18
	38	1623.4	8.6E-002	62
	39	1728.4	1.1E-001	43

N U C L I D E   I D E N T I F I C A T I O N   R E P O R T

Nuclide Name	Energy (keV)	Yield (%)	Activity (pCi/EA)	Activity Uncertainty
I-131	177.2	0.26		
	284.3*	6.06	3.82E+003	6.9E+002
	364.5*	81.20	4.07E+003	3.4E+002
	637.0*	7.27	3.69E+003	5.2E+002
	722.9*	1.80	4.27E+003	1.2E+003
I-132	262.7*	1.44	3.49E+003	2.1E+003
	505.9*	5.03	1.67E+003	8.5E+002
	522.7*	16.10	2.14E+003	3.1E+002
	621.2*	1.58	1.80E+003	1.7E+003
	630.2*	13.70	1.94E+003	3.2E+002
	650.6*	2.66	2.00E+003	1.5E+003
	667.7*	98.70	2.17E+003	1.4E+002
	669.8	4.90		
	671.6*	5.20	1.97E+003	5.6E+002
	727.2*	5.40	2.05E+003	6.5E+002

Sample 2011-00450 03/15/2011 6:49:15 AM Page 4

	772.6*	76.20	2.13E+003	1.8E+002
	809.8	2.90		
	812.2*	5.60	1.86E+003	5.8E+002
	954.5*	18.10	1.96E+003	3.3E+002
	1136.0*	2.96	3.04E+003	1.4E+003
	1173.2*	1.09	2.88E+003	3.5E+003
	1372.1	2.47		
	1398.6*	7.10	2.56E+003	7.1E+002
TE-132	111.8*	1.85	2.99E+003	1.2E+003
	116.3*	1.94	2.78E+003	1.1E+003
	228.2*	88.20	3.71E+003	4.6E+002
I-133	262.7*	0.36	1.38E+004	8.2E+003
	510.5	1.83		
	529.9*	87.00	5.63E+002	7.2E+001
	618.0	0.54		
	875.3	4.51		
CS-134	569.3*	15.43	3.46E+002	2.2E+002
	604.7*	97.60	4.15E+002	6.2E+001
	795.8*	85.40	4.43E+002	5.6E+001
CS-137	661.7*	85.21	5.56E+002	6.1E+001

* denotes radioisotopes identified by photopeak analysis

Analysis by ____________________ Badge No. __________ Date __________

Reviewed by ____________________ Badge No. __________ Date __________

ALL ERRORS ARE QUOTED AT 2.000 sigma

From: LIA06 Hoc
Sent: Friday, March 25, 2011 5:50 AM
To: LIA08 Hoc; LIA11 Hoc
Subject: FW: March 25 0600EDT one pager (2).docx
Attachments: March 25 0600 EDT one pager (3).doc

FYI.

Liaison Team Director
U.S. Nuclear Regulatory Commission
Operations Center

From: McGinty, Tim
Sent: Friday, March 25, 2011 5:42 AM
To: McGinty, Tim; PMT09 Hoc; RST01 Hoc; LIA07 Hoc; LIA06 Hoc
Cc: Ross-Lee, MaryJane; Ross-Lee, MaryJane; Giitter, Joseph
Subject: March 25 0600EDT one pager (2).docx

Comments please, on updated one-pager to be discussed with the Chairman this morning. Comments if any by 0555, please. Thanks, Tim McGinty

From: PMT09 Hoc
Sent: Friday, March 25, 2011 4:48 AM
To: Hoc, PMT12
Subject: FYI
Attachments: Proposal to form a Fukushima Source Term Working Group.doc

Proposal to form a Fukushima Source Term Working Group

(b)(5)

To: Hoc, PMT12
Subject: Please file

From: PMT09 Hoc
Sent: Friday, March 25, 2011 4:08 AM
To: Hoc, PMT12
Subject: file
Attachments: 2011 03 25 Reentry guidance.doc

Reentry Guidance

(b)(5)

C:\FoiaProject\FoiaPDFExport\PSTs\PMT09_HOC\Emails\00337\00002.doc

Reentry Guidance

(b)(5)

C:\FoiaProject\FoiaPDFExport\PSTs\PMT09_HOC\Emails\00337\00002.doc

Reentry Guidance

(b)(5)

C:\FoiaProject\FoiaPDFExport\PSTs\PMT09_HOC\Emails\00337\00002.doc

From: PMT09 Hoc
Sent: Friday, March 25, 2011 2:06 AM
To: Hoc, PMT12
Subject: FW: Site team ?

From: PMT09 Hoc
Sent: Friday, March 25, 2011 2:06 AM
To: PMT09 Hoc
Subject: Site team ?

We are developing a regimen for the US Ambassador to allow temporary reentry to evacuated areas (beyond the area evacuated by Japanese direction) for US citizens to recover personnel items from home. The regimen requires radiological coverage for the reentry in order to minimize contamination spread and maintain doses to citizens within limits.

We would like to ask DOE assets in country whether they have radiation control personnel and equipment that could/would support the effort.

From: Devlin, Stephanie
Sent: Thursday, March 24, 2011 5:32 PM
To: PMT09 Hoc; Hoc, PMT12
Subject: FW: Japan SharePt site

From: Cook, Christopher
Sent: Thursday, March 24, 2011 4:40 PM
To: Devlin, Stephanie
Subject: Japan SharePt site

http://portal.nrc.gov/edo/nrr/NRR%20TA/FAQ%20Related%20to%20Events%20Occuring%20in%20Japan/Forms/AllItems.aspx?View=%7b282DC699%2dFA97%2d430B%2dA1F9%2d6008558261C5%7d

****

Christopher B. Cook, Ph.D.
Chief, Geoscience and Geotechnical Engineering Branch 2
US NRC, Office of New Reactors
(301) 415-6397
Christopher.Cook@nrc.gov

From: PMT09 Hoc
Sent: Thursday, March 24, 2011 5:21 PM
To: Hoc, PMT12

GENERAL CRITERIA AS TO WHEN NRC WOULD RELAX ITS PAGs TO ALLOW FOR RE-ENTRY INTO THE 50-MILES EPZ TO GATHER PERSONAL BELONGINGS, PETS, ETC

(b)(5)

From: LIA06 Hoc
Sent: Thursday, March 24, 2011 2:18 PM
To: Ross-Lee, MaryJane
Subject: RE: March 24 1515 EDT one pager (2).docx
Attachments: March 24 1515EDT one pager (2).doc

MJ.. I edited the 1000 meeting comment.. Mike

Liaison Team Director
U.S. Nuclear Regulatory Commission
Operations Center

From: Ross-Lee, MaryJane
Sent: Thursday, March 24, 2011 1:08 PM
To: PMT09 Hoc; RST01 Hoc; LIA07 Hoc; LIA06 Hoc
Cc: Weber, Michael; Camper, Larry
Subject: RE: March 24 1515 EDT one pager (2).docx
Importance: High

Comments please, on updated one-pager to be discussed with the Chairman this afternoon. Comments if any by 1415, please. Thanks, MJ

From:	PMT09 Hoc
Sent:	Wednesday, March 23, 2011 10:32 PM
To:	RST01 Hoc
Cc:	Hoc, PMT12
Subject:	MELCOR worst case assumptions and (separate) Plausible Realistic Case assumptions
Attachments:	Plausible Realistic Case source term summary.doc; MELCOR based worst case source term information.doc

See attached. These are two separate runs. NARAC has finished the MELCOR worst case, and will be starting the Plausible Realistic Case run soon.

PMT

03/23/2011, 1650 EDT

Information on MELCOR based worst case source terms for dose analyses

(b)(5)

(b)(5)

"M:\PMT\MELCOR based worst case source term information.doc"

(b)(5)

3/23/2011

Plausible Realistic Case assumptions

Per a conference call with OSTP, DOE, NARAC and NRC, NARAC is running a new case on a plausible realistic case for Tokyo. Once agreed upon by the inter-agency group, this analysis will be provided to the Japanese government. The attendees agreed that the source term would include:

- No spent fuel pool fires
- Core damage in Units 1, 2 and 3, assumed as 33% each
- Design containment leakage rate (0.5% per day)
- Release period starts at 21:15Z on March 15.
- Release is assumed to occur at a constant rate for 12 days.
- NARAC will use actual and forecast meteorological conditions.

The basis for the source term is the "SuperCore" reactor source term, which was 33% damage to Unit 2.

Estimates of TEDE, Thyroid dose, worker protection dose rate and total deposition in Japan will be calculated.

"M:\PMT\Plausible Realistic Case source term summary.doc"

From: PMT09 Hoc
Sent: Wednesday, March 23, 2011 9:52 PM
To: LIA07 Hoc
Cc: Hoc, PMT12
Subject: SITREP update
Attachments: Insert A March 24.doc

The attached is a PMT addition to the SITREP for the next update on 3/24, based on current information. We may have additional additions and/or corrections to the SITREP subsequent to this addition.

PMT

Insert A:

Per a conference call with OSTP, DOE, NARAC and NRC, NARAC is running a new case on a plausible realistic case for Tokyo. Once agreed upon by the inter-agency group, this analysis will be provided to the Japanese government. The attendees agreed that the source term would include:

- No spent fuel pool fires
- Core damage in Units 1, 2 and 3, assumed as 33% each
- Design containment leakage rate (0.5% per day)
- Release period starts at 21:15Z on March 15.
- Release is assumed to occur at a constant rate for 12 days.
- NARAC will use actual and forecast meteorological conditions.

Estimates of TEDE, Thyroid dose, worker protection dose rate and total deposition in Japan will be calculated.

PMT confirmed reports that INPO had access to one million KI pills from ANBEX, Inc. (866-463-6754) at 44 cents/pill.

"M:\PMT\SITREP updates\Insert A March 24.doc"

From: PMT02 Hoc
Sent: Sunday, April 03, 2011 6:26 PM
To: PMT11 Hoc
Subject: HDS FDA DILs
Attachments: DHS FDA Derived Intervention Levels.pdf

PMT Dose Analyst (PMT02)
NRC Operation Center

THIS IS A DRILL --- THIS IS A DRILL --- THIS IS A DRILL

Source: SFP damage release thru wind shift

Miles	0.5	1	1.5	2	3	5	7	10
(kilometers)	0.8	1.61	2.41	3.22	4.83	8.05	11.27	16.09
Total EDE	3.80E+02	1.40E+02	7.50E+01	4.90E+01	2.50E+01	9.90E+00	4.70E+00	1.60E+00
Thyroid CDE	9.30E+01	3.50E+01	2.10E+01	1.50E+01	1.00E+01	5.20E+00	3.10E+00	1.10E+00
Inhalation CEDE	1.10E+02	4.00E+01	2.40E+01	1.70E+01	1.10E+01	5.90E+00	3.50E+00	1.30E+00
Cloudshine	8.80E-01	3.50E-01	1.90E-01	1.10E-01	8.70E-02	4.30E-02	2.60E-02	1.10E-02
4-day Groundshine	3.00E+02	1.10E+02	6.20E+01	4.10E+01	2.20E+01	8.50E+00	2.90E+00	6.60E-01
atio for B5/(B7+B8/4)	1.23E+00	1.26E+00	1.34E+00	1.45E+00	1.79E+00	2.40E+00	4.13E+00	6.25E+00

average ==> 2.057203

Source Term: Fukushia Daiichi Unit 2 Reactor 33% core Melt.

miles	0.5	1	1.5	2	3	5	7	10
(kilometers)	0.8	1.61	2.41	3.22	4.83	8.05	11.27	16.09
Total EDE	2.70E+02	1.40E+02	9.50E+01	7.50E+01	5.50E+01	3.80E+01	2.90E+01	5.10E+00
Thyroid CDE	3.30E+03	1.60E+03	1.10E+03	8.90E+02	6.60E+02	4.50E+02	3.40E+02	7.30E+01
Inhalation CEDE	2.20E+02	1.10E+02	7.70E+01	6.00E+01	4.50E+01	3.00E+01	2.30E+01	4.10E+00
Cloudshine	1.80E+00	9.40E-01	6.50E-01	4.60E-01	3.40E-01	2.30E-01	1.70E-01	4.80E-02
4-day Groundshine	5.20E+01	2.60E+01	1.80E+01	1.40E+01	1.00E+01	7.10E+00	5.40E+00	8.90E-01
Inter Phase 1st Yr	1.70E+03	8.40E+02	5.80E+02	4.60E+02	3.40E+02	2.30E+02	1.70E+02	2.60E+01
Inter Phase 2nd Yr	1.00E+03	5.10E+02	3.50E+02	2.80E+02	2.00E+02	1.40E+02	1.10E+02	1.60E+01
atio for B5/(B7+B8/4)	2.23E+02	2.15E+02	2.14E+02	2.25E+02	2.32E+02	2.24E+02	2.24E+02	2.70E+02

average ==> 1.90E+02

recommendation is about 200.

For example, whenpacket reading is 25 mrem, then estimated Thyroid CDE is (25)x(200) =5,000 mre

15	20	30	40	50	
24.1	32.2	48.3	64.4	80.5	
1.70E+00	9.80E-01	8.40E-01	6.40E-01	1.00E+00	
4.10E-01	2.60E-01	1.70E-01	2.30E-01	2.30E-01	
4.70E-01	3.00E-01	2.00E-01	2.60E-01	2.60E-01	
6.60E-03	4.20E-03	2.80E-03	3.60E-03	3.60E-03	
1.30E+00	7.70E-01	7.30E-01	3.90E-01	7.80E-01	
1.24E+00	1.32E+00	9.17E-01	2.27E+00	1.16E+00	

15	20	30	40	50	
24.1	32.2	48.3	64.4	80.5	
2.40E-01	2.30E-01	2.50E-01	3.10E-01	7.10E-01	
2.60E+00	2.60E+00	2.80E+00	3.20E+00	5.00E+00	
1.70E-01	1.70E-01	1.90E-01	2.10E-01	3.30E-01	
2.50E-03	2.30E-03	2.50E-03	2.90E-03	4.50E-03	
5.90E-02	5.90E-02	5.60E-02	9.50E-02	3.90E-01	
1.80E+00	1.80E+00	1.80E+00	3.10E+00	1.40E+01	
1.10E+00	1.10E+00	1.10E+00	1.90E+00	8.30E+00	
1.51E+02	1.52E+02	1.70E+02	1.20E+02	4.90E+01	1.90E+02

ACCIDENTAL RADIOACTIVE CONTAMINATION
OF HUMAN FOOD AND ANIMAL FEEDS:
RECOMMENDATIONS FOR STATE AND LOCAL AGENCIES

This document is intended to provide guidance. It represents the Agency's current thinking on the above. It does not create or confer any rights for or on any person and does not operate to bind FDA or the public. An alternative approach may be used if such approach satisfies the requirements of the applicable statute, regulations or both.

Radiation Programs Branch
Division of Mammography Quality and Radiation Programs
Office of Health and Industry Programs

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Comments and suggestions may be submitted at any time for Agency consideration to: Radiation Programs Branch (HFZ-240), Center for Devices and Radiological Health, 1350 Piccard Drive, Rockville, MD 20850. Comments may not be acted upon by the Agency until the document is next revised or updated. For questions regarding the use or interpretation of this guidance document contact Donald Thompson at 301-827-0012 or DLT@cdrh.fda.gov.

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Food and Drug Administration
Center for Devices and Radiological Health
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Prepared by: Center for Devices and Radiological Health
Food and Drug Administration

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ACCIDENTAL RADIOACTIVE CONTAMINATION OF HUMAN FOOD AND ANIMAL FEEDS: RECOMMENDATIONS FOR STATE AND LOCAL AGENCIES[1]

INTRODUCTION

Recommendations on accidental radioactive contamination of human food and animal feeds were issued in 1982 by the Food and Drug Administration (FDA) (FDA 1982, Shleien et al 1982). Since then, there have been enough significant advancements related to emergency planning to warrant updating the recommendations. New scientific information and radiation protection philosophy are incorporated, experience gained since 1982 is included, and guidance developed by international organizations is taken into account (Schmidt 1988a, 1988b, 1990, Burnett and Rosenstein 1989).

These recommendations provide guidance applicable to accidents at nuclear power plants and many other types of accidents where a significant radiation dose[2] could be received as a result of consumption of contaminated food. These recommendations rescind and replace the 1982 FDA recommendations.

GENERAL PROVISIONS

(a) Applicability.

The recommendations provide guidance to State and local agencies to aid in emergency response planning and execution of protective actions associated with production, processing, distribution, and use of human food and animal feeds accidentally contaminated with radionuclides. The recommendations do not authorize or apply to deliberate releases of radionuclides which are permitted and limited by general controls and/or terms and conditions stipulated by a regulatory agency.

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1 This document is intended to provide guidance. It represents the Agency's current thinking on the above. It does not create or confer any rights for or on any person and does not operate to bind FDA or the public. An alternative approach may be used if such approach satisfies the requirements of the applicable statute, regulations, or both.

2 The term "radiation dose" is used when the intended meaning is general or refers to more than one specific dose quantity.

(b) Scope.

The recommendations advise that health risk to the public be averted by limiting the radiation dose received as a result of consumption of accidentally contaminated food. This will be accomplished by: (1) setting limits, called Derived Intervention Levels (DILs) on the radionuclide activity concentration (concentration) permitted in human food, and (2) taking protective actions to reduce the amount of contamination.

DILs are limits on the concentrations permitted in human food distributed in commerce. They are established to prevent consumption of undesirable amounts of radionuclides and have units of radionuclide activity per kilogram of food, i.e. becquerels per kilogram, Bq/kg (previously used units - picocuries per kilogram, pCi/kg)[3]. Comparable limits were not provided in the 1982 FDA recommendations. DILs apply during the first year after an accident. If there is concern that food will continue to be significantly contaminated beyond the first year, the long-term circumstances need to be evaluated to determine whether the DILs should be continued or if other guidance may be more applicable.

Protective actions would be initiated subject to evaluation of the situation and would continue until, in the absence of the actions, the concentrations remain below the DILs. Protective actions can be taken to:

- avoid or limit, through precautionary measures, the amount of contamination that could become incorporated in human food and animal feeds, or

- delay or limit consumption of human food and animal feeds suspected of being contaminated until the concentration of contamination has been determined, or

- reduce the amount of contamination in human food and animal feeds.

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[3] The International System of Units is used throughout this document. Units that were used in previous FDA guidance are shown in parenthesis in the main text of this document as reference points for the reader.

Limits on concentrations permitted in animal feeds are not given in these recommendations. However, protective actions for animal feeds are included as measures to reduce or prevent subsequent contamination of human food.

PROTECTIVE ACTION GUIDES

The 1982 FDA recommendations established two levels of Protective Action Guides (PAGs). PAGs were defined as "projected dose commitment values to individuals in the general population that warrant protective action following a release of radioactive material." The lower level, called the Preventive PAG, was a projected dose commitment of 5 mSv (0.5 rem) to the whole body, active bone marrow, or any other organ except the thyroid, or a projected dose commitment of 15 mSv (1.5 rem) to the thyroid. The Preventive PAG was associated with low-impact protective actions (e.g. placing dairy cows on stored feed). The upper level, called the Emergency PAG, was a projected dose commitment of 50 mSv (5 rem) to the whole body, active bone marrow, or any other organ except the thyroid, or a projected dose commitment of 150 mSv (15 rem) to the thyroid. The Emergency PAG was associated with higher-impact protective actions (e.g., diversion of fresh milk to cheese or milk powder).

The 1982 FDA recommendations were developed from the prevailing scientific understanding of the relative risks associated with radiation as described in the 1960 and 1961 reports of the Federal Radiation Council (FRC 1960, 1961). Since 1982, FDA and the other federal agencies in the United States have adopted the methodology and terminology for expressing radiation doses provided by the International Commission on Radiological Protection (ICRP) in 1977 (ICRP 1977, ICRP l984a, EPA 1987). The ICRP's dose quantities for radiation protection purposes include effective dose equivalent, committed effective dose equivalent, dose equivalent for a specific tissue, and committed dose equivalent for a specific tissue[4,5].

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4 See Appendix A (Glossary) for explanation of these dose quantities and their use in this document.

5 The ICRP adopted new recommendations in 1990, which include revisions in its methodology and terminology for expressing radiation doses and the relative risks associated with irradiation of specific organs (ICRP l991a). There is not yet consensus among the federal agencies on the use of these changes.

These current recommendations replace the Preventive and Emergency PAGs with one set of PAGs for the ingestion pathway. The PAGs are 5 mSv (0.5 rem) for committed effective dose equivalent or 50 mSv (5 rem) committed dose equivalent to an individual tissue or organ, whichever is more limiting. These correspond to the "intervention levels of dose" consensus values set by international organizations (see Appendix B). Intervention levels of dose are radiation doses at which introduction of protective actions should be considered (ICRP 1984b). The FDA guidance retains use of the term Protection Action Guide (PAG) for consistency with U.S. federal and state needs.

The current nominal estimate for the general population for lifetime total cancer mortality for low-LET (linear energy transfer) ionizing radiation, delivered at low doses and low dose rates, is 4.5×10^{-3} for a reference dose equivalent in the whole body of 100 mSv (10 rem) (CIRRPC 1992). For 5 mSv (0.5 rem) committed effective dose equivalent (the recommended PAG) the associated lifetime total cancer mortality would be 2.25×10^{-4} or approximately 1 in 4400.[6] For comparison, the estimate of the normal lifetime total cancer mortality in the United States for the general population, not associated with additional radiation dose from ingestion of contaminated food from an accident, is 0.19 or approximately 1 in 5 (CIRRPC 1992). For example, in a general population of 10,000 individuals, each receiving a committed effective dose equivalent of 5 mSv (0.5 rem), the number of cancer deaths over the lifetimes of the individuals could increase in theory by about 2 cancer deaths, that is from the normal number of 1900 to 1902.

The numerical estimate of cancer deaths presented above for the recommended PAG of 5 mSv (0.5 rem) was obtained by the practice of linear extrapolation from the nominal risk estimate for lifetime total cancer mortality for the general population at 100 mSv (10 rem) dose equivalent in the whole body. Other methods of extrapolation to the low-dose region could yield higher or

[6] The alternate PAG of 50 mSv (5 rem) committed dose equivalent to a specific tissue or organ is always associated with a lifetime cancer mortality for the specific tissue that is as limiting or in some cases more limiting than the lifetime total cancer mortality associated with the PAG of 5 mSv (0.5 rem) for committed effective dose equivalent.

lower numerical estimates of cancer deaths. Studies of human populations exposed at low doses are inadequate to demonstrate the actual magnitude of risk. There is scientific uncertainty about cancer risk in the low-dose region below the range of epidemiological observation, and the possibility of no risk cannot be excluded (CIRRPC 1992).

DERIVED INTERVENTION LEVELS

A DIL corresponds to the concentration in food present throughout the relevant period of time that, in the absence of any intervention, could lead to an individual receiving a radiation dose equal to the PAG, or in international terms, the intervention level of dose. The equation given below is the basic formula for computing DILs.[7]

$$\text{DIL (Bq/kg)} = \frac{\text{PAG (mSv)}}{\text{f} \times \text{Food Intake (kg)} \times \text{DC (mSv/Bq)}}$$

Where:

DC	=	Dose coefficient; the radiation dose received per unit of activity ingested (mSv/Bq).
f	=	Fraction of the food intake assumed to be contaminated.
Food Intake	=	Quantity of food consumed in an appropriate period of time (kg).

The FDA DILs provide a large margin of safety for the public because each DIL is set according to a conservatively safe scenario for the most vulnerable group of individuals (see Appendix D). In addition, protective action would be taken if radionuclide concentrations were to reach or exceed a DIL at any point in time, even though such concentrations would need to be sustained throughout the relevant extended period of time for the radiation dose to actually reach the PAG. In practice, when FDA DILs are used, radiation doses to the vast majority of the affected public would be very small fractions of the PAG. As a result, future adjustments in the absolute values

[7] In the previous system of units DIL would be in units of pCi/kg, intervention level of dose in units of mrem and DCs in units of mrem/pCi.

of the PAGs would not necessarily require proportionate modifications in the DILs. Any modification of the DILs would depend on a review of all aspects of the conservatively safe scenario and how the DILs are applied.

Food with concentrations below the DILs is permitted to move in commerce without restriction. Food with concentrations at or above the DILs is not normally permitted into commerce. However, State and local officials have flexibility in whether or not to apply restrictions in special circumstances, such as permitting use of food by a population group with a unique dependency on certain food types.

(a) Use of Derived Intervention Levels for Food Monitoring after the Chernobyl Accident

Developments in the U.S.

Following the Chernobyl accident in 1986, a task group of representatives from FDA and the Food Safety and Inspection Service (FSIS) of the United States Department of Agriculture established DILs for application to imported foods under their respective regulatory control. The FDA DILs were called "Levels of Concern" (LOCs) (FDA 1986a, 1986b) and the FSIS DILs were called "Screening Values." Food containing concentrations below the LOCs and Screening Values was allowed to be imported into the U.S.

FDA LOCs were derived from the 1982 Preventive PAGs and used the following assumptions:

- the entire intake of food would be contaminated,
- I-131 could be a major source of radiation dose for only 60 days following the accident
- Cs-134 + Cs-137 could be a major source of radiation dose for up to one year.

The LOCs provided such a large margin of safety that derivation of LOCs for other radionuclides, judged to be of less health significance, was considered unnecessary.

The FSIS Screening Value for I-131 was the same as the FDA LOC for I-131 in infant foods. The FSIS Screening Value for Cs-134 + Cs-137 initially differed from the FDA LOC because the

FSIS assumed that only meat and poultry (not 100% of the diet) would be contaminated (USDA 1986a). In November 1986, the FSIS changed the Screening Value for Cs-134 + Cs-137 to be the same as the FDA LOC (USDA 1986b, Engel et al 1989). The FDA and FSIS DILs for the Chernobyl accident contamination in imported food after November 1986 are given in Table 1.

Table 1

FDA AND FSIS DERIVED INTERVENTION LEVELS FOR IMPORTED FOOD AFTER THE CHERNOBYL ACCIDENT, Bq/kg (pCi/kg)

	FDA LOC		FSIS Screening Value
Radionuclide	Infant Food	Other Food	Meat and Poultry
I-131	55 (1500)	300 (8000)	55 (1500)
Cs-134 + Cs-137	370 (10,000)	370 (10,000)	370 (10,000)

The food monitoring results from FDA and others following the Chernobyl accident support the conclusion that I-131, Cs-134 and Cs-137 are the principal radionuclides that contribute to radiation dose by ingestion following a nuclear reactor accident, but that Ru-103 and Ru-106 also should be included (see Appendix C). Also, use of DILs was shown to be a practical way to control the radiation dose from ingestion of food that has been contaminated as a result of a nuclear reactor accident.

International Activities

Efforts by international organizations to develop DILs have been extensive. Derivations have been based on the consensus value for the intervention level of dose, and have been for application within individual countries and in international trade. Each of the various international organizations selected values for the components in the basic formula for computing DILs, and each introduced additional judgments to arrive at its recommended DILs. As a result, the DILs recommended by the various organizations differed. The DILs adopted by the Commission of European Communities (CEC) for use in future accidents and those adopted by the Codex Alimentarius (CODEX) for use in international trade[8] are presented in Appendix F.

(b) Recommended Derived Intervention Levels

In these recommendations, FDA uses the term Derived Intervention Level (DIL), which is consistent with international usage. DIL is equivalent to, and replaces the previous FDA term Level of Concern (LOC).

The recommended DILs are for radionuclides expected to deliver the major portion of the radiation dose from ingestion during the first year following an accident. The DILs are for accidental releases of radionuclides from large nuclear reactors and for other radiological emergencies where there is a possibility of accidental radioactive contamination of human food. The approach provides the flexibility necessary to respond to special circumstances that may be unique to a particular accident. A summary of the considerations in selecting DILs is given in this section, with a more detailed explanation available in Appendix D.

The types of accidents and the principal radionuclides for which the DILs were developed are:

- nuclear reactors (I-131; Cs-134 + Cs-137; Ru-103 + Ru-106),
- nuclear fuel reprocessing plants (Sr-90; Cs-137; Pu-239 + Am-241),
- nuclear waste storage facilities (Sr-90; Cs-137; Pu-239 + Am-241),
- nuclear weapons (i.e., dispersal of nuclear material without nuclear detonation) (Pu-239)
- radioisotope thermoelectric generators (RTGs) and radioisotope heater units (RHUs) used in space vehicles (Pu-238)

The radionuclides listed are expected to be the predominant contributors to radiation dose through ingestion.[9] Several radionuclides could be released by an accident at a nuclear

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[8] An application of the CODEX DILs can be found in the International Atomic Energy Agency's (IAEA) interim edition of its basic safety standards for protection against ionizing radiation (IAEA 1994). IAEA based its "generic action levels for foodstuffs," found in Schedule V of IAEA 1994, on CODEX DILs.

[9] A discussion of the principal radionuclides for an accident at a nuclear reactor is given in Appendix C.

reactor, a nuclear fuel processing plant or a nuclear waste storage facility, while only the specific radionuclide used in a nuclear weapon or a space vehicle would be released in that type of accident. When more than one radionuclide is released, the relative contribution that a radionuclide makes to radiation dose from ingestion of subsequently contaminated food depends on the specifics of the accident and the mode of release (NRC 1975, DOE 1989, EPA 1977).

In unique circumstances, such as transportation accidents, other radionuclides may contribute radiation doses through the food ingestion pathway. These situations are not specifically treated in these recommendations. An evaluation of the radiation dose from ingestion of these other radionuclides should be performed, however, to determine if the PAGs would be exceeded. FDA should be notified during such an evaluation.

DILs were calculated for the nine radionuclides noted above. For each radionuclide, DILs were calculated for six age groups using Protective Action Guides, dose coefficients, and dietary intakes relevant to each radionuclide and age group. The age groups included 3 months, 1 year, 5 years, 10 years, 15 years and adult (>17 years). The dose coefficients used were from ICRP Publication 56 (ICRP 1989).

The DILs were based on the entire diet[10] for each age group, not for individual foods or food groups. The calculation presumed that contamination would occur in thirty percent of the dietary intake. The value of thirty percent was based on the expectation that normally less than ten percent of the annual dietary intake of most members of the population would consist of contaminated food. An additional factor of three was applied to account for limited sub-populations that might be more dependent on local food supplies. An exception was made for I-131 in the diets of the 3-month and 1-year age groups, where the entire intake over a sixty-day period was assumed to be contaminated.

[10] The "entire diet" includes tap water used for drinking.

The nine radionuclides comprised five radionuclide groups, each having common characteristics. The five groups are: Sr-90; I-131; Cs-134 + Cs-137; Ru-103 + Ru-106; and Pu-238 + Pu-239 + Am-241. An accident could involve more than one of the five groups.

Protection of the more vulnerable segments of the population and the practicality of implementation were major considerations in the selection of the recommendations. These considerations lead to the single DIL or the single criterion for each radionuclide group that is presented in Table 2, based on the most limiting Protective Action Guide (PAG) and age group for the radionuclide group.[11]

The recommended DILs may be applied immediately following an accident. Early identification of other radionuclides that may be present in food is not required. However, the recommended DILs should be evaluated as soon as possible after an accident to ensure that they are appropriate for the situation. Appendix E presents a discussion on DILs for a number of other radionuclides that could be released from the reactor core of a nuclear power plant.

(c) Imported or Exported Food

The LOCs that applied to radioactive contamination from the Chernobyl accident in imported foods subject to FDA authority were given in an FDA Compliance Policy Guide (FDA 1986b). This guidance remains in effect and would be reviewed and modified as necessary to respond to any future accident resulting in radioactive contamination of imported food.

Food exported from the United States is controlled by standards, regulations and guidance in the importing countries. Two examples of guidance applicable to accidentally contaminated foods exported from the United States are the guidelines issued by the CODEX Alimentarius Commission of the Joint FAO/WHO Food Standards Program and the regulations adopted by the

[11] The PAG of 5 mSv (0.5 rem) for committed effective dose equivalent was most limiting for Cs-134 + Cs-137 and Ru-103 + Ru-106; the PAG of 50 mSv (5 rem) for committed dose equivalent to a single specific tissue or organ was most limiting for Sr-90, I-131 and Pu-238 + Pu 239 + Am-241.

Commission of the European Communities (CEC). The DILs adopted by these two organizations (presented in Appendix F) differ from each other and from the FDA LOCs.

Table 2

Recommended Derived Intervention Level (DIL) or Criterion for Each Radionuclide Group[(a),(b)]

	All Components of the Diet	
Radionuclide Group	(Bq/kg)	(pCi/kg)
Sr-90	160	4300
I-131	170	4600
Cs-134 + Cs-137	1200	32,000
Pu-238 + Pu-239 + Am-241	2	54
Ru-103 + Ru-106[(c)]	$\frac{C_3}{6800} + \frac{C_6}{450} < 1$	$\frac{C_3}{180{,}000} + \frac{C_6}{12{,}000} < 1$

Notes:

(a) The DIL for each radionuclide group is applied independently (see discussion in Appendix D). Each DIL applies to the sum of the concentrations of the radionuclides in the group at the time of measurement.

(b) Applicable to foods as prepared for consumption. For dried or concentrated products such as powdered milk or concentrated juices, adjust by a factor appropriate to reconstitution, and assume the reconstitution water is not contaminated. For spices, which are consumed in very small quantities, use a dilution factor of 10.

(C) Due to the large difference in DILs for Ru-103 and Ru-106, the individual concentrations of Ru-103 and Ru-106 are divided by their respective DILs and then summed. The sum must be less than one. C3 and C6 are the concentrations, at the time of measurement, for Ru-103 and Ru-106, respectively (see discussion in Appendix D).

PROTECTIVE ACTIONS

Protective actions are steps taken to limit the radiation dose from ingestion by avoiding or reducing the contamination that could occur on the surface of, or be incorporated into, human food and animal feeds. Such actions can be taken prior to and/or after confirmation of contamination. The protective actions for a specific accident are determined by the particulars of the situation and once initiated they continue at least until the concentrations are expected to remain below the DILs.

For contamination events not effectively managed using DILs, protective actions appropriate to the situation would still be established and applied by the responsible officials. For example, in 1988 FDA developed guidance for use in responding to a contamination event that could have occurred from an uncontrolled reentry of the Russian satellite Cosmos 1900. FDA issued an advisory which specified protective actions against contamination in the form of widely but sparsely distributed discrete radioactive particulates and large pieces of radioactive debris (FDA 1988). The uncontrolled reentry of Cosmos 1900 did not occur.

(a) Protective Actions Prior to Confirmation of Contamination

Protective actions which can be taken within the area likely to be affected and prior to confirmation of contamination consist of:

- simple precautionary actions to avoid or reduce the potential for contamination of food and animal feeds, and
- temporary embargoes to prevent the introduction into commerce of food which is likely to be contaminated.

Protective actions can be taken before the release or arrival of contamination if there is advance knowledge that radionuclides may accidentally contaminate the environment.

For some types of accidents, determination of when and what protective actions would be taken may be facilitated by associating them with the accident classifications designated by the Nuclear Regulatory Commission (NRC) or the Department of Energy (DOE). For accidents involving commercial nuclear power reactors, the NRC has established four emergency classes: Notification of Unusual Event, Alert, Site Area Emergency, and General Emergency. Criteria for declaring these classes were published by the NRC (NRC 1980, 1991).

For accidents at DOE facilities, the DOE has established three emergency classes: Alert, Site Area Emergency, and General Emergency. These classes are comparable to those established by NRC. Incidents considered as Unusual Events by NRC licensees are covered as Unusual Occurrences by DOE (DOE 1992)

Simple precautionary actions include modest adjustment of normal operations prior to arrival of contamination. These will not guarantee contamination in food will be below the DILS but the severity of the forthcoming problem would be significantly reduced. Typical precautionary actions include covering exposed products, moving animals to shelter, corralling livestock and providing protected feed and water.

Precautionary actions should be implemented so as to avoid placing in jeopardy persons implementing the action. For example, in the case of an accident involving a commercial nuclear power plant, if the predictions of the magnitude of future off-site contamination are persuasive, precautionary actions that could be taken and completed before a declaration of Site Area Emergency or General Emergency could be considered. However, precautionary actions that would involve persons either not seeking shelter or leaving the immediate vicinity of shelter should not be taken after declaration of a Site Area Emergency or General Emergency. A temporary embargo on food and agricultural products (including animal feeds) prevents the consumption of food that is likely to be contaminated. Distribution and use of possibly contaminated food and animal feeds is halted until the situation can be evaluated and monitoring and control actions instituted. Temporary embargoes are applied when the concentrations are not yet known. Because there is potential for negative impact on the community, justification for this action must be significant. The embargo should remain in effect at least until results are obtained. For nuclear power plants, a temporary embargo should be issued only upon declaration of a General Emergency and if predictions of the extent and magnitude of the off-site contamination are persuasive. The geographical area under control by the embargo would depend on the accident sequence, the meteorological conditions, and the food affected.

(b) Protective Actions for Foods Confirmed to be Contaminated

Protective actions which should be implemented when the contamination in food equals or exceeds the DILs consist of:

- temporary embargoes to prevent the contaminated food from being introduced into commerce,
- normal food production and processing actions that reduce the amount of contamination in or on food to below the DILs.

A temporary embargo to prevent the introduction into commerce of food from a contaminated area should be considered when the amount of contamination equals or exceeds the DILs or when the presence of contamination is confirmed, but the concentrations are not yet known. The temporary embargo would continue until measurements confirm that concentrations are below the DILs.

Normal food production and processing procedures that could reduce the amount of radioactive contamination in or on the food could be simple, (such as holding to allow for radioactive decay, or removal of surface contamination by brushing, washing, or peeling) or could be complex (Grauby and Luykx 1990, FDA 1982, USDA 1989). The blending of contaminated food with uncontaminated food is not permitted because this is a violation of the Federal Food, Drug and Cosmetic Act (FDA 1991).

Protective actions focus on the specific foods having the greatest sources of radiation dose to the population. Factors that determine which foods are most significant include the agricultural practices in the area of contamination and the stage of the growing or harvest season at the time of the accident. In general, foods consumed fresh, such as milk, leafy vegetables, and fruit, are initially most important. Grains, root crops, other produce, and animal-derived food products are significant later as they come to market.

Specific protective actions to be implemented following an accident are not provided in these recommendations because there is such a wide variety of actions that could be taken. The protective actions would be determined by state and local officials with assistance from the growers, producers, and manufacturers.

(c) Protective Actions for Animal Feeds Confirmed as Contaminated

Protective actions to reduce the impact of contamination in or on animal feeds, including pasture and water, should also be taken on a case-by-case basis. Accurately forecasting the transfer of radioactive contamination through the agricultural pathway, from animal feed to human food, is problematic. The forecast is influenced by many factors, such as: the type of feed (e.g., fresh pasture, grain), other intakes (e.g., other feeds, supplements), the chemical form of the radionuclide, medications being administered, the animal species, and the type of resulting human food (e.g., milk, meat, eggs).

Protective actions that could be taken when animal feeds are contaminated include the substitution of uncontaminated water for contaminated water and the removal of lactating dairy animals and meat animals from contaminated feeds and pasture with substitution of uncontaminated feed. Corralling livestock in an uncontaminated area could also be effective. The protective actions would be determined by State and local officials, with assistance from growers, producers, and manufacturers.

APPENDIX A - GLOSSARY

absorbed dose - the quotient of the mean energy imparted by ionizing radiation, $d\varepsilon$, to matter of mass dm, unit: Gy (ICRU 1993)

averted dose - the radiation dose saved by implementing a protective action. It may be expressed in any of the relevant dose quantities. (ICRP 1991b)

Becquerel (Bq) - the unit of radionuclide activity or expectation value of the number of spontaneous nuclear transitions per unit of time. Bq = 1 transition per second. Unit: 1/s (ICRU 1980) The unit of radionuclide activity used in the previous FDA guidance was the curie (Ci)[12]. 1 Bq = 27 x 10^{-12} Ci = 27 picocuries (pCi).

committed dose equivalent (H_T) - the dose equivalent accruing in an organ or tissue up to a specified number of years after the intake of a radionuclide into the body. In this document, committed dose equivalent is always computed to age 70 years. Unit: Sv (ICRP 1984a)

committed effective dose equivalent (H_E) - committed dose equivalents to individual organs or tissues, multiplied by weighting factors, then summed. In this document, committed effective dose equivalent is always computed to age 70 years. Unit: Sv (ICRP 1984a)

contamination - radionuclides on or in food or animal feed as a result of an accidental release.

concentration - radionuclide activity concentration. Unit: Bq/kg; 1 Bq/kg = 27 pCi/kg.

Derived Intervention Level (DIL) - concentration derived from the intervention level of dose at which introduction of protective measures should be considered. Unit: Bq/kg (IAEA 1985)

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[12] The International System of Units is used throughout the document. In this Glossary, the units that were used in previous FDA guidance are given as reference points for the reader in the definitions of the units "Becquerel" and "sievert".

dose coefficient (DC) - the conversion coefficient for committed dose equivalent or committed effective dose equivalent per unit intake of radionuclide activity. Unit: Sv/Bq (ICRP 1989)

dose equivalent[13] (H_T) - the product of the absorbed dose in an organ or tissue and the quality factor. Unit: Sv (ICRU 1993)

effective dose equivalent (H_E) - sum of weighted dose equivalents for irradiated tissues or organs.

$$H_E = W_T H_T$$

where W_T is a weighting factor representing the proportionate stochastic risk for tissue T, and H_T is the mean dose equivalent received by tissue T. A list of tissues and their weighting factors is given by ICRP (ICRP 1984a). Unit: Sv

gray (Gy) - unit of absorbed dose. 1 Gy = 1 J/kg; 1 milligray (mGy) = 10^{-3} Gy. (ICRU 1993) The unit of absorbed dose in previous FDA publications was the rad. 1 Gy = 100 rad; 1 mGy = 0.1 rad.

intervention level of dose - reference level of dose equivalent to an individual at which introduction of protective actions should be considered. Unit: Sv (ICRP 1977, ICRP 1984b)

Level of Concern (LOC) - concentration in an imported food, set by FDA after the Chernobyl accident, below which unrestricted distribution in U.S. commerce is permitted.

precautionary action - action taken, prior to confirmation of contamination, to avoid or reduce the potential for contamination of food and animal feed.

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[13] In this document, dose equivalent and committed dose equivalent are synonymous, and effective dose equivalent and committed effective dose equivalent are synonymous, because they

always refer to the general public, to radionuclides deposited in the body, and to values computed to age 70 years.

protective action - action taken to limit the radiation dose from ingestion by avoiding or reducing the contamination in or on human food and animal feeds.

Protective Action Guide (PAG) - committed effective dose equivalent or committed dose equivalent to an individual organ or tissue that warrants protective action following a release of radionuclides.

quality factor - modifying factor that weights the absorbed dose for the biological effectiveness of the charged particles producing the absorbed dose. (ICRU 1993)

sievert (Sv) - unit of dose equivalent. 1 Sv = 1 J/kg; 1 millisievert (mSv) = 10^{-3}Sv. (ICRU 1993) The unit of dose equivalent used in previous FDA guidance was the rem. 1 Sv = 100 rem; 1 mSv = 0.1 rem.

APPENDIX B - INTERNATIONAL CONSENSUS ON INTERVENTION LEVELS OF DOSE

In 1984, the International Commission on Radiological Protection (ICRP) recommended basic principles for planning intervention in the event of major radiation accidents and provided general guidance on radiation dose levels for the implementation of countermeasures (ICRP 1984b). The term "intervention level of dose" is used by ICRP for these dose levels. The ICRP guidance indicated that for any countermeasure there is a lower level of radiation dose below which the introduction of the countermeasure is unlikely to be warranted, an upper level of radiation dose above which the countermeasure should almost certainly be implemented, and when between these levels, the specifics of the situation determine which actions (if any) would be taken. For the control of food, ICRP indicated lower and upper levels of 5 mSv[14] and 50 mSv, respectively, for committed effective dose equivalent and 50 mSv and 500 mSv, respectively, for committed dose equivalent to an individual organ or tissue (ICRP 1984b, ICRP 1977).

Since 1984, a number of international organizations have provided guidance dealing with the ingestion of radionuclides that was consistent with the ICRP guidance. These organizations included the Commission of the European Communities (CEC), the Codex Alimentarius Commission (CODEX), the Food and Agricultural Organization of the United Nations (FAO), the International Atomic Energy Agency (IAEA), the Nuclear Energy Agency of the Organization for Economic Cooperation and Development (NEA), and the World Health Organization (WHO). All have adopted 5 mSv committed effective dose equivalent as the radiation dose level above which intervention was recommended (CODEX 1989, FAO 1987, IAEA 1986, Luykx 1989, NEA 1989, Waight 1988, WHO 1988). All except CODEX also adopted 50 mSv committed dose equivalent to an individual tissue or organ when that value is more limiting.

[14] The International System of Units is used throughout this document. See Appendix A, Glossary, for equivalence to units used in previous FDA guidance.

The ICRP has updated its general concepts on intervention in its Publication 60 (ICRP 1991a). Additional advice for intervention for protection of the public was provided in its Publication 63 (ICRP 1991b). The additional advice included an intervention level of averted dose (10 mSv effective dose[15] in a year) for restriction of a single foodstuff. ICRP considered this level appropriate for almost all cases, excepting when alternative food supplies are not available or population groups might suffer serious disruption of their food supply.

The ICRP approach recommended that in application of this intervention level of averted dose, the net benefit of withdrawing a particular foodstuff be made optimum, based on knowledge of the local situation and other assumptions about the monetary value assigned to the effective dose. The ICRP provided an example of how to evaluate the optimum. Such a procedure requires information that would not be available during the early phases of an accident.

The FDA uses the principles in the general guidance provided by ICRP in 1984 for the immediate response to a major radiation accident, recognizing that at later stages, after the local situation is stabilized and more clearly defined, the longer-term intervention for food can be modified based on more detailed evaluation of local conditions by local authorities. Therefore, the PAGs for the ingestion pathway at the onset of an accident are 5 mSv committed effective dose equivalent or 50 mSv committed dose equivalent to an individual tissue or organ, whichever is more limiting.

[15] Effective dose is the ICRP's revised formulation of effective dose equivalent, as described in its 1990 recommendations (ICRP 1991a)

APPENDIX C - RADIONUCLIDES DETECTED IN FOOD FOLLOWING THE CHERNOBYL NUCLEAR POWER PLANT ACCIDENT OF APRIL 1986

(a) Analyses of Imported Food by the United States and Canada

(1) I-131 and Cs-134 + Cs-137

Shortly after the accident at Chernobyl on April 26, 1986, the FDA and FSIS of the USDA began sampling imported food for analysis to determine radionuclide activity concentrations. Regulatory actions were based on FDA Levels of Concern (LOCs) and the FSIS Screening Levels which were developed in 1986 and applied to I-131 and Cs-134 + Cs-137.

The regulatory results of FDA and FSIS import monitoring and analyses are summarized in Table C-1[16]. The radionuclide activity concentrations (concentrations) exceeded the FDA LOCs (Cunningham ct al 1992) in 23 out of 2,600 (0.9%) food samples, and exceeded the FSIS Screening Values (equal to the LOCs) (Engel et al 1989, Randecker 1990) in 107 out of 6,295 (1.7%) meat and poultry samples. In general, Cs-134 and Cs-137 were the principal radionuclides detected by FDA and FSIS in the imported foods analyzed. I-131 was significant for only about two months. Cs-134 and Cs-137 were also the dominant radionuclides in imported foods analyzed by Canada (NHW 1987). The European countries of the Nuclear Energy Agency (NEA) also found that I-131 and Cs-134 + Cs-137 contributed most of the radiation dose from radionuclides ingested with food contaminated by the Chernobyl accident (NEA 1987, NEA 1989).

(2) Radionuclides Other Than I-131 and Cs-134 + Cs-137

In addition to the radionuclides used for regulatory actions (I-131, Cs-134 + Cs-137), a number of other radionuclides were detected in imported food entering the U. S. and Canada. Of these,

[16] The International System of Units is used throughout the document. See Appendix A, Glossary, for equivalence to units used in previous FDA guidance.

the most commonly detected radionuclides were Ru-103, Ru-106, Ba-140, Sr-90, Ce-144 and Zr-95. The results of FDA and Canadian import sampling for the latter radionuclides are summarized in Table C-2. The data supported the prediction that I-131 and Cs-134 + Cs-137 were the most significant radionuclides for screening of imported foods, and that the other radionuclides were of significantly less importance.

During 1986, of about 500 imported samples monitored by FDA, Ru-103 and Ru-106 were above the detection levels for 18 samples and Ba-140 was above the detection levels in 9 samples (Cunningham et al 1992). These radionuclides were not detected after 1986. Only selected samples were analyzed for Sr-90. Two samples, containing relatively high amounts of Cs-134 + Cs-137 were analyzed for Sr-90 in 1986. In the following years, a total of 40 samples (those having Cs-134 + Cs-137 in excess of 110 Bq/kg) were analyzed for Sr-90. The Sr-90 was above the detection levels in all 42 samples.

For Canadian imported foods, Ru-103 was above detection levels in 46 of 840 samples analyzed during 1986 and 1987, and below detection levels in all samples analyzed later. Ru-106 was above detection levels in 130 of 936 samples analyzed from 1986 through 1989 (Marshall 1992). Samples were analyzed for Ce-144 and Zr-95 from 1987 through 1989. Out of 486 samples, Ce-144 was above detection levels in 88 samples and Zr-95 was above detection levels in 3 samples.

Concentrations in FDA and Canadian imported samples were generally below 10% of the respective Derived Intervention Levels (DILs) given in Appendices D and E. The main exceptions were for Ru-106 in Canadian samples which ranged up to 42% of the DIL.

The results of analysis for imported samples collected by the U.S. and Canada are representative of collections distant from the accident site. Therefore, not only was the food variety relatively limited, but time delays between accident and sample collection, processing effects, and selective screening that exporters may have applied could have influenced the findings. Consequently, findings from samples collected at countries close to Chernobyl are most useful for U.S. decision-makers responding to a domestic release because these findings are more representative of a local contamination event.

(b) Analyses of Foods Collected Locally at Central and Eastern European Countries

In 1986, FDA received a variety of foods collected locally by United States Embassy staff in Central and Eastern European countries. A total of 48 samples from Bulgaria, Czechoslovakia, Finland, Hungary, Poland, Romania, Russia, and Yugoslavia, were analyzed. Results for Ru-103, Ru-106, and Ba-140 are summarized in Table C-3. The number of samples above detection levels for each radionuclide is given with the ranges of associated percentages relative to the DILs. I-131 and Cs-134 + Cs-137 (not shown) were also detected in most of the samples. I-131 concentrations exceeded the DIL for 27 samples; while Cs-134 + Cs-137 exceeded the DIL for 2 samples.

Most of the 48 embassy samples were fresh vegetables. The edible portions were leafy for 28 samples and roots, bulbs, shoots, or seedlings for 12 samples. Ru-103 was above detection levels in all vegetables, exceeding its DIL for 6 samples. Ru-106 was above detection levels in all vegetables, exceeding its DIL for 14 samples. Ba-140 was above detection levels in 19, but did not exceed its DIL in any vegetables (maximum, 6.3% of DIL).

Other samples included 3 fresh fruit and 5 processed foods (cheese, yogurt, ice cream, and 2 milk samples). Ru-106 was above detection levels in all fruit (maximum, 14% of DIL) and in 2 processed foods (maximum, 29% of DIL). Ru-103 and Ba-140 were above detection levels but did not exceed 2% of their DILs in the fruit or processed food samples.

In September 1986, 28 samples of spices from Turkey and Greece (not offered for import) were provided by the American Spice Trade Association (ASTA) for testing by FDA. This set of samples represented deposition at a distance comparable to many of the Eastern European embassy samples but were analyzed at a later time after the accident. FDA analyzed spices for gamma-ray emitting radionuclides and Sr-90. Findings are included in Table C-3. Following the advice of CEC (CEC 1989a) and CODEX (CODEX.1989) for minor foods, a dilution factor of ten was applied to the concentrations for herbs, spices and flavorings, because they will be consumed in very small quantities.

Cs-134 + Cs-137 (not shown in Table C-3), Ru-103, Ru-106, and Sr-90 were above detection levels in all samples. I-131 and Ba-140 were below detection levels having undergone ten or more half-lives of radioactive decay.

Ru-103, having decayed for over four half-lives, ranged to a maximum of only 4.5% of its DIL while Sr-90, though having decayed very little, reached 10% of the DIL in only 8 samples (maximum, 30% of DIL). Ru-106 exceeded its DIL in 2 samples, was 50% to 100% in 5, and 10% to 50% in another 17.

(c) Conclusions

The results support the expectation that concentrations of I-131 and Cs-134 + Cs-137 would serve as the main indicators of the need for protective actions for imported and local food. However, concentrations of Ru-106 were consistently in excess or at a significant fraction of the DIL, which suggests that Ru-106 should also serve as an indicator, i.e. be included as a principal radionuclide for nuclear reactor incidents.

Also, for local samples of fresh vegetables harvested during the first week of the incident, half of the samples had Ru-103 concentrations a significant fraction of the DIL and another quarter of the samples had Ru-103 concentrations in excess of the DIL. Consequently, it would be prudent to consider Ru-103 as a principal radionuclide for local deposition, particularly in the early phase of a nuclear reactor incident.

Sr-90 did not exceed 11% of the DIL in imported food (Table C-2). For the series of 28 local (ASTA) spice samples (Table C-3), Sr-90 was less than 30% of its DIL (generally a lower percent of the DIL than found for Ru-106 or Cs-134 + Cs-137). Also, the analytical method for determination of Sr-90 in food is lengthy compared to analysis for the gamma-ray emitting radionuclides, such that protective actions based on the concentration of Sr-90 could not be taken in a timely manner. Therefore, Sr-90 would not be an effective indicator of the need for protective actions in the early phase of a nuclear reactor incident.

During the first year after an accident, concentrations in local or imported food other than for I-131, Cs-134, Cs-137, Ru-103 and Ru-106 are expected to be significant only when one or more of these principal radionuclides has exceeded its DIL. Therefore, the food would already have been subject to protective action.

Table C-1
SUMMARY OF U.S. REGULATORY FINDINGS FOR IMPORTED FOOD FOLLOWING THE CHERNOBYL ACCIDENT

Agency	Number of Samples Analyzed	Sampling Period	Number of Samples Contaminated Above Regulatory Limits[c]	
			I-131	Cs-134 + Cs-137
FDA[a]	2600	5/86-9/92	2	21
FSIS[b]	6295	5/86-10/88	-	107
Regulatory Limits[c]			300 Bq/kg	370 Bq/kg

(a) Food and Drug Administration
(b) Food Safety and Inspection Service of the U.S. Department of Agriculture
(c) FDA: Levels of Concern FSIS: Screening Levels

Table C-2

Ru-103, Ru-106, Ba-140, Sr-90, Ce-144, and Zr-95

IN IMPORTED FOOD SAMPLES[a] (UNITED STATES AND CANADA)

Year, Number, and Type of Samples Analyzed[b]				Number of Samples with Measurable Concentration (Maximum Percent of Derived Intervention Level)					
				Ru-103[c]	Ru-106[c]	Ba-140	Sr-90	Ce-144	Zr-95
U.S. (FDA)	1986	500[d]	Herbs	2 (0.02)	2 (9)				
			Others	16 (1.3)	16 (6)	9 (1.9)	2[e] (8)		
	1987	37[f]	Herbs				24 (3)		
			Others				13 (11)		
	1989	3[f]	Herbs				3 (2)		
Canada	1986	450[d]	Herbs	26 (0.5)	13 (42)			58 (9)	3 (0.9)
			Others	10 (0.5)	1 (3)				
	1987	390[d]	Herbs	10 (0.05)	75 (22)				
			Others		2 (19)				
	1988	76	Herbs		30 (10)			26 (4)	
	1989	20	Herbs		9 (4)			4 (2)	

(a) For herbs (which include herbs, spices, and flavorings), a dilution factor of ten was applied to the concentrations. No dilution factor was applied for other foods.
(b) Number of samples analyzed for the featured radionuclides. Not equal to number of samples analyzed for principal radionuclides.
(c) The reported Ru-106 concentrations in FDA reports were usually the sum of Ru-103 + Ru-106. Values in this table are the individual Ru-103 and Ru-106 concentrations.
(d) Approximate number.
(e) Number of samples tested for Sr-90, one of which exceeded the 1986 LOC for Cs-134 + Cs-137.
(f) Only samples with Cs-134 + Cs-137 in excess of 0.3 of 1986 LOC were analyzed for Sr-90.

Table C-3

Ru-103, Ru-106, Ba-140, and Sr-90
IN SAMPLES FROM U.S. EMBASSIES IN CENTRAL AND EASTERN EUROPE
AND FROM THE AMERICAN SPICE TRADE ASSOCIATION (ASTA)

	Type and Number of Samples Analyzed	Number of Samples with Measurable Concentrations in 1986 (Range, as Percent of Derived Intervention Level) Ru-103[a]	Ru-106	Ba-140	Sr-90
EMBASSY SAMPLES	Leafy Vegetables 28	28 (0.1-507)	28 (1-3500)	14 (0.1-6.3)	NA
	Non-leafy Vegetables 12	12 (1-222)	12 (9-1570)	5 (0.2-5.4)	NA
	Fruit 3	3 (0.3-1.4)	3 (4-14)	ND	NA
	Processed Food 5	2 (0.6-2)	2 (4-29)	3 (0.2-1.4)	NA
ASTA SAMPLES	Spices 28	28 (0.2-4.5)	28 (6-1640)	ND	28 (0.9-30)

(a) Embassy samples were received primarily in May and June 1986 and the ASTA samples in September 1986. Due to radioactive decay, the relative concentration of Ru-103 compared to Ru-106 is considerably lower for the ASTA samples than for the embassy samples.
NA Not analyzed.
ND Not detected.

APPENDIX D - DERIVATION OF RECOMMENDED DERIVED INTERVENTION LEVELS

The Derived Intervention Level (DIL) for a specific radionuclide is calculated as follows:

$$\text{DIL (Bq/kg)} = \frac{\text{PAG (mSv)}}{\text{f x Food Intake (kg) x DC (mSv/Bq)}}$$

Where:	DIL	=	Derived Intervention Level
	PAG	=	Protective Action Guide
	DC	=	Dose coefficient
	Food Intake	=	Quantity of food consumed in an appropriate period of time
	f	=	Fraction of food intake assumed to be contaminated

The recommended Protective Action Guides (PAGs) are 5 mSv[17] committed effective dose equivalent, or 50 mSv committed dose equivalent to individual tissues and organs, whichever is more limiting. These PAGs are consistent with the consensus of international organizations on the levels of radiation dose below which ingestion pathway interventions are generally not appropriate (see Appendix B).

Dose coefficients (DCs) are given in Table D-l and food intakes are given in Tables D-2 and D-3. The fraction of food intake assumed to be contaminated (f) equals 0.3, except for I-131 in infant diets where f equals 1.0.

(a) Radionuclides

Based upon data on radionuclides in human food following the Chernobyl accident, DILs for I-131, Cs-134, Cs-137, Ru-103 and Ru-106 would facilitate application of food monitoring programs following accidents involving nuclear reactors. For accidents at nuclear fuel

[17] The International System of Units is used throughout the document. See Appendix A, Glossary, for equivalence to units used in previous FDA guidance.

reprocessing facilities and nuclear waste storage facilities, DILs for Sr-90, Cs-137, Pu-239, and Am-241 would be used. For nuclear weapons accidents and accidents involving radioisotope thermal generators (RTGs) and radioisotope heater units (RHUs) used in space vehicles, DILs for Pu-239 and Pu-238, respectively, would be used. The selection of these radionuclides as the major contributors to radiation dose through ingestion is consistent with recommendations on DILs published by NEA, WHO, CODEX, and CEC (NEA 1989, WHO 1988, CODEX 1989, CEC 1989b, IAEA 1994).

(b) Age Groups and Dose Coefficients (DCs)

The general population was divided into six age groups ranging from infants to adults and corresponding to the age groups in ICRP Publication 56 (ICRP 1989) for which ICRP has published DCs. The age groups are 3 months, 1 year, 5 years, 10 years, 15 years, and adult. The radionuclides, age groups and dose coefficients used in the calculations are presented in Table D-1.

(C) Food Intake

Food intake included all dietary components including tap water used for drinking, and is the overall quantity consumed in one year, with exceptions in the period of time for I-131 ($T_{1/2}$ = 8.04 days) and Ru-103 ($T_{1/2}$ = 39.3 days). For these, the quantities consumed were for a 60-day period and a 280-day period, respectively, due to the more rapid decay of these radionuclides. The intake periods for I-131 and Ru-103 are the nearest whole number of days for decay of these radionuclides to less than 1% of the initial activities.

Dietary intakes were derived from a 1984 EPA report which presented average daily food intake by age and gender (EPA 1984a, EPA 1984b). The EPA intakes were based on data from the 1977-1978 Nationwide Food Consumption Survey published by the U. S. Department of Agriculture (USDA 1982, USDA 1983). The age groups and annual dietary intakes for various food classes and the total, calculated from data in the EPA report, are given in Table D-2.

The dietary intakes derived for the ICRP age groups for which DCs are available, using the results in Table D-2, are presented in Table D-3.

(d) Fractions of Food Intake Assumed to be Contaminated (f)

For food consumed by most members of the general public, ten percent of the dietary intakes was assumed to be contaminated. This assumption recognizes the ready availability of uncontaminated food from unaffected areas of the United States or through importation from other countries, and also that many factors could reduce or eliminate contamination of local food by the time it reaches the market[18].

Use of ten percent of the dietary intake as the portion contaminated was consistent with recommendations made by a Group of Experts to the Commission of the European Communities (CEC 1986a) and by the Nuclear Energy Agency (NEA) of the Organization for Economic Cooperation and Development (NEA 1989). The NEA noted that modification of this value would be appropriate if justified by detailed local findings.

FDA applied an additional factor of three to account for the fact that sub-populations might be more dependent on local food supplies. Therefore, during the immediate period after a nuclear accident, a value of 0.3 (i.e., thirty percent) is the fraction of food intake that FDA recommends should be presumed to be contaminated. If, subsequently, there is convincing local information that the actual fraction of food intake that is contaminated (f) is considerably higher or lower, there will be adequate time for State and local officials to determine whether to adjust the value of f (and therefore adjust the values of the DILs) for the affected area.
For infants, (i.e., the 3-month and 1-year age groups) the diet consists of a high percentage of milk and the entire milk intake of some infants over a short period of time might come from supplies directly impacted by an accident. Therefore, f was set equal to 1.0 (100%) for the infant diet.

[18] In most situations, one would expect less than ten percent of the dietary intakes to be contaminated.

(e) Selection of Recommended Derived Intervention Levels

DILs are presented in Table D-4 for Sr-90, I-131, Cs-134, Cs-137, Ru-103, Ru-106, Pu-238, Pu-239, and Am-241 for six population age groups and applicable PAGs. To facilitate the execution of food monitoring programs, two criteria were used in selecting FDA's recommended DILs. First, the most limiting DIL for either of the applicable PAGs was selected for each of the nine radionuclides. These DILs are presented in Table D-5 for each of the six age groups. In addition, the average DIL is presented for the radionuclide group Pu + Am, composed of Pu-238, Pu-239, and Am-241, and the radionuclide group Cs, composed of Cs-134 + Cs-137. The three radionuclides in the Pu + Am group deposit on the bone surface and are alpha-particle emitters. The radionuclides in the Cs group are deposited throughout the body and are beta-particle and gamma-ray emitters. The average values are recommended for these groups because the calculated DILs for radionuclides in each group are similar.

The radionuclides Ru-103 and Ru-106 are chemically identical, are deposited throughout the body, and are beta-particle and gamma-ray emitters. However, their widely differing half lives (i.e., 39.3 days and 373 days, respectively) result in markedly differing individual DILs which do not permit simple averaging. Instead, the concentrations of Ru-103 (C_3) and Ru-106 (C_6) are divided by their respective DILs and are then summed[19]. The sum must be less than one.

Therefore, $$\frac{C_3}{DIL_3} + \frac{C_6}{DIL_6} < 1.0 \qquad \text{(equation D-1)}$$

This assures that the sum of the separate radiation dose contributions from the Ru-103 and Ru-106 concentrations will be less than that required by the Protective Action Guide during the first year after an accident.

[19] Laboratories that are not equipped to resolve separately the concentrations for Ru-103 and Ru-106 should contact FDA for alternate procedures.

Second, there are dietary components which are common to all six age groups. A principal example is fresh milk, for which the consumer of particular supplies cannot be identified in advance. Therefore, the most limiting DIL for all age groups in Table D-5, for each radionuclide or radionuclide group, was selected and is applicable to all components of the diet.

These DILs are presented in Table D-6 and were rounded to two significant figures (one significant figure for the Pu + Am group). These are the FDA's recommended DILs.

The DILs in Table D-6 apply independently to each radionuclide or radionuclide group, because they apply to different types of accidents, or in the case of a nuclear reactor accident, to different limiting age groups. However, the DILs for Ru-103 and Ru-106 are used in equation D-1 to evaluate that criterion for the radionuclide group Ru-103 + Ru-106.

The FDA recommended DILs in Table D-6 are given in Table 2 in the main text, along with clarifying notes on application of the DILs.

Table D-1

DOSE COEFFICIENTS (mSv/Bq) [a]

Radionuclide	Age Group 3 month	1 year	5 years	10 years	15 years	Adult
Sr-90 bone srfc	1.0E-03	7.4E-04	3.9E-04	5.5E-04	1.2E-03	3.8E-04
Sr-90	1.3E-04	9.1E-05	4.1E-05	4.3E-05	6.7E-05	3.5E-05
I-131 thyroid	3.7E-03	3.6E-03	2.1E-03	1.1E-03	6.9E-04	4.4E-04
I-131	1.1E-04	1.1E-04	6.3E-05	3.2E-05	2.1E-05	1.3E-05
Cs-134	2.5E-05	1.5E-05	1.3E-05	1.4E-05	2.0E-05	1.9E-05
Cs-137	2.0E-05	1.1E-05	9.0E-06	9.8E-06	1.4E-05	1.3E-05
Ru-103	7.7E-06	5.1E-06	2.7E-06	1.7E-06	1.0E-06	8.1E-07
Ru-106	8.9E-05	5.3E-05	2.7E-05	1.6E-05	9.2E-06	7.5E-06
Pu-238 bone srfc	1.6E-01	1.6E-02	1.5E-02	1.5E-02	1.6E-02	1.7E-02
Pu-238	1.3E-02	1.2E-03	1.0E-03	8.8E-04	8.7E-04	8.8E-04
Pu-239 bone srfc	1.8E-01	1.8E-02	1.8E-02	1.7E-02	1.9E-02	1.8E-02
Pu-239	1.4E-02	1.4E-03	1.1E-03	1.0E-03	9.8E-04	9.7E-04
Am-241 bone srfc	2.0E-01	1.9E-02	1.9E-02	1.9E-02	2.1E-02	2.0E-02
Au-241	1.2E-02	1.2E-03	1.0E-03	9.0E-04	9.1E-04	8.9E-04

(a) Dose coefficients are from ICRP Publication 56 (ICRP 1989). The committed effective dose equivalents or committed dose equivalents are computed to age 70 years.

Table D-2

ANNUAL DIETARY INTAKES (kg/y) [(a)]

Food Class	AGE GROUP(years) < 1	1-4	5-9	10-14	15-19	20-24	25-29	30-39	40-59	60 & up
Dairy	208	153	180	186	167	112	98.2	86.4	80.8	90.6
(fresh milk) [(b)]	(99.3)	(123)	(163)	(167)	(148)	(96.5)	(79.4)	(66.8)	(61.7)	(70.2)
Egg	1.8	7.2	6.2	7.0	9.1	10.3	10.2	11.0	11.4	10.5
Meat	16.5	33.7	46.9	58.4	69.2	71.2	72.6	73.4	70.7	56.3
Fish	0.3	2.5	4.0	4.9	6.1	6.8	7.6	7.1	8.0	6.3
Produce	56.6	59.9	82.3	96.0	97.1	91.4	99.1	102	115	121
Grain	20.4	57.6	79.0	90.6	89.4	77.3	78.4	73.7	70.2	67.1
Beverage	112	271	314	374	453	542	559	599	632	565
(tap water)[(b)]	(62.3)	(159)	(190)	(226)	(243)	(240)	(226)	(232)	(268)	(278)
Misc	2.0	9.3	13.3	14.8	13.9	10.9	11.9	12.5	13.3	13.0
TOTAL	418	594	726	832	905	922	937	965	1001	930

(a) Computed from daily intake values in grams per day provided in (EPA 1984b). The total annual intakes are rounded to nearest 1 kg/y.
(b) Fresh milk is included in the dairy entry, and tap water used for drinking is included in the beverage entry. The total annual intakes (kg/y) for fresh milk and tap water are also each given separately in parentheses.

Table D-3

DIETARY INTAKES
FOR ICRP AGE GROUPS

ICRP age group	Intake (kg)		
	annual[(a)]	280-day Ru-103	60- day I-131
3 months	418	320	69
1 year	506	387	83
5 years	660	506	109
10 years	779	597	128
15 years	869	666	143
Adult	943	723	155

(a) The annual dietary intakes for the ICRP age groups were obtained by assigning or averaging the appropriate annual dietary intakes given in Table D-2 for the EPA age groups, as follows:

3 months:		<1
1 year:	average	<1 and 1-4
5 years:	average	1-4 and 5-9
10 years:	average	5-9 and 10-14
15 years:	average	10-14 and 15-19
Adult:	average	15-19, 20-24, 25-29, 30-39, 40-59, 60 and up

Table D-4

PAGs AND DERIVED INTERVENTION LEVELS[a]

(individual radionuclides, by age groups)

Radionuclide	PAG (mSv)	Derived Intervention Levels(Bq/kg) 3 months	1 year	5 years	10 years	15 years	Adult
Sr-90 bone srfc.	50	400	445	648	389	160	465
Sr-90	5	308	362	616	497	286	505
I-131 thyroid	50	196	167	722	1200	1690	2420
I-131	5	659	548	2410	4110	5540	8180
Cs-134	5	1600	2190	1940	1530	958	930
Cs-137	5	2000	2990	2810	2180	1370	1360
Ru-103	5	6770	8410	12200	16400	25000	28400
Ru-106	5	449	621	935	1340	2080	2360
Pu-238 bone srfc.	50	2.5	21	17	14	12	10
Pu-238	5	3.1	27	25	24	22	20
Pu-239 bone srfc.	50	2.2	18	14	13	10	9.8
Pu-239	5	2.9	24	23	21	20	18
Am-241 bone srfc.	50	2.0	17	13	11	9.1	8.8
Am-241	5	3.3	27	25	24	21	20

(a) Derived Intervention Levels were computed using dose coefficients from Table D-1, dietary intakes from Table D-3, and "f" as given below:

0.3 (except for I-131 in infant diets, i.e., the 3-month and 1-year age groups)
1.0 (I-131 in infant diets)

(b) The observed trend in Derived Intervention Levels for Sr-90 as a function of age, i.e. minimum values at 15 years, results primarily from the mass of exchangeable strontium in bone as a function of age (Leggett et al 1982).

Table D-5

DERIVED INTERVENTION LEVELS (Bq/kg)

(individual radionuclides, by age group, most limiting of either PAG)

Radionuclide	3 months	1 year	5 years	10 years	15 years	Adult
Sr-90	308	362	616	389	160	465
I-131	196	167	722	1200	1690	2420
Cs-134	1600	2190	1940	1530	958	930
Cs-137	2000	2990	2810	2180	1370	1360
Cs group[(a)]	1800	2590	2380	1880	1160	1150
Ru-103	6770	8410	12200	16400	25000	28400
Ru-106	449	621	935	1340	2080	2360
Pu-238	2.5	21	17	14	12	10
Pu-239	2.2	18	14	13	10	9.8
Am-241	2.0	17	13	11	9.1	8.8
Pu+Am group[(b)]	2 .2	19	15	13	9. 6	9. 3

(a) Computed as: (DIL for Cs-134 + DIL for Cs-137)/2

(b) Computed as: (DIL for Pu-238 + DIL for Pu-239 + DIL for Am-241) /3

Table D-6

DERIVED INTERVENTION LEVELS (Bq/kg)
(radionuclide groups, most limiting of all diets)

Radionuclide Group	Derived Intervention Levels
Sr-90	160 (15 years)
I-131	170 (1 year)
Cs group	1200 (adult)
Ru-103[(a)]	6800 (3 months)
Ru-106[(a)]	450 (3 months)
Pu + Am group	2 (3 months)

(a) Due to the large differences in DILs for Ru-103 and Ru-106, the individual concentrations of Ru-103 and Ru-106 are divided by their respective DILs and then summed. The sum must be less than one.

APPENDIX E - DERIVED INTERVENTION LEVELS FOR OTHER RADIONUCLIDES IN THE INVENTORY OF THE CORE OF AN OPERATING NUCLEAR REACTOR

After a reactor accident, radionuclides other than the principal radionuclides may also be detected in the food supply, usually at much lower concentrations (See Appendix C). However, in the event other radionuclides are present in significant concentrations, this Appendix presents Derived Intervention Levels (DILs) for a number of other radionuclides commonly found in a reactor core inventory.

The DILs for fifteen other radionuclides were determined by the same procedure used in Appendix D. The Protective Action Guides were also the same, i.e. 5 mSv[20] committed effective dose equivalent, or 50 mSv committed dose equivalent to individual tissues and organs.

Age groups and their related food intakes for one year were given previously in Table D-3, Appendix D. Dietary intakes for seven of the fifteen other radionuclides that have half-lives much less than one year were computed for the periods of time (i.e. in nearest whole number of days) required for the radionuclides to decay to less than 1% of the initial activities. Table E-1 and Table E-2 give the relevant data for these seven radionuclides.

Dose coefficients for seven of the fifteen other radionuclides included in this Appendix are provided in ICRP Publication 56 (ICRP 1989) for all six age groups. For the remaining eight radionuclides, DCs are available in NRPB Publication GS7 (NRPB 1987), but for only three age groups, i.e. 1-year, 10-year and adult. The more limited data in NRPB publication GS7 are supplemented as indicated in the next section.

Fractions of food intake assumed to be contaminated (f) are:

0.3 for all radionuclides except Te-132, I-133 and Np-239 in infant diets (i.e., the 3-month and 1-year age groups);

1.0 for Te-132, I-133 and Np-239 in infant diets.

[20] The International System of Units is used throughout the document. See Appendix A, Glossary, for equivalence to units used in previous FDA guidance.

SELECTION OF DERIVED INTERVENTION LEVELS

The dose coefficients in ICRP Publication 56 and NRPB Publication GS7 are for individual tissues and the effective dose equivalent, as formulated in ICRP Publication 26. ICRP has also developed dose coefficients for individual tissues and the effective dose, as formulated in ICRP publication 60. These latter dose coefficients were published in ICRP Publication 67 (ICRP 1993) and ICRP 72 Publication (ICRP 1996) for all six age groups. Review of all these DCs demonstrated that the trend for relative values of DCs with age for any given radionuclide or for radionuclides with common biokinetic characteristics and half lives is similar. Therefore, DCs for the missing 3-month, 5-year, and 15-year age groups were derived for the eight radionuclides in NRPB Publication GS7, based on the trends observed in the three sets of ICRP tables. Table E-3 presents the derived DCs for these three age groups and the data from ICRP Publication 67 or 72 used in the derivations. Table E-4 gives the DCs used in computing the DILs for all fifteen radionuclides presented in Table E-5. DILs have been rounded to two significant figures (except one significant figure for Np-237 and Cm-244).

In the same manner as for the principal radionuclides in Appendix D, the most limiting Derived Intervention Level for a radionuclide for either PAG is given in Table E-6 for each age group. Then, the most limiting DIL for a radionuclide for each age group is presented in Table E-7.

During the immediate period after a nuclear reactor accident, decisions on protective actions for food may be required and may need to be based on the general status of the facility or the overall prognosis for worsening conditions. Once food monitoring data is available, the recommended DILs or criterion for the principal radionuclides I-131, Cs-134 + Cs-137, and Ru-103 + Ru-106 recommended in Table 2 of the main text should be used.

The more complex radiochemical or gamma-ray spectrometric analyses for the fifteen other radionuclides listed in this Appendix would not be generally available. If other radionuclides are subsequently detected in food, there will be adequate time to review the data on the concentrations of the other radionuclides to evaluate whether their contributions to radiation dose via ingestion are unexpectedly high, and to determine whether additional radionuclides should be controlled by their respective DILs in Table E-7. The evaluation takes place with knowledge of the radiation dose represented by the concentrations of the principal radionuclides, which may already exceed one or more of their DILs.

Table E-1

NEAREST WHOLE NUMBER OF DAYS FOR SHORT-LIVED RADIONUCLIDES TO HAVE DECAYED TO LESS THAN 1% OF INITIAL ACTIVITY (A_o)

Radionuclide	Half-life	Number of Days for Decay to Less Than 1% of A_o
I-133	20.8 h	6
Np-239	2.36 d	16
Te-132	3.26 d	22
Ba-140	12.7 d	85
Ce-141	32.5 d	217
Nb-95[(a)]	35.2 d	236
Sr-89	50.5 d	336

(a) Applies to Nb-95 existing in core inventory of an operating reactor at the time of release. Nb-95 produced as a result of decay of released parent Zr-95 is accounted for in the treatment of Zr-95.

TABLE E-2

DIETARY INTAKES

ICRP Age Group (annual intake, kg) [(a)]		Radionuclide and days[(b)] for decay to 1%						
		Sr-89 336	Nb-95 236	Ce-141 217	Ba-140 85	Te-132 22	Np-239 16	I-133 6
		Intake (kg)						
3 months	(418)	385	270	249	97	25	18	6.9
1 year	(506)	466	327	301	118	31	22	8.3
5 years	(660)	608	427	392	154	40	29	11
10 years	(779)	717	503	463	181	47	34	13
15 years	(869)	799	562	517	202	52	38	14
Adult	(943)	868	610	561	220	57	41	16

(a) The annual intakes (from Table D-3) are for radionuclides which do not decay to less than 1% of initial activity within a year.

(b) Time periods for intakes are for specified radionuclides (from Table E-1) which decay to less than 1% of the initial activity within a year.

Table E-3

DOSE COEFFICIENTS (mSv/Bq) DERIVED FOR THE 3-MONTH, 5-YEAR AND 15-YEAR AGE GROUPS[a] NOT AVAILABLE IN NRPB PUBLICATION GS7, USING DATA IN ICRP PUBLICATIONS[b]

Radionuclide [c]		References Used	Dose Coefficients by Age Group					
			3 months	1 year	5 years	10 years	15 years	Adult
Sr-89	H_E	NRPB GS7	**3.0E-05**	1.5E-05	**7.7E-06**	5.2E-06	**3.5E-06**	2.2E-06
Sr-89	E	ICRP 72	3.6E-05	1.8E-05	8.9E-06	5.8E-06	4.0E-06	2.6E-06
Y-91	LLI	NRPB GS7	**3.3E-04**	2.1E-04	**1.1E-04**	7.1E-05	**3.8E-05**	3.0E-05
Y-91	E	ICRP 72	2.8E-05	1.8E-05	8.8E-06	5.2E-06	2.9E-06	2.4E-06
Te-132	THY	NRPB GS7	**4.6E-04**	2.2E-04	**1.3E-04**	6.0E-05	**3.5E-05**	1.9E-05
Te-132	THY	ICRP 67	6.2E-04	3.0E-04	1.6E-04	7.1E-05	4.6E-05	2.9E-05
I-133	THY	NRPB GS7	**9.6E-04**	8.6E-04	**5.0E-04**	2.3E-04	**1.5E-04**	8.3E-05
I-133	E	ICRP 72	4.9E-05	4.4E-05	2.3E-05	1.0E-05	6.8E-06	4.3E-06
Ba-140	LLI	NRPB GS7	**2.1E-04**	1.8E-04	**9.7E-05**	6.0E-05	**3.1E-05**	2.6E-05
Ba-140	LLI	ICRP 67	2.2E-04	1.9E-04	9.9E-05	5.7E-05	3.1E-05	2.9E-05
Ce-141	LLI	NRPB G57	**9.3E-05**	6.0E-05	**3.3E-05**	2.0E-05	**1.2E-05**	8.7E-06
Ce-141	LLI	ICRP 67	9.8E-05	6.3E-05	3.2E-05	1.9E-05	1.1E-05	8.7E-06
Cm-242	BS	NRPB GS7	**2.1E-02**	2.6E-03	**1.4E-03**	8.9E-04	**5.6E-04**	4.5E-04
Cm-242	E	ICRP 72	5.9E-04	7.5E-05	3.9E-05	2.4E-05	1.5E-05	1.2E-05
Cm-244	ES	NRPB GS7	**2.5E-01**	2.5E-02	**1.6E-02**	1.2E-02	**9.9E-03**	9.8E-03
Cm-244	E	ICRP 72	2.9E-03	2.9E-04	1.9E-04	1.4E-04	1.2E-04	1.2E-04

(a) The dose coefficients (DCs) derived for age groups not available in NRPB Publication GS7 are indicated in bold font.

(b) The derived DCs were obtained by multiplying the DC for the NRPB age group contiguous to the missing NRPB age group by the following: the ratio of the DC for the desired age group to the DC of the contiguous age group, from the supporting ICRP data. When there were two contiguous age groups (i.e. for the 5-year and 15-year age groups), the two resulting DCs for the missing NRPB age groups were averaged.

(c) The dose quantity used is noted for each radionuclide. LLI is lower large intestine, THY is thyroid, BS is bone surface, H_E is effective dose equivalent, and E is effective dose.

Table E-4 DOSE COEFFICIENTS (mSv/Bq)[a]

Radionuclides	AGE GROUP 3 months	1 year	5 years	10 years	15 years	Adult
Sr-89 lower large intestine	2.8E-05	1.4E-04	7.1E-05	4.8E-05	2.3E-05	2.1E-05
Sr-89	3.0E-05	1.5E-05	7.7E-06	5.2E-06	3.5E-06	2.2E-06
Y-91 lower large intestine	3.3E-04	2.1E-04	1.1E-04	7.1E-05	3.8E-05	3.0E-05
Y-91	2.8E-05	1.7E-05	8.8E-06	5.7E-06	3.1E-06	2.4E-06
Zr-95	1.0E-05	6.6E-06	3.6E-06	2.2E-06	1.4E-06	1.1E-06
Nb-95	5.2E-06	3.7E-06	2.1E-06	1.3E-06	8.6E-07	6.8E-07
Te-132 thyroid	4.6E-04	2.2E-04	1.3E-04	6.0E-05	3.5E-05	1.9E-05
Te-132	3.0E-05	1.9E-05	1.1E-05	6.4E-06	3.4E-06	2.0E-06
I-129 thyroid	3.7E-03	4.3E-03	3.5E-03	3.8E-03	2.8E-03	2.1E-03
I-129	1.1E-04	1.3E-04	1.0E-04	1.1E-04	8.4E-05	6.4E-05
I-133 thyroid	9.6E-04	8.6E-04	5.0E-04	2.3E-04	1.5E-04	8.3E-05
I-133	2.9E-05	2.6E-05	1.8E-05	7.0E-06	4.3E-06	2.5E-06
Ba-140 lower large intestine	2.1E-04	1.8E-04	9.7E-05	6.0E-05	3.1E-05	2.6E-05
Ba-140	2.5E-05	1.4E-05	7.6E-06	5.1E-06	3.7E-06	2.3E-06
Ce-141 lower large intestine	9.3E-05	6.0E-05	3.3E-05	2.0E-05	1.1E-05	8.7E-06
Ce-141	7.8E-06	4.9E-06	2.5E-06	1.6E-06	9.0E-07	7.0E-07
Ce-144 lower large intestine	7.6E-04	4.9E-04	2.4E-04	1.5E-04	8.2E-05	6.6E-05
Ce-144	8.0E-05	4.3E-05	2.1E-05	1.3E-05	7.2E-06	5.8E-06
Np-237 bone surface	1.0E-01	8.9E-03	9.3E-03	9.9E-03	1.2E-02	1.2E-02
Np-237	5.5E-03	4.9E-04	4.3E-04	4.0E-04	4.7E-04	4.5E-04
Np-239 lower large intestine	9.8E-05	6.4E-05	3.2E-05	1.9E-05	1.1E-05	8.8E-06
Np-239	9.6E-06	6.3E-06	3.2E-06	1.9E-06	1.1E-06	8.7E-07
Pu-241 bone surface	3.3E-03	3.4E-04	3.5E-04	3.9E-04	3.9E-04	3.7E-04
Pu-241	2.2E-04	2.2E-05	2.1E-05	2.0E-05	2.0E-05	1.9E-05
Cm-242 bone surface	2.1E-02	2.6E-03	1.4E-03	8.9E-04	5.6E-04	4.5E-04
Cm-242	1.4E-03	1.8E-04	9.8E-05	6.4E-05	3.8E-05	3.0E-05
Cm-244 bone surface	2.5E-01	2.5E-02	1.6E-02	1.2E-02	9.9E-03	9.8E-03
Cm-244	1.4E-02	1.4E-03	9.2E-04	6.7E-04	5.9E-04	5.4E-04

(a) When dose coefficients were available from ICRP Publication 56 (ICRP 1989), they were given for all six age groups. When dose coefficients were available only from NRPB GS7 (NRPB 1987), they were given for only three age groups (i.e. 1 year, 10 years, and adult),and derived for the other three age groups (see Table E-3). The committed effective dose equivalents or committed dose equivalents are computed to age 70 years.

TABLE E-5 PAG AND DERIVED INTERVENTION LEVELS[a]

Radionuclide	PAG (mSv)	Derived Intervention Levels (Bq/kg)					
		3 months	1 year	5 years	10 years	15 years	Adult
Sr-89 lower large intestine	50	1600	2600	3900	4800	9100	9100
Sr-89	5	1400	2400	3600	4500	5800	8700
Y-91 lower large intestine	50	1200	1600	2300	3000	5300	5900
Y-91	5	1500	1900	2900	3800	6200	7400
Zr-95	5	4000	5000	7000	9700	14000	16000
Nb-95	5	12000	14000	19000	26000	35000	40000
Te-132 thyroid	50	4400	7300	35000	59000	89000	150000
Te-132	5	6700	8500	38000	55000	94000	150000
I-129 thyroid	50	110	76	72	56	69	84
I-129	5	360	250	250	200	230	280
I-133 thyroid	50	7600	7000	30000	56000	79000	130000
I-133	5	25000	23000	84000	180000	280000	420000
Ba-140 lower large intestine	50	8200	7900	11000	15000	27000	29000
Ba-140	5	6900	10000	14000	18000	22000	33000
Ce-141 lower large intestine	50	7200	9200	13000	18000	27000	34000
Ce-141	5	8600	11000	17000	23000	36000	43000
Ce-144 lower large intestine	50	530	670	1100	1400	2300	2700
Ce-144	5	500	770	1200	1700	2700	3100
Np-237 bone surface	50	4	37	27	22	16	15
Np-237	5	7	67	59	54	41	39
Np-239 lower large intestine	50	28000	36000	180000	260000	400000	460000
Np-239	5	29000	36000	180000	260000	400000	470000
Pu-241 bone surface	50	120	970	720	550	490	480
Pu-241	5	180	1500	1200	1100	960	930
Cm-242 bone surface	50	19	130	180	240	340	390
Cm-242	5	29	180	260	330	510	590
Cm-244 bone surface	50	2	13	16	18	19	18
Cm-244	5	3	24	27	32	33	33

(a) Derived Intervention Levels derived using dose coefficients from Table E-4, dietary intakes from Table E-2 and "f" as given below:
0.3 (except for I-133, Te-132 and Np-239 in infant diets, i.e., the 3-month and 1-year age groups)
1.0 for I-133, Te-132 and Np-239 in infant diets.

TABLE E-6

DERIVED INTERVENTION LEVELS (Bq/kg)

Most limiting of Derived Intervention Levels for 5 mSv H_E or 50 mSv H_T
(individual radionuclides, by age group)

Radionuclide	3 months	1 year	5 years	10 years	15 years	Adult
Sr-89	1400	2400	3600	4500	5800	8700
Y-91	1200	1600	2300	3000	5300	5900
Zr-95	4000	5000	7000	9700	14000	16000
Nb-95	12000	14000	19000	26000	35000	40000
Te-132	4400	7300	35000	55000	89000	150000
I-129	110	76	72	56	68	84
I-133	7600	7000	30000	56000	79000	130000
Ba-140	6900	7900	11000	15000	27000	29000
Ce-141	7200	9200	12000	18000	29000	34000
Ce-144	500	670	1100	1400	2300	2700
Np-237	4	37	27	22	16	15
Np-239	28000	36000	180000	260000	400000	460000
Pu-241	120	970	720	550	490	480
Cm-242	19	130	180	240	340	390
Cm-244	2	13	16	18	19	18

TABLE E-7

DERIVED INTERVENTION LEVELS (Bq/kg)
(radionuclide groups, most limiting of all diets)

Radionuclide Group	Derived Intervention Level	
Sr-89	1400	(3 months)
Y-91	1200	(3 months)
Zr-95	4000	(3 months)
Nb-95	12000	(3 months)
Te-132	4400	(3 months)
I-129	56	(10 years)
I-133	7000	(1 year)
Ba-140	6900	(3 months)
Ce-141	7200	(3 months)
Ce-144	500	(3 months)
Np-237	4	(3 months)
Np-239	28000	(3 months)
Pu-241	120	(3 months)
Cm-242	19	(3 months)
Cm-244	2	(3 months)

APPENDIX F - DERIVED INTERVENTION LEVELS ADOPTED BY THE COMMISSION OF THE EUROPEAN COMMUNITIES AND THE CODEX ALIMENTARIUS COMMISSION FOR INTERNATIONAL TRADE

Foods exported from the U.S. are subject to the criteria used by the importing country, such as the recommendations of the CODEX Alimentarius Commission (CODEX) or the regulations of the Commission of the European Communities (CEC). CODEX is operated by the Joint Food Standards Programme of the Food and Agriculture Organization of the United Nations (FAO) and World Health Organization (WHO). CODEX develops and recommends standards and other guidance which are widely used in international trade. CEC regulations govern trade within the European Economic Community (EEC) and between the EEC and other countries. U.S. food exporters need to be familiar with the guidance from these organizations.

A discussion of CEC and CODEX Derived Intervention Levels (DILs)[21] is given below to provide insight into their differences.

(a) Commission of The European Communities: DILs for Future Accidents

The CEC adopted regulations in 1987 and 1989, establishing DILs for human food and animal feeds following a nuclear accident or any other case of radiological emergency (CEC 1987, 1989a, 1989b). These were established for use following any future accident and do not apply to residual contamination from the accident at Chernobyl. DILs addressing radioactive contamination from the Chernobyl accident were adopted by the CEC in 1986 (CEC 1986b).

The DILs for foods contaminated by future accidents are presented in Table F-l. DILs were given for four radionuclide groups and four food categories. The radionuclide groups include: isotopes of strontium, notably Sr-90; isotopes of iodine, notably I-131; alpha-emitting isotopes of

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[21] The International System of Units is used throughout the document. See Appendix A, Glossary, for equivalence to units used in previous FDA guidance.

plutonium and transplutonium elements, notably Pu-239 and Am-241; and all other radionuclides of half-life greater than 10 days, notably Cs-134 and Cs-137. For each group, CEC specified DILs for four food categories: baby foods, dairy produce, other food except minor food, and liquid foods.

Baby foods were defined as "foodstuffs intended for the feeding of infants during the first four to six months of life, ... and are put up for sale in packages which are clearly identified and labeled food preparation for infants". Dairy produce, liquid food, and minor foods were defined by reference to specific CEC regulations and nomenclature. Liquid foods included tap water and the CEC stated the "same values should be applied to drinking water supplies at the discretion of competent authorities of member states". Dried products referred to the products as prepared for consumption. Dilution factors were not specified and the CEC permitted member states to specify the dilution conditions.

DILs for minor foods such as spices were established, in a separate regulation, at ten times the DILs specified for "other foods" (CEC 1989a). Each DIL is to be applied independently. However, for each radionuclide group, the concentrations within the group are to be added when more than one radionuclide is present. The DILs are to be reviewed within three months following an accident to determine if they should be continued.

(b) CODEX Alimentarius Commission: DILs for Use in International Trade

CODEX adopted guidance in 1989 establishing DILs for food contaminated with radionuclides. The CODEX DILs were issued as guideline levels following an accidental nuclear contamination event (CODEX 1989). The guidance was developed from earlier publications of FAO (FAO 1987, Lupien and Randall 1988) and WHO (Waight 1988, WHO 1988). The DILs are presented in Table F-2. They were given for several radionuclide groups categorized by the magnitude of their dose coefficients and two food groups.

The food groups are milk and infant foods and foods destined for general consumption. CODEX defined infant food as a food prepared specifically for consumption by infants in the first year of life and stated that such foods are packaged and identified as being for this purpose (CODEX 1989). The radionuclides were grouped according to the magnitude of their dose coefficients (DCs). The specific groupings differed for the two food groups. CODEX listed representative radionuclides for each DC group. CODEX guidelines were not restricted to these radionuclides; any radionuclide can be placed into the appropriate DC group.

CODEX DILs apply for one year following a nuclear accident. They are intended to be applied to food prepared for consumption. Each DIL is to be applied independently. However, for each, the concentrations within the group are to be added. No guidance is provided for foods which are consumed in small quantities, although CODEX stated that application of the DILs to products of this type may be unnecessarily restrictive (CODEX 1989).

Table F-1

DILs ADOPTED BY CEC FOR FUTURE ACCIDENTS[(a)] (CEC 1989b)

Radionuclide Group	Derived Intervention Levels(Bq/kg)			
	Baby Foods	Dairy Produce	Other except minor foods	Liquids
Isotopes of strontium, notably Sr-90	75	125	750	125
Isotopes of iodine, notably I-131	150	500	2000	500
Alpha-emitting isotopes of Pu and transplutonium elements, notably Pu-239, Am-241	1	20	80	20
All other radionuclides of half-life greater than 10 days, notably Cs-134, Cs-137	400	1000	1250	1000

(a) Do not apply to residual contamination from the accident at Chernobyl.

Table F-2

DIL VALUES RECOMMENDED BY CODEX (CODEX 1989)

FOODS DESTINED FOR GENERAL CONSUMPTION

Approximate Dose Coefficient (Sv/Bq)	Representative Radionuclides	DIL (Bq/kg)
10^{-6}	Am-241, Pu-239	10
10^{-7}	Sr-90	100
10^{-8}	I-131, Cs-134, Cs-137	1000

MILK AND INFANT FOODS

Approximate Dose Coefficient (Sv/Bq)	Representative Radionuclides	DIL (Bq/kg)
10^{-5}	Am-241, Pu-239	1
10^{-7}	I-131, Sr-90	100
10^{-8}	Cs-134, Cs-137	1000

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NUREG–1302

Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors

Generic Letter 89–01, Supplement No. 1

U.S. Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

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NUREG-1302

Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors

Generic Letter 89-01, Supplement No. 1

Date Published: April 1991

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ABSTRACT

This report contains guidance which may be voluntarily used by licensees who choose to implement the provision of Generic Letter 89-01, which allows Radiological Effluent Technical Specifications (RETS) to be removed from the main body of the Technical Specifications and placed in the Offsite Dose Calculation Manual (ODCM). Guidance is provided for Standard Effluent Controls definitions, Controls for effluent monitoring instrumentation, Controls for effluent releases, Controls for radiological environmental monitoring, and the basis for Controls.

Guidance on the formulation of RETS has been available in draft form (NUREG-0472 and -0473) for a number of years; the current effort simply recasts those RETS into Standard Radiological Effluent Controls for application to the ODCM. Also included for completeness are: (1) radiological environmental monitoring program guidance previously which had been available as a Branch Technical Position (Rev. 1, November 1979); (2) existing ODCM guidance; and (3) a reproduction of Generic Letter 89-01.

PREFACE

This compilation of Standard Radiological Effluent Controls (SREC) contains all of the controls addressed in Generic Letter 89-01, to be incorporated into a licensee's Offsite Dose Calculation Manual (ODCM) at the time the procedural details of the current Radiological Effluent Technical Specifications (RETS) are transferred out of the licensee's Technical Specifications (TS). It has been developed by recasting the RETS of the most current Standard Technical Specifications from the "LCO" format into the "Controls" format of an ODCM entry. Note that these GE-SREC have been patterned after the W-SREC. The following text guidance incorporates the wording of the most recent SREC, however, no attempt has been made to translate REC numbering of the W-SREC into that of the BWR numbering system.

The following GE-SREC provide the latest version of staff guidance, and document current practice in the operating procedures required by 10 CFR 20.106, 40 CFR Part 190, 10 CFR 50.36(a), and Appendix I to 10 CFR Part 50. This document contains no new requirements and its use is completely voluntary.

TABLE OF CONTENTS

FOREWORD

RADIOLOGICAL EFFLUENT TECHNICAL SPECIFICATIONS

Licensee Technical Specification (TS) amendment requests for incorporation of Radiological Effluent Technical Specifications (RETS) pursuant to 10 CFR 50.36a and Appendix I to 10 CFR Part 50 were approved in the mid-1980s for most operating reactors licensed before 1979 (ORs). Plants licensed after 1979 (NTOLs), included the RETS as part of their initial Technical Specifications. By November 1987, the RETS were implemented by all licensees of operating power reactors. Detailed Safety Evaluation Reports (SERs) documented the acceptability of the plant-specific RETS of the ORs, while the acceptance of the RETS for the NTOLs followed the regular pattern of the Standard Technical Specifications (STS). Thus, for all operating plants, the compliance of the licensee with 10 CFR 50.36a and Appendix I to 10 CFR Part 50 is a matter of record.

Early draft revisions of model RETS, distributed to licensees in mid-1978, contained equations for dose calculations, setpoint determinations and meteorological dispersion factors, as well as the procedural details for complying with Appendix I to 10 CFR Part 50. In later revisions, including Revision 2 used as the bench mark for the NRC staff's acceptance of OR RETS, the equations were removed and incorporated into an Offsite Dose Calculation Manual (ODCM) prepared by the licensee and provided to NRC for review along with the proposed RETS.

Early guidance for preparation of the Radiological Effluent Technical Specifications (RETS) and Offsite Dose Calculation Manual (ODCM) was published in NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," October 1978. Copies of model RETS, however, have been available only in draft form as NUREG-0472, Revision 2, "Radiological Effluent Technical Specifications for PWRs," February 1, 1980; NUREG-0473, Revision 2, "Radiological Effluent Technical Specifications for BWRs," February 1, 1980; and succeeding draft revisions. Staff guidance for the Radiological Environmental Monitoring Program is contained in the Radiological Assessment Branch Technical Position (RAB-BTP), originally issued in March 1978 and upgraded by Revision 1 in November 1979 as a result of the accident at Three Mile Island. This Revision 1 to the RAB-BTP was forwarded to all operating reactor licensees in November 1979 and remains in effect at the present time. Since this BTP was never incorporated into the Regulatory Guide System, a copy is reproduced in this document as Appendix A. Even though it has been used extensively in reviewing ODCMs, guidance for the contents of the ODCM is found only in an appendix to a paper presented at an Atomic Industrial Forum conference in 1981, and has had only informal distribution since that time.

OFFSITE DOSE CALCULATION MANUAL

The potential for augmentation of a licensee's ODCM through transfer of the procedural details of the RETS following the guidance of Generic Letter 89-01, provides an opportunity to assemble in one set of documents the staff guidance for the ODCM.

The current overview guidance for development of the ODCM was prepared originally in July 1978 and revised in February 1979 after discussions with committees of the Atomic Industrial Forum. This guidance was made generally available as "Appendix B - General Contents of the Offsite Dose Calculation Manual (ODCM) (Revision 1, February 1979)" to the paper authored by C. A. Willis and F. J. Congel, "Status of NRC Radiological Effluent Technical Specification Activities" presented at the Atomic Industrial Forum Conference on NEPA and Nuclear Regulation, October 4-7, 1981, Washington, D.C. -A copy of this guidance that continues in effect to date, is reproduced in this document as Appendix B.

During the discussions leading up to the implementation of the RETS by the ORs, it became important to record in a "living" document certain interpretations and understandings reached in these discussions. The ODCM thus became a repository for such interpretations, as well as for other information requested by the staff in connection with its evaluation of licensee's commitments and performance under 10 CFR 50.36a and Appendix I to 10 CFR Part 50.

TECHNICAL SPECIFICATION IMPROVEMENT PROGRAM

Recently, the NRC staff has examined the contents of the RETS in relation to the Commission's Interim Policy Statement on Technical Specification Improvements. The staff has determined that programmatic controls can be implemented in the Administrative Controls section of the Technical Specifications (TS) to satisfy existing regulatory requirements for RETS. At the same time, the procedural details of the current TS on radioactive effluents and radiological environmental monitoring can be relocated to the Offsite Dose Calculation Manual (ODCM).

To initiate the change, new programmatic controls for radioactive effluents and radiological environmental monitoring are incorporated in the TS to conform to the regulatory requirements of 10 CFR 20.106, 40 CFR Part 190, 10 CFR 50.36a, and Appendix I to 10 CFR Part 50. The procedural details included in licensees' present TS on radioactive effluents, environmental monitoring, and associated reporting requirements will be relocated to the ODCM. Licensees will handle future changes to these procedural details in the ODCM under the administrative controls for changes to the ODCM. Detailed guidance to effect the transfer of the RETS to the ODCM is given in Generic Letter 89-01, reproduced in its entirety as Appendix C.

GUIDANCE FOR THE TRANSFER OF RETS TO ODCM

Enclosure 1 of Generic Letter (GL) 89-01 of Appendix B provides detailed guidance for the preparation of a license amendment request to implement the transfer of RETS to ODCM. Page 1 of the enclosure states:

> "The NRC staff's intent in recommending --- the relocation of procedural details of the current RETS to the ODCM is to fulfill the goal of the Commission Policy Statement for Technical Specification Improvements. It is not the staff's intent to reduce the level of radiological effluent control. Rather, this amendment will provide programmatic controls for RETS consistent with regulatory requirements and allow relocation of the procedural details of current RETS to the ODCM."

Page 2 of Enclosure 1 states:

"...the procedural details covered in the licensee's current RETS, consisting of the limiting conditions for operation, their applicability, remedial actions, surveillance requirements, and the Bases section of the TS for these requirements, are to be relocated to the ODCM --- in a manner that ensures that these details are incorporated in plant operating procedures. The NRC staff does not intend to repeat technical reviews of the relocated procedural details because their consistency with the applicable regulatory requirements is a matter of record from past NRC reviews of RETS."

DISCUSSION

For the purpose of the transfer described in GL 89-01 of Appendix B, the RETS will consist of the specifications from the STS listed in Enclosure 2 of Appendix B of GL 89-01. Licensees with nonstandard TS should consider the analogous TS in their format.

It is suggested that the most straightforward method of transferring a licensee's commitments in the RETS to the ODCM in accordance with GL 98-01 is to recast the RETS in the licensee's present TS from the "Limiting Condition for Operation (LCO)" format of the TS into the "Controls" format of the ODCM entry. The accompanying package provides an example of this recasting into Standard Radiological Effluent Controls (SREC) from the model RETS for Boiling Water Reactors (BWRs). This recasting is in format only. The TS pages have been transferred to the ODCM without change except for the substitution of "Controls" for "LCO." Plants that have RETS that closely follow the STS format will be able to use the accompanying examples directly as guidance. For plants with nonstandard RETS, the transfer of TS commitments to the ODCM should be made similarly page by page, again with the substitution of "Controls" for "LCO."

This NUREG report contains no new requirements; licensee implementation of this guidance is completely voluntary.

SUMMARY

As part of the license amendment request for TS improvement relative to the RETS, a licensee confirms that the guidance of Generic Letter 89-01 has been followed. This guidance includes the following:

"The procedural details covered in the licensee's current RETS, consisting of the limiting conditions for operation, their applicability, remedial actions, surveillance requirements, and the Bases section of the TS for these requirements, are to be relocated to the ODCM --- in a manner that ensures that these details are incorporated in plant operating procedures."

The Standard Radiological Effluent Controls (SREC) compiled in this report document current staff practice in the operating procedures required by 10 CFR 20.106, 40 CFR Part 190, 10 CFR 50.36(a), and Appendix I to 10 CFR Part 50. Thus they contain all of the controls required by Generic Letter 89-01, to be incorporated into a licensee's ODCM at the time the procedural details of the current RETS are transferred out of the licensee's TS.

NOTE

These GE-SREC have been
patterned after the W-SREC.
The following text guidance incorporates the
wording of the most recent SREC; however,
no attempt has been made to translate the
REC numbering of the W-SREC into that
of the BWR numbering system

SECTION 1.0

DEFINITIONS

1.0 DEFINITIONS

The defined terms of this section appear in capitalized type and are applicable throughout these Controls.

ACTION

1.1 ACTION shall be that part of a Control that prescribes remedial measures required under designated conditions.

CHANNEL CALIBRATION

1.4 An CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel such that it responds within the required range and accuracy to known values of input. The CHANNEL CALIBRATION shall encompass the entire channel including the sensors and alarm, interlock and/or trip functions and shall include the CHANNEL FUNCTIONAL TEST. The CHANNEL CALIBRATION may be performed by any series of sequential, overlapping, or total channel steps such that the entire channel is calibrated.

CHANNEL CHECK

1.5 A CHANNEL CHECK shall be the qualitative assessment of channel behavior during operation by observation. This determination shall include, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent instrument channels measuring the same parameter.

CHANNEL FUNCTIONAL TEST

1.6 A CHANNEL FUNCTIONAL TEST shall be:

a. Analog channels - the injection of a simulated signal into the channel as close to the sensor as practicable to verify OPERABILITY including alarm and/or trip functions and channel failure trips.

b. Bistable channels - the injection of a simulated signal into the sensor to verify OPERABILITY including alarm and/or trip functions.

The CHANNEL FUNCTIONAL TEST may be performed by any series of sequential, overlapping or total channel steps such that the entire channel is tested.

DOSE EQUIVALENT I-131

1.10 DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microCurie/gram) which alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed in [Table III of TID-14844, "Calculation of Distance Factors for Power and Test Reactor Sites" or Table E-7 of NRC Regulatory Guide 1.109, Revision 1, October 1977].

FREQUENCY NOTATION

1.13 The FREQUENCY NOTATION specified for the performance of Surveillance Requirements shall correspond to the intervals defined in Table 1.1.

GASEOUS RADWASTE TREATMENT SYSTEM

1.14 A GASEOUS RADWASTE TREATMENT SYSTEM (e.g., the "augmented offgas system") is any system designed and installed to reduce radioactive gaseous effluents by collecting primary coolant system offgases from the main condenser evacuation system and providing for delay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.

MEMBER(S) OF THE PUBLIC

1.16 MEMBER(S) OF THE PUBLIC shall include all persons who are not occupationally associated with the plant. This category does not include employees of the licensee, its contractors, or vendors. Also excluded from this category are persons who enter the site to service equipment or to make deliveries. This category does include persons who use portions of the site for recreational, occupational, or other purposes not associated with the plant.

OFFSITE DOSE CALCULATION MANUAL

1.17 The OFFSITE DOSE CALCULATION MANUAL (ODCM) shall contain the methodology and parameters used in the calculation of offsite doses resulting from radioactive gaseous and liquid effluents, in the calculation of gaseous and liquid effluent monitoring Alarm/Trip Setpoints, and in the conduct of the Environmental Radiological Monitoring Program. The ODCM shall also contain (1) the Radioactive Effluent Controls and Radiological Environmental Monitoring Programs required by Section 6.8.4 and (2) descriptions of the information that should be included in the Annual Radiological Environmental Operating and Semiannual Radioactive Effluent Release Reports required by TS 6.9.1.3 and 6.9.1.4.

OPERABLE - OPERABILITY

1.18 A system, subsystem, train, component or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified function(s), and when all necessary attendant instrumentation, controls, electrical power, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its function(s) are also capable of performing their related support function(s).

OPERATIONAL CONDITION - CONDITION

1.19 An OPERATIONAL CONDITION, i.e., CONDITION, shall be any one inclusive combination of mode switch position and average reactor coolant temperatures as specified in Table 1.2.

PURGE - PURGING

1.23 PURGE or PURGING shall be any controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner that replacement air or gas is required to purify the confinement.

RATED THERMAL POWER

1.25 RATED THERMAL POWER shall be a total reactor core heat transfer rate to the reactor coolant of ____MWt.

REPORTABLE EVENT

1.27 A REPORTABLE EVENT shall be any of those conditions specified in Section 50.73 of 10 CFR Part 50.

SITE BOUNDARY

1.30 The SITE BOUNDARY shall be that line beyond which the land is neither owned, nor leased, nor otherwise controlled by the licensee.

SOURCE CHECK

1.33 A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to a source of increased radioactivity.

THERMAL POWER

1.35 THERMAL POWER shall be the total reactor core heat transfer rate to the reactor coolant.

UNRESTRICTED AREA

1.38 An UNRESTRICTED AREA shall be any area at or beyond the SITE BOUNDARY access to which is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials, or any area within the SITE BOUNDARY used for residential quarters or for industrial, commercial, institutional, and/or recreational purposes.

VENTILATION EXHAUST TREATMENT SYSTEM

1.39 A VENTILATION EXHAUST TREATMENT SYSTEM shall be any system designed and installed to reduce gaseous radioiodine or radioactive material in particulate form in effluents by passing ventilation or vent exhaust gases through charcoal adsorbers and/or HEPA filters for the purpose of removing iodines or particulates from the gaseous exhaust stream prior to the release to the environment. Such a system is not considered to have any effect on noble gas effluents. Engineered Safety Features Atmospheric Cleanup Systems are not considered to be VENTILATION EXHAUST TREATMENT SYSTEM components.

VENTING

1.40 VENTING shall be the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration, or other operating condition, in such a manner that replacement air or gas is not provided or required during VENTING. Vent, used in system names, does not imply a VENTING process.

TABLE 1.1

FREQUENCY NOTATION

NOTATION	FREQUENCY
S	At least once per 12 hours.
D	At least once per 24 hours.
W	At least once per 7 days.
M	At least once per 31 days.
Q	At least once per 92 days.
SA	At least once per 184 days.
R	At least once per 18 months.
S/U	Prior to each reactor startup.
N.A.	Not applicable.
P	Completed prior to each release.

TABLE 1.2

OPERATIONAL CONDITIONS

CONDITION	MODE SWITCH POSITION	AVERAGE REACTOR COOLANT TEMPERATURE
1. POWER OPERATION	Run	Any temperature
2. STARTUP	Startup/Hot Standby	Any temperature
3. HOT SHUTDOWN	Shutdown#,***	> 200°F
4. COLD SHUTDOWN	Shutdown#,##,***	≤ 200°F
5. REFUELING*	Shutdown or Refuel**,#	≤ 140°F

#The reactor mode switch may be placed in the Run or Startup/Hot Standby position to test the switch interlock functions provided that the control rods are verified to remain fully inserted by a second licensed operator or other technically qualified member of the unit technical staff.

##The reactor mode switch may be placed in the Refuel position while a single control rod drive is being removed from the reactor pressure vessel per Specification 3.9.10.1.

*Fuel in the reactor vessel with the vessel head closure bolts less than fully tensioned or with the head removed.

**See Special Tests Exceptions 3.10.1 and 3.10.3.

***The reactor mode switch may be placed in the Refuel position while a single control rod is being recoupled provided that the one-rod-out interlock is OPERABLE.

SECTIONS 3.0 AND 4.0

CONTROLS

AND

SURVEILLANCE REQUIREMENTS

3/4.0 APPLICABILITY

CONTROLS

3.0.1 Compliance with the Controls contained in the succeeding controls is required during the OPERATIONAL CONDITIONS or other conditions specified therein; except that upon failure to meet the Control, the associated ACTION requirements shall be met.

3.0.2 Noncompliance with a control shall exist when the requirements of the Control and associated ACTION requirements are not met within the specified time intervals. If the Control is restored prior to expiration of the specified time intervals, completion of the ACTION requirements is not required.

3.0.3 When a Control is not met, except as provided in the associated ACTION requirements, within 1 hour action shall be initiated to place the unit in an OPERATIONAL CONDITION in which the control does not apply by placing it, as applicable, in:

1. At least STARTUP within the next 6 hours,
2. At least HOT SHUTDOWN within the following 6 hours, and
3. At least COLD SHUTDOWN within the subsequent 24 hours.

Where corrective measures are completed that permit operation under the ACTION requirements, the action may be taken in accordance with the specified time limits as measured from the time of failure to meet the Control. Exceptions to these requirements are stated in the individual controls.

This control is not applicable in OPERATIONAL CONDITIONS 4 or 5.

3.0.4 Entry into an OPERATIONAL CONDITION or other specified condition shall not be made unless the conditions for the Control are met without reliance on provisions contained in the ACTION requirements. This provision shall not prevent passage through or to OPERATIONAL CONDITIONS as required to comply with ACTION requirements. Exceptions to these requirements are stated in the individual controls.

APPLICABILITY

SURVEILLANCE REQUIREMENTS

4.0.1 Surveillance Requirements shall be met during the OPERATIONAL CONDITIONS or other conditions specified for individual Controls unless otherwise stated in an individual Surveillance Requirement.

4.0.2 Each Surveillance Requirement shall be performed within the specified time interval with:

a. A maximum allowable extension not to exceed 25% of the surveillance interval, but

b. The combined time interval for any three consecutive surveillance intervals shall not exceed 3.25 times the specified surveillance interval.

4.0.3 Failure to perform a Surveillance Requirement within the specified time interval shall constitute a failure to meet the OPERABILITY requirements for a Control. Exceptions to these requirements are stated in the individual controls. Surveillance Requirements do not have to be performed on inoperable equipment.

4.0.4 Entry into an OPERATIONAL CONDITION or other specified applicable condition shall not be made unless the Surveillance Requirement(s) associated with the Control has been performed within the applicable surveillance interval or as otherwise specified.

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

CONTROLS

3.3.3.10 In accordance with [plant name] TS 6.8.4.g.1), the radioactive liquid effluent monitoring instrumentation channels shown in Table 3.3-12 shall be OPERABLE with their Alarm/Trip Setpoints set to ensure that the limits of Control 3.11.1.1 are not exceeded. The Alarm/Trip Setpoints of these channels shall be determined and adjusted in accordance with the methodology and parameters in the OFFSITE DOSE CALCULATION MANUAL (ODCM).

APPLICABILITY: At all times.

ACTION:

a. With a radioactive liquid effluent monitoring instrumentation channel Alarm/Trip Setpoint less conservative than required by the above control, immediately suspend the release of radioactive liquid effluents monitored by the affected channel, or declare the channel inoperable, or change the setpoint so it is acceptably conservative.

b. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 3.3-12. Restore the inoperable instrumentation to OPERABLE status within 30 days and, if unsuccessful, explain in the next Semiannual Radioactive Effluent Release Report pursuant to Control 6.9.1.4 why this inoperability was not corrected in a timely manner.

c. The provisions of Controls 3.0.3 and 3.0.4 are not applicable. Report all deviations in the Semiannual Radioactive Effluent Release Report.

SURVEILLANCE REQUIREMENTS

4.3.3.10 Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST at the frequencies shown in Table 4.3-8.

TABLE 3.3-12

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	ACTION
1. Radioactivity Monitors Providing Alarm and Automatic Termination of Release		
a. Liquid Radwaste Effluent Line	1	35
2. Radioactivity Monitors Providing Alarm But Not Providing Automatic Termination of Release		
a. Service Water System Effluent Line	1	37
b. Component Cooling Water System Effluent Line	1	37
3. (Not Used)		
4. Flow Rate Measurement Devices		
a. Liquid Radwaste Effluent Line	1	38
b. Discharge Canal	1	38
5. Radioactivity Recorders*		
a. Liquid Radwaste Effluent Line	1	39

*Required only if Alarm/Trip Setpoint is based on recorder-controller.

(NOT USED)

TABLE 3.3-12 (Continued)

ACTION STATEMENTS

ACTION 35 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided that prior to initiating a release:

a. At least two independent samples are analyzed in accordance with Control 4.11.1.1.1, and

b. At least two technically qualified members of the facility staff independently verify the release rate calculations and discharge line valving.

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION 37 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided that, at least once per 12 hours, grab samples are collected and analyzed for radioactivity at a lower limit of detection of no more than 10^{-7} microCurie/ml.

ACTION 38 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided the flow rate is estimated at least once per 4 hours during actual releases. Pump performance curves generated in place may be used to estimate flow.

ACTION 39 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided the radioactivity level is determined at least once per 4 hours during actual releases.

TABLE 4.3-8

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
1. Radioactivity Monitors Providing Alarm and Automatic Termination of Release				
a. Liquid Radwaste Effluent Line	D	P	R(3)	Q(1)
2. Radioactivity Monitors Providing Alarm But Not Providing Automatic Termination of Release				
a. Service Water System Effluent Line	D	M	R(3)	Q(2)
b. Component Cooling Water System Effluent Line	D	M	R(3)	Q(2)
3. (Not Used)				
4. Flow Rate Measurement Devices				
a. Liquid Radwaste Effluent Line	D(4)	N.A.	R	Q
b. Discharge Canal	D(4)	N.A.	R	Q
5. Radioactivity Recorders*				
a. Liquid Radwaste Effluent Line	D	N.A.	R	Q

*Required only if Alarm/Trip Setpoint in based on recorder-controller.

(NOT USED)

TABLE 4.3-8 (Continued)

TABLE NOTATIONS

(1) The CHANNEL FUNCTIONAL TEST shall also demonstrate that automatic isolation of this pathway and control room alarm annunciation occur if any of the following conditions exists:

   a. Instrument indicates measured levels above the Alarm/Trip Setpoint, or

   b. Circuit failure, or

   c. Instrument indicates a downscale failure, or

   d. Instrument controls not set in operate mode.

(2) The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exists:

   a. Instrument indicates measured levels above the Alarm Setpoint, or

   b. Circuit failure, or

   c. Instrument indicates a downscale failure, or

   d. Instrument controls not set in operate mode.

(3) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Bureau of Standards (NBS) or using standards that have been obtained from suppliers that participate in measurement assurance activities with NBS. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used.

(4) CHANNEL CHECK shall consist of verifying indication of flow during periods of release. CHANNEL CHECK shall be made at least once per 24 hours on days on which continuous, periodic, or batch releases are made.

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

CONTROLS

3.3.3.11 In accordance with [plant name] TS 6.8.4.g.1), the radioactive gaseous effluent monitoring instrumentation channels shown in Table 3.3-13 shall be OPERABLE with their Alarm/Trip Setpoints set to ensure that the limits of Control 3.11.2.1 are not exceeded. The Alarm/Trip Setpoints of these channels shall be determined and adjusted in accordance with the methodology and parameters in the ODCM.

APPLICABILITY: As shown in Table 3.3-13

ACTION:

a. With a radioactive gaseous effluent monitoring instrumentation channel Alarm/Trip Setpoint less conservative than required by the above control, immediately suspend the release of radioactive gaseous effluents monitored by the affected channel, or declare the channel inoperable, or change the setpoint so it is acceptably conservative.

b. With less than the minimum number of radioactive gaseous effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 3.3-13. Restore the inoperable instrumentation to OPERABLE status within 30 days and, if unsuccessful, explain in the next Semi-annual Radioactive Effluent Release Report pursuant to Control 6.9.1.4 why this inoperability was not corrected in a timely manner.

c. The provisions of Controls 3.0.3 and 3.0.4 are not applicable. Report all deviations in the Semiannual Radioactive Effluent Release Report.

SURVEILLANCE REQUIREMENTS

4.3.3.11 Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION and CHANNEL FUNCTIONAL TEST at the frequencies shown in Table 4.3-9.

TABLE 3.3-13

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
1. Main Condenser Offgas Treatment System Effluent Monitoring System			
a. Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release	1	*	47
b. Iodine Sampler	1	*	51
c. Particulate Sampler	1	*	51
d. Effluent System Flow Rate Measuring Device	1	*	46
e. Sampler Flow Rate Measuring Device	1	*	46
2A. NOT USED			
2B. NOT USED			

TABLE 3.3-13 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
3. Reactor Building Ventilation/Purge System			
a. Noble Gas Activity Monitor	1	*	48
b. Iodine Sampler	1	*	51
c. Particulate Sampler	1	*	51
d. Flow Rate Monitor	1	*	46
e. Sampler Flow Rate Monitor	1	*	46
4. Main Stack System			
a. Noble Gas Activity Monitor	1	*	47
b. Iodine Sampler	1	*	51
c. Particulate Sampler	1	*	51
d. Flow Rate Monitor	1	*	46
e. Sampler Flow Rate Monitor	1	*	46
5. Turbine Building Ventilation System			
a. Noble Gas activity Monitor	1	*	47
b. Iodine Sampler	1	*	51
c. Particulate Sampler	1	*	51

TABLE 3.3-13 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
5. Turbine Building Ventilation System (Continued)			
d. Flow Rate Monitor	1	*	46
e. Sampler Flow Rate Monitor	1	*	46
6. Auxiliary Building Ventilation System			
a. Noble Gas Activity Monitor	1	*	47
b. Iodine Sampler	1	*	51
c. Particulate Sampler	1	*	51
d. Flow Rate Monitor	1	*	46
e. Sampler Flow Rate Monitor	1	*	46
7. Fuel Storage Area Ventilation System			
a. Noble Gas Activity Monitor	1	*	47
b. Iodine Sampler	1	*	51
c. Particulate Sampler	1	*	51
d. Flow Rate Monitor	1	*	46
e. Sampler Flow Rate Monitor	1	*	46

TABLE 3.3-13 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
8. Radwaste Area Ventilation System			
a. Noble Gas Activity Monitor	1	*	47
b. Iodine Sampler	1	*	51
c. Particulate Sampler	1	*	51
d. Flow Rate Monitor	1	*	46
e. Sampler Flow Rate Monitor	1	*	46
9. Turbine Gland Seal Condenser Vent and Mechanical Vacuum Pump Exhaust System			
a. Noble Gas Activity Monitor	1	*	47
b. Iodine Sampler	1	*	51
c. Particulate Sampler	1	*	51
d. Flow Rate Monitor	1	*	46
e. Sampler Flow Rate Monitor	1	*	46
10. Condenser Air Ejector Radioactivity Monitor (Prior to Input to Holdup System)			
a. Noble Gas Activity Monitor	1	***	45

(NOT USED)

TABLE 3.3-13 (Continued)

TABLE NOTATIONS

*At all times.

**During main condenser offgas treatment system operation.

***During operation of the main condenser air ejector.

ACTION STATEMENTS

ACTION 45 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, releases to the environment may continue for up to 72 hours provided:

a. The offgas system is not bypassed, and

b. The offgas delay system noble gas activity effluent (downstream) monitor is OPERABLE;

Otherwise, be in at least HOT STANDBY within 12 hours.

ACTION 46 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided the flow rate is estimated at least once per 4 hours.

ACTION 47 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided grab samples are taken at least once per 12 hours and these samples are analyzed for radioactivity within 24 hours.

ACTION 48 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, immediately suspend release of radioactive effluents via this pathway.

ACTION 49 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, operation of the main condenser offgas treatment system may continue provided grab samples are collected at least once per 4 hours and analyzed within the following 4 hours.

ACTION 50 - With the number of channels OPERABLE one less than required by the Minimum Channels OPERABLE requirement, operation of this system may continue for up to 14 days.

ACTION 51 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via the affected pathway may continue provided samples are continuously collected with auxiliary sampling equipment as required in Table 4.11-2.

(NOT USED)

TABLE 4.3-9

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
1. Main Condenser Offgas Treatment System Effluent Monitoring System					
a. Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release	D	D	R(3)	Q(1)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Effluent System Flow Rate Measuring Device	D	N.A.	R	Q	*
e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*
2A. NOT USED					
2B. NOT USED					

TABLE 4.3-9 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
3. Reactor Building Ventilation/Purge System					
a. Noble Gas Activity Monitor	D	M	R(3)	Q(1)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Flow Rate Monitor	D	N.A.	R	Q	*
e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*
4. Main Stack System					
a. Noble Gas Activity Monitor	D	M	R(3)	Q(2)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Flow Rate Monitor	D	N.A.	R	Q	*
e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*

TABLE 4.3-9 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
5. Turbine Building Ventilation System					
a. Noble Gas Activity Monitor	D	M	R(3)	Q(2)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Flow Rate Monitor	D	N.A.	R	Q	*
e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*
6. Auxiliary Building Ventilation System					
a. Noble Gas Activity Monitor	D	M	R(3)	Q(2)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Flow Rate Monitor	D	N.A.	R	Q	*
e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*

TABLE 4.3-9 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
7. Fuel Storage Area Ventilation System					
a. Noble Gas Activity Monitor	D	M	R(3)	Q(2)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Flow Rate Monitor	D	N.A.	R	Q	*
e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*
8. Radwaste Area Ventilation System					
a. Noble Gas Activity Monitor	D	M	R(3)	Q(2)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Flow Rate Monitor	D	N.A.	R	Q	*
e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*

TABLE 4.3-9 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
9. Turbine Gland Seal Condenser Vent and Mechanical Vacuum Pump Exhaust System					
a. Noble Gas Activity Monitor	D	M	R(3)	Q(2)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Flow Rate Monitor	D	N.A.	R	Q	*
e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*
10. Condenser Air Ejector Radioactivity Monitor (Prior to Input to Holdup System)					
a. Noble Gas Activity Monitor	D	M	R(3)	Q(2)	***

TABLE 4.3-9 (Continued)

TABLE NOTATIONS

*At all times.
**During main condenser offgas treatment system operation.
***During operation of the main condenser air ejector.

(1) The CHANNEL FUNCTIONAL TEST shall also demonstrate that automatic isolation of this pathway and control room alarm annunciation occurs if any of the following conditions exists:

a. Instrument indicates measured levels above the Alarm/Trip Setpoint, or

b. Circuit failure, or

c. Instrument indicates a downscale failure, or

d. Instrument controls not set in operate mode.

(2) The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exists:

a. Instrument indicates measured levels above the Alarm Setpoint, or

b. Circuit failure, or

c. Instrument indicates a downscale failure, or

d. Instrument controls not set in operate mode.

(3) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Bureau of Standards (NBS) or using standards that have been obtained from suppliers that participate in measurement assurance activities with NBS. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used.

(4) The CHANNEL CALIBRATION shall include the use of standard gas samples containing a nominal:

a. One volume percent hydrogen, balance nitrogen, and

b. Four volume percent hydrogen, balance nitrogen.

(5) The CHANNEL CALIBRATION shall include the use of standard gas samples containing a nominal:

a. One volume percent oxygen, balance nitrogen, and

b. Four volume percent oxygen, balance nitrogen.

3/4.11 RADIOACTIVE EFFLUENTS

3/4.11.1 LIQUID EFFLUENTS

CONCENTRATION

CONTROLS

3.11.1.1 In accordance with [plant name] TS 6.8.4.g.2) and 3), the concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS (see Figure 5.1-3) shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2 x 10^{-4} microCurie/ml total activity.

APPLICABILITY: At all times.

ACTION:

a. With the concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS exceeding the above limits, immediately restore the concentration to within the above limits.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.11.1.1.1 Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program of Table 4.11-1.

4.11.1.1.2 The results of the radioactivity analyses shall be used in accordance with the methodology and parameters in the ODCM to assure that the concentrations at the point of release are maintained within the limits of Control 3.11.1.1.

TABLE 4.11-1

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

LIQUID RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD)(1) (μCi/ml)
1. Batch Waste Release Tanks(2) a.	P Each Batch	P Each Batch	Principal Gamma Emitters(3)	5×10^{-7}
			I-131	1×10^{-6}
b.	P One Batch/M	M	Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}
c.	P Each Batch	M Composite(4)	H-3	1×10^{-5}
			Gross Alpha	1×10^{-7}
	P Each Batch	Q Composite(4)	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}
2. Continuous Releases(5) a.	Continuous(6)	W Composite(6)	Principal Gamma Emitters(3)	5×10^{-7}
			I-131	1×10^{-6}
b.	M Grab Sample	M	Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}
c.	Continuous(6)	M Composite(6)	H-3	1×10^{-5}
			Gross Alpha	1×10^{-7}
	Continuous(6)	Q Composite(6)	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}

TABLE NOTATIONS

(1) The LLD is defined, for purposes of these controls, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66\ s_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot \exp(-\lambda \Delta t)}$$

Where:

LLD = the "a priori" lower limit of detection (microCurie per unit mass or volume),

s_b = the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (counts per minute),

E = the counting efficiency (counts per disintegration),

V = the sample size (units of mass or volume),

2.22×10^6 = the number of disintegrations per minute per microCurie,

Y = the fractional radiochemical yield, when applicable,

λ = the radioactive decay constant for the particular radionuclide (sec^{-1}), and

Δt = the elapsed time between the midpoint of sample collection and the time of counting (sec).

Typical values of E, V, Y, and Δt should be used in the calculation.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

(2) A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analyses, each batch shall be isolated, and then thoroughly mixed by a method described in the ODCM to assure representative sampling.

TABLE 4.11-1 (Continued)

TABLE NOTATIONS (Continued)

(3) The principal gamma emmiters for which the LLD control applies include the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, and Ce-141. Ce-144 shall also be measured, but with an LLD of 5×10^{-6}. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Semiannual Radioactive Effluent Release Report pursuant to Control 6.9.1.4 in the format outlined in Regulatory Guide 1.21, Appendix B, Revision 1, June 1974.

(4) A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen that is representative of the liquids released.

(5) A continuous release is the discharge of liquid wastes of a nondiscrete volume, e.g., from a volume of a system that has an input flow during the continuous release.

(6) To be representative of the quantities and concentrations of radioactive materials in liquid effluents, samples shall be collected continuously in proportion to the rate of flow of the effluent stream. Prior to analyses, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be representative of the effluent release.

RADIOACTIVE EFFLUENTS

DOSE

CONTROLS

3.11.1.2 In accordance with [plant name] TS 6.8.4.g.4) and 6.8.4.9.5), the dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released, from each unit, to UNRESTRICTED AREAS (see Figure 5.1-3) shall be limited:

a. During any calendar quarter to less than or equal to 1.5 mrems to the whole body and to less than or equal to 5 mrems to any organ, and

b. During any calendar year to less than or equal to 3 mrems to the whole body and to less than or equal to 10 mrems to any organ.

APPLICABILITY: At all times.

ACTION:

a. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, pursuant to Control 6.9.2, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits. This Special Report shall also include: (1) the results of radiological analyses of the drinking water source, and (2) the radiological impact on finished drinking water supplies with regard to the requirements of 40 CFR Part 141, Safe Drinking Water Act.*

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.11.1.2 Cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year shall be determined in accordance with the methodology and parameters in the ODCM at least once per 31 days.

*The requirements of ACTION a.(1) and (2) are applicable only if drinking water supply is taken from the receiving water body within 3 miles of the plant discharge. In the case of river-sited plants this is 3 miles downstream only.

LIQUID RADWASTE TREATMENT SYSTEM

CONTROLS

3.11.1.3 In accordance with [plant name] TS 6.8.4.g.6), the Liquid Radwaste Treatment System shall be OPERABLE and appropriate portions of the system shall be used to reduce releases of radioactivity when the projected doses due to the liquid effluent, from each unit, to UNRESTRICTED AREAS (see Figure 5.1-3) would exceed 0.06 mrem to the whole body or 0.2 mrem to any organ in a 31-day period.

APPLICABILITY: At all times.

ACTION:

a. With radioactive liquid waste being discharged without treatment and in excess of the above limits and any portion of the Liquid Radwaste Treatment System not in operation, prepare and submit to the Commission within 30 days, pursuant to Control 6.9.2, a Special Report that includes the following information:

   1. Explanation of why liquid radwaste was being discharged without treatment, identification of any inoperable equipment or subsystems, and the reason for the inoperability,

   2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

   3. Summary description of action(s) taken to prevent a recurrence.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.11.1.3.1 Doses due to liquid releases from each unit to UNRESTRICTED AREAS shall be projected at least once per 31 days in accordance with the methodology and parameters in the ODCM when Liquid Radwaste Treatment Systems are not being fully utilized.

4.11.1.3.2 The installed Liquid Radwaste Treatment System shall be considered OPERABLE by meeting Controls 3.11.1.1 and 3.11.1.2.

RADIOACTIVE EFFLUENTS

3/4.11.1.4 (NOT USED)

RADIOACTIVE EFFLUENTS

3/4.11.2 GASEOUS EFFLUENTS

DOSE RATE

CONTROLS

3.11.2.1 In accordance with [plant name] TS 6.8.4.g.3) and 7), the dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY (see Figure 5.1-3) shall be limited to the following:

a. For noble gases: Less than or equal to 500 mrems/yr to the whole body and less than or equal to 3000 mrems/yr to the skin, and

b. For Iodine-131, for Iodine-133, for tritium, and for all radionuclides in particulate form with half-lives greater than 8 days: Less than or equal to 1500 mrems/yr to any organ.

APPLICABILITY: At all times.

ACTION:

a. With the dose rate(s) exceeding the above limits, immediately restore the release rate to within the above limit(s).

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.11.2.1.1 The dose rate due to noble gases in gaseous effluents shall be determined to be within the above limits in accordance with the methodology and parameters in the ODCM.

4.11.2.1.2 The dose rate due to Iodine-131, Iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents shall be determined to be within the above limits in accordance with the methodology and parameters in the ODCM by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Table 4.11-2.

TABLE 4.11-2

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

GASEOUS RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD)(1) (μCi/ml)
1. Offgas Treatment System	M Grab Sample	M	Principal Gamma Emitters(2)	1×10^{-4}
2. Containment PURGE OR VENT	P Each PURGE(3) Grab Sample	P Each PURGE(3)	Principal Gamma Emitters(2)	1×10^{-4}
		M	H-3 (oxide)	1×10^{-6}
3. a. (List other release points where gaseous effluents are released from the facility)	M(3),(5) Grab Sample	M(3)	Principal Gamma Emitters(2)	1×10^{-4}
			H-3 (oxide)	1×10^{-6}
4. All Release Types as listed in 1., 2., and 3. above	Continuous(6)	W(7) Charcoal Sample	I-131	1×10^{-12}
	Continuous(6)	W(7) Particulate Sample	Principal Gamma Emitters(2)	1×10^{-11}
	Continuous(6)	M Composite Particulate Sample	Gross Alpha	1×10^{-11}
	Continuous(6)	Q Composite Particulate Sample	Sr-89, Sr-90	1×10^{-11}
	Continuous(6)	Noble Gas Monitor	Noble Gases Gross Beta or Gamma	1×10^{-6}

TABLE 4.11-2 (Continued)

TABLE NOTATIONS

(1)The LLD is defined, for purposes of these controls, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$\text{LLD} = \frac{4.66\ s_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot \exp(-\lambda \Delta t)}$$

Where:

LLD = the "a priori" lower limit of detection (microCurie per unit mass or volume),

s_b = the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (counts per minute),

E = the counting efficiency (counts per disintegration),

V = the sample size (units of mass or volume),

2.22×10^6 = the number of disintegrations per minute per microCurie,

Y = the fractional radiochemical yield, when applicable,

λ = the radioactive decay constant for the particular radionuclide (sec^{-1}), and

Δt = the elapsed time between the midpoint of sample collection and the time of counting (sec).

Typical values of E, V, Y, and Δt should be used in the calculation.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

TABLE 4.11-2 (Continued)

TABLE NOTATIONS (Continued)

(2) The principal gamma emitters for which the LLD control applies include the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 in noble gas releases and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, I-131, Cs-134, Cs-137, Ce-141 and Ce-144 in Iodine and particulate releases. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Semiannual Radioactive Effluent Release Report pursuant to Control 6.9.1.4 in the format outlined in Regulatory Guide 1.21, Appendix B, Revision 1, June 1974.

(3) Sampling and analysis shall also be performed following shutdown, startup, or a THERMAL POWER change exceeding 15% of RATED THERMAL POWER within a 1-hour period.

(4) Not applicable.

(5) Tritium grab samples shall be taken at least once per 7 days from the ventilation exhaust from the spent fuel pool area, whenever spent fuel is in the spent fuel pool.

(6) The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with Controls 3.11.2.1, 3.11.2.2, and 3.11.2.3.

(7) Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing, or after removal from sampler. Sampling shall also be performed at least once per 24 hours for at least 7 days following each shutdown, startup, or THERMAL POWER change exceeding 15% of RATED THERMAL POWER within a 1-hour period and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. This requirement does not apply if: (1) analysis shows that the DOSE EQUIVALENT I-131 concentration in the reactor coolant has not increased more than a factor of 3; and (2) the noble gas monitor shows that effluent activity has not increased more than a factor of 3.

RADIOACTIVE EFFLUENTS

DOSE - NOBLE GASES

CONTROLS

3.11.2.2 In accordance with [plant name] TS 6.8.4.g.5) and 8), the air dose due to noble gases released in gaseous effluents, from each unit, to areas at and beyond the SITE BOUNDARY (see Figure 5.1-3) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 5 mrads for gamma radiation and less than or equal to 10 mrads for beta radiation, and

b. During any calendar year: Less than or equal to 10 mrads for gamma radiation and less than or equal to 20 mrads for beta radiation.

APPLICABILITY: At all times.

ACTION

a. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, pursuant to Control 6.9.2, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.11.2.2 Cumulative dose contributions for the current calendar quarter and current calendar year for noble gases shall be determined in accordance with the methodology and parameters in the ODCM at least once per 31 days.

DOSE - IODINE-131, IODINE-133, TRITIUM, AND RADIOACTIVE MATERIAL IN PARTICULATE FORM

CONTROLS

3.11.2.3 In accordance with [plant name] TS 6.8.4.g.5) and 9), the dose to a MEMBER OF THE PUBLIC from Iodine-131, Iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released, from each unit, to areas at and beyond the SITE BOUNDARY (see Figure 5.1-3) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 7.5 mrems to any organ and,

b. During any calendar year: Less than or equal to 15 mrems to any organ.

APPLICABILITY: At all times.

ACTION:

a. With the calculated dose from the release of Iodine-131, Iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, pursuant to Control 6.9.2, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.11.2.3 Cumulative dose contributions for the current calendar quarter and current calendar year for Iodine-131, Iodine-133, tritium and radionuclides in particulate form with half-lives greater than 8 days shall be determined in accordance with the methodology and parameters in the ODCM at least once per 31 days.

RADIOACTIVE EFFLUENTS

GASEOUS RADWASTE TREATMENT SYSTEM

CONTROLS

3.11.2.4 The GASEOUS RADWASTE TREATMENT SYSTEM shall be in operation.

APPLICABILITY: Whenever the main condenser air ejector (evacuation) system is in operation.

ACTION:

a. With gaseous radwaste from the main condenser air ejector system being discharged without treatment for more than 7 days, prepare and submit to the Commission within 30 days, pursuant to Control 6.9.2, a Special Report that includes the following information:

    1. Identification of the inoperable equipment or subsystems and the reason for inoperability,

    2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

    3. Summary description of action(s) taken to prevent a recurrence.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.11.2.4 The readings of the relevant instruments shall be checked every 12 hours when the main condenser air ejector is in use to ensure that the gaseous radwaste treatment system is functioning.

VENTILATION EXHAUST TREATMENT SYSTEM

CONTROLS

3.11.2.5 The VENTILATION EXHAUST TREATMENT SYSTEM shall be OPERABLE and appropriate portions of this system shall be used to reduce releases of radioactivity when the projected doses in 31 days due to gaseous effluent releases, from each unit, to areas at and beyond the SITE BOUNDARY (see Figure 5.1-3) would exceed:

a. 0.2 mrad to air from gamma radiation, or

b. 0.4 mrad to air from beta radiation, or

c. 0.3 mrem to any organ of a MEMBER OF THE PUBLIC.

APPLICABILITY: At all times.

ACTION:

a. With radioactive gaseous waste being discharged without treatment and in excess of the above limits, prepare and submit to the Commission within 30 days, pursuant to Control 6.9.2, a Special Report that includes the following information:

   1. Identification of any inoperable equipment or subsystems, and the reason for the inoperability,

   2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

   3. Summary description of action(s) taken to prevent a recurrence.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.11.2.5.1 Doses due to gaseous releases from each unit to areas at and beyond the SITE BOUNDARY shall be projected at least once per 31 days in accordance with the methodology and parameters in the ODCM when the Ventilation Exhaust Treatment System is not being fully utilized.

4.11.2.5.2 The installed VENTILATION EXHAUST TREATMENT SYSTEM shall be considered OPERABLE by meeting Controls 3.11.2.1, and either 3.11.2.2 or 3.11.2.3.

RADIOACTIVE EFFLUENTS

3/4.11.2.6 (NOT USED)

RADIOACTIVE EFFLUENTS

3/4.11.2.7 (NOT USED)

CONTROLS

3.11.2.8 VENTING or PURGING of the Mark I or II containment drywell shall be through the Standby Gas Treatment System.

APPLICABILITY: Whenever the drywell is vented or purged.

ACTION:

a. With the requirements of the above control not satisfied, suspend all VENTING and PURGING of the drywell.

b. The provisions of controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.11.2.8 The containment drywell shall be determined to be aligned for VENTING or PURGING through the Standby Gas Treatment System within 4 hours prior to start of and at least once per 12 hours during VENTING or PURGING of the drywell.

RADIOACTIVE EFFLUENTS

3/4.11.3 (NOT USED)

3/4.11.4 TOTAL DOSE

CONTROLS

3.11.4 In accordance with [plant name] TS 6.8.4.g.11), the annual (calendar year) dose or dose commitment to any MEMBER OF THE PUBLIC due to releases of radioactivity and to radiation from uranium fuel cycle sources shall be limited to less than or equal to 25 mrems to the whole body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems.

APPLICABILITY: At all times.

ACTION:

a. With the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Control 3.11.1.2a., 3.11.1.2b., 3.11.2.2a., 3.11.2.2b., 3.11.2.3a., or 3.11.2.3b., calculations shall be made including direct radiation contributions from the units (including outside storage tanks etc.) to determine whether the above limits of Control 3.11.4 have been exceeded. If such is the case, prepare and submit to the Commission within 30 days, pursuant to Control 6.9.2, a Special Report that defines the corrective action to be taken to reduce subsequent releases to prevent recurrence of exceeding the above limits and includes the schedule for achieving conformance with the above limits. This Special Report, as defined in 10 CFR 20.405(c), shall include an analysis that estimates the radiation exposure (dose) to a MEMBER OF THE PUBLIC from uranium fuel cycle sources, including all effluent pathways and direct radiation, for the calendar year that includes the release(s) covered by this report. It shall also describe levels of radiation and concentrations of radioactive material involved, and the cause of the exposure levels or concentrations. If the estimated dose(s) exceeds the above limits, and if the release condition resulting in violation of 40 CFR Part 190 has not already been corrected, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR Part 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.11.4.1 Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with Controls 4.11.1.2, 4.11.2.2, and 4.11.2.3, and in accordance with the methodology and parameters in the ODCM.

4.11.4.2 Cumulative dose contributions from direct radiation from the units (including outside storage tanks etc.) shall be determined in accordance with the methodology and parameters in the ODCM. This requirement is applicable only under conditions set forth in ACTION a. of Control 3.11.4.

3/4.12 RADIOLOGICAL ENVIRONMENTAL MONITORING

3/4.12.1 MONITORING PROGRAM

CONTROLS

3.12.1 In accordance with [plant name] TS 6.8.4.h.1), the Radiological Environmental Monitoring Program shall be conducted as specified in Table 3.12-1.

APPLICABILITY: At all times.

ACTION:

a. With the Radiological Environmental Monitoring Program not being conducted as specified in Table 3.12-1, prepare and submit to the Commission, in the Annual Radiological Environmental Operating Report required by Control 6.9.1.3, a description of the reasons for not conducting the program as required and the plans for preventing a recurrence.

b. With the level of radioactivity as the result of plant effluents in an environmental sampling medium at a specified location exceeding the reporting levels of Table 3.12-2 when averaged over any calendar quarter, prepare and submit to the Commission within 30 days, pursuant to Control 6.9.2, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce radioactive effluents so that the potential annual dose* to a MEMBER OF THE PUBLIC is less than the calendar year limits of Controls 3.11.1.2, 3.11.2.2, or 3.11.2.3. When more than one of the radionuclides in Table 3.12-2 are detected in the sampling medium, this report shall be submitted if:

$$\frac{\text{concentration (1)}}{\text{reporting level (1)}} + \frac{\text{concentration (2)}}{\text{reporting level (2)}} + \ldots \geq 1.0$$

When radionuclides other than those in Table 3.12-2 are detected and are the result of plant effluents, this report shall be submitted if the potential annual dose* to a MEMBER OF THE PUBLIC from all radionuclides is equal to or greater than the calendar year limits of Control 3.11.1.2, 3.11.2.2, or 3.11.2.3. This report is not required if the measured level of radioactivity was not the result of plant effluents; however, in such an event, the condition shall be reported and described in the Annual Radiological Environmental Operating Report required by Control 6.9.1.3.

*The methodology and parameters used to estimate the potential annual dose to a MEMBER OF THE PUBLIC shall be indicated in this report.

ACTION (Continued)

c. With milk or fresh leafy vegetation samples unavailable from one or more of the sample locations required by Table 3.12-1, identify specific locations for obtaining replacement samples and add them within 30 days to the Radiological Environmental Monitoring Program given in the ODCM. The specific locations from which samples were unavailable may then be deleted from the monitoring program. Pursuant to Control 6.14, submit in the next Semiannual Radioactive Effluent Release Report documentation for a change in the ODCM including a revised figure(s) and table for the ODCM reflecting the new location(s) with supporting information identifying the cause of the unavailability of samples and justifying the selection of the new location(s) for obtaining samples.

d. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.12.1 The radiological environmental monitoring samples shall be collected pursuant to Table 3.12-1 from the specific locations given in the table and figure(s) in the ODCM, and shall be analyzed pursuant to the requirements of Table 3.12-1 and the detection capabilities required by Table 4.12-1.

TABLE 3.12-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM*

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS[1]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
1. Direct Radiation[2]	Forty routine monitoring stations (DR1-DR40) either with two or more dosimeters or with one instrument for measuring and recording dose rate continuously, placed as follows: An inner ring of stations, one in each meteorological sector in the general area of the SITE BOUNDARY (DR1-DR16); An outer ring of stations, one in each meteorological sector in the 6- to 8-km range from the site (DR17-DR32); and The balance of the stations (DR33-DR40) to be placed in special interest areas such as population centers, nearby residences, schools, and in one or two areas to serve as control stations.	Quarterly.	Gamma dose quarterly.

*The number, media, frequency, and location of samples may vary from site to site. This table presents an acceptable minimum program for a site at which each entry is applicable. Local site characteristics must be examined to determine if pathways not covered by this table may significantly contribute to an individual's dose and should be included in the sample program. The code letters in parentheses, e.g., DR1, A1, provide one way of defining sample locations in this control that can be used to identify the specific locations in the map(s) and table in the ODCM.

TABLE 3.12-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS(1)	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
2. Airborne			
Radioiodine and Particulates	Samples from five locations (A1-A5): Three samples (A1-A3) from close to the three SITE BOUNDARY locations, in different sectors, of the highest calculated annual average ground-level D/Q; One sample (A4) from the vicinity of a community having the highest calculated annual average ground-level D/Q; and One sample (A5) from a control location, as for example 15 to 30 km distant and in the least prevalent wind direction.	Continuous sampler operation with sample collection weekly, or more frequently if required by dust loading.	Radioiodine Cannister: I-131 analysis weekly. Particulate Sampler: Gross beta radioactivity analysis following filter change;(3) and gamma isotopic analysis(4) of composite (by location) quarterly.
3. Waterborne			
a. Surface(5)	One sample upstream (Wa1). One sample downstream (Wa2).	Composite sample over 1-month period.(6)	Gamma isotopic analysis(4) monthly. Composite for tritium analysis quarterly.
b. Ground	Samples from one or two sources (Wb1, Wb2), only if likely to be affected(7).	Quarterly.	Gamma isotopic(4) and tritium analysis quarterly

TABLE 3.12-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS(1)	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
3. Waterborne (Continued)			
c. Drinking	One sample of each of one to three (Wc1 - Wc3) of the nearest water supplies that could be affected by its discharge. One sample from a control location (Wc4).	Composite sample over 2-week period(6) when I-131 analysis is performed; monthly composite otherwise.	I-131 analysis on each composite when the dose calculated for the consumption of the water is greater than 1 mrem per year(8). Composite for gross beta and gamma isotopic analyses(4) monthly. Composite for tritium analysis quarterly.
d. Sediment from Shoreline	One sample from downstream area with existing or potential recreational value (Wd1).	Semiannually.	Gamma isotopic analysis(4) semiannually.
4. Ingestion			
a. Milk	Samples from milking animals in three locations (Ia1 - Ia3) within 5 km distance having the highest dose potential. If there are none, then one sample from milking animals in each of three areas (Ia1 - Ia3) between 5 to 8 km distant where doses are calculated to be greater than 1 mrem per yr.(8) One sample from milking animals at a control location (Ia4), 15 to 30 km distant and in the least prevalent wind direction.	Semimonthly when animals are on pasture; monthly at other times.	Gamma isotopic(4) and I-131 analysis semimonthly when animals are on pasture; monthly at other times.

TABLE 3.12-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS[1]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
4. Ingestion (Continued)			
b. Fish and Invertebrates	One sample of each commercially and recreationally important species in vicinity of plant discharge area. (Ib1 - Ib__).	Sample in season, or semiannually if they are not seasonal.	Gamma isotopic analysis[4] on edible portions.
	One sample of same species in areas not influenced by plant discharge (Ib10 - Ib__).		
c. Food Products	One sample of each principal class of food products from any area that is irrigated by water in which liquid plant wastes have been discharged (Ic1 - Ic__).	At time of harvest[9].	Gamma isotopic analyses[4] on edible portion.
	Samples of three different kinds of broad leaf vegetation grown nearest each of two different offsite locations of highest predicted annual average ground level D/Q if milk sampling is not performed (Ic10 - Ic13).	Monthly during growing season.	Gamma isotopic[4] and I-131 analysis.
	One sample of each of the similar broad leaf vegetation grown 15 to 30 km distant in the least prevalent wind direction if milk sampling is not performed (Ic20 - Ic23).	Monthly during growing season.	Gamma isotopic[4] and I-131 analysis.

TABLE 3.12-1 (Continued)

TABLE NOTATIONS

(1) Specific parameters of distance and direction sector from the centerline of one reactor, and additional description where pertinent, shall be provided for each and every sample location in Table 3.12-1 in a table and figure(s) in the ODCM. Refer to NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," October 1978, and to Radiological Assessment Branch Technical Position, Revision 1, November 1979. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to circumstances such as hazardous conditions, seasonal unavailability, and malfunction of automatic sampling equipment. If specimens are unobtainable due to sampling equipment malfunction, effort shall be made to complete corrective action prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented in the Annual Radiological Environmental Operating Report pursuant to Control 6.9.1.3. It is recognized that, at times, it may not be possible or practicable to continue to obtain samples of the media of choice at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the Radiological Environmental Monitoring Program given in the ODCM. Pursuant to Control 6.14, submit in the next Semiannual Radioactive Effluent Release Report documentation for a change in the ODCM including a revised figure(s) and table for the ODCM reflecting the new location(s) with supporting information identifying the cause of the unavailability of samples for the pathway and justifying the selection of the new location(s) for obtaining samples.

(2) One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. For the purposes of this table, a thermoluminescent dosimeter (TLD) is considered to be one phosphor; two or more phosphors in a packet are considered as two or more dosimeters. Film badges shall not be used as dosimeters for measuring direct radiation. (The 40 stations is not an absolute number. The number of direct radiation monitoring stations may be reduced according to geographical limitations; e.g., at an ocean site, some sectors will be over water so that the number of dosimeters may be reduced accordingly. The frequency of analysis or readout for TLD systems will depend upon the characteristics of the specific system used and should be selected to obtain optimum dose information with minimal fading.)

(3) Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than 10 times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.

TABLE 3.12-1 (Continued)

TABLE NOTATIONS (Continued)

(4) Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.

(5) The "upstream sample" shall be taken at a distance beyond significant influence of the discharge. The "downstream" sample shall be taken in an area beyond but near the mixing zone. "Upstream" samples in an estuary must be taken far enough upstream to be beyond the plant influence. Salt water shall be sampled only when the receiving water is utilized for recreational activities.

(6) A composite sample is one in which the quantity (aliquot) of liquid sampled is proportional to the quantity of flowing liquid and in which the method of sampling employed results in a specimen that is representative of the liquid flow. In this program composite sample aliquots shall be collected at time intervals that are very short (e.g., hourly) relative to the compositing period (e.g., monthly) in order to assure obtaining a representative sample.

(7) Groundwater samples shall be taken when this source is tapped for drinking or irrigation purposes in areas where the hydraulic gradient or recharge properties are suitable for contamination.

(8) The dose shall be calculated for the maximum organ and age group, using the methodology and parameters in the ODCM.

(9) If harvest occurs more than once a year, sampling shall be performed during each discrete harvest. If harvest occurs continuously, sampling shall be monthly. Attention shall be paid to including samples of tuberous and root food products.

TABLE 3.12-2

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

REPORTING LEVELS

ANALYSIS	WATER (pCi/l)	AIRBORNE PARTICULATE OR GASES (pCi/m^3)	FISH (pCi/kg, wet)	MILK (pCi/l)	FOOD PRODUCTS (pCi/kg, wet)
H-3	20,000*				
Mn-54	1,000		30,000		
Fe-59	400		10,000		
Co-58	1,000		30,000		
Co-60	300		10,000		
Zn-65	300		20,000		
Zr-Nb-95	400				
I-131	2**	0.9		3	100
Cs-134	30	10	1,000	60	1,000
Cs-137	50	20	2,000	70	2,000
Ba-La-140	200			300	

*For drinking water samples. This is 40 CFR Part 141 value. If no drinking water pathway exists, a value of 30,000 pCi/l may be used.

**If no drinking water pathway exists, a value of 20 pCi/l may be used.

TABLE 4.12-1

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS(1) (2)

LOWER LIMIT OF DETECTION (LLD)(3)

ANALYSIS	WATER (pCi/l)	AIRBORNE PARTICULATE OR GASES (pCi/m^3)	FISH (pCi/kg, wet)	MILK (pCi/l)	FOOD PRODUCTS (pCi/kg, wet)	SEDIMENT (pCi/kg, dry)
Gross Beta	4	0.01				
H-3	2000*					
Mn-54	15		130			
Fe-59	30		260			
Co-58,60	15		130			
Zn-65	30		260			
Zr-Nb-95	15					
I-131	1**	0.07		1	60	
Cs-134	15	0.05	130	15	60	150
Cs-137	18	0.06	150	18	80	180
Ba-La-140	15			15		

*If no drinking water pathway exists, a value of 3000 pCi/l may be used.

**If no drinking water pathway exists, a value of 15 pCi/l may be used.

TABLE 4.12-1 (Continued)

TABLE NOTATIONS

(1)This list does not mean that only these nuclides are to be considered. Other peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Annual Radiological Environmental Operating Report pursuant to Control 6.9.1.3.

(2)Required detection capabilities for thermoluminescent dosimeters used for environmental measurements shall be in accordance with the recommendations of Regulatory Guide 4.13.

(3)The LLD is defined, for purposes of these controls, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66\ s_b}{E \cdot V \cdot 2.22 \cdot Y \cdot \exp(-\lambda \Delta t)}$$

Where:

LLD = the "a priori" lower limit of detection (picoCuries per unit mass or volume),

s_b = the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (counts per minute),

E = the counting efficiency (counts per disintegration),

V = the sample size (units of mass or volume),

2.22 = the number of disintegrations per minute per picoCurie,

Y = the fractional radiochemical yield, when applicable,

λ = the radioactive decay constant for the particular radionuclide (sec^{-1}), and

Δt = the elapsed time between environmental collection, or end of the sample collection period, and time of counting (sec).

Typical values of E, V, Y, and Δt should be used in the calculation.

TABLE 4.12-1 (Continued)

TABLE NOTATIONS (Continued)

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement. Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidable small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors shall be identified and described in the Annual Radiological Environmental Operating Report pursuant to Control 6.9.1.3.

3/4.12.2 LAND USE CENSUS

CONTROLS

3.12.2 In accordance with [plant name] TS 6.8.4.h.2), a Land Use Census shall be conducted and shall identify within a distance of 8 km (5 miles) the location in each of the 16 meteorological sectors of the nearest milk animal, the nearest residence, and the nearest garden* of greater than 50 m^2 (500 ft^2) producing broad leaf vegetation. [For elevated releases as defined in Regulatory Guide 1.111, Revision 1, July 1977, the Land Use Census shall also identify within a distance of 5 km (3 miles) the locations in each of the 16 meteorological sectors of all milk animals and all gardens of greater than 50 m^2 producing broad leaf vegetation.]

APPLICABILITY: At all times.

ACTION:

a. With a Land Use Census identifying a location(s) that yields a calculated dose or dose commitment greater than the values currently being calculated in Control 4.11.2.3, pursuant to Control 6.9.1.4, identify the new location(s) in the next Semiannual Radioactive Effluent Release Report.

b. With a Land Use Census identifying a location(s) that yields a calculated dose or dose commitment (via the same exposure pathway) 20% greater than at a location from which samples are currently being obtained in accordance with Control 3.12.1, add the new location(s) within 30 days to the Radiological Environmental Monitoring Program given in the ODCM. The sampling location(s), excluding the control station location, having the lowest calculated dose or dose commitment(s), via the same exposure pathway, may be deleted from this monitoring program after [October 31] of the year in which this Land Use Census was conducted. Pursuant to Control 6.14, submit in the next Semiannual Radioactive Effluent Release Report documentation for a change in the ODCM including a revised figure(s) and table(s) for the ODCM reflecting the new location(s) with information supporting the change in sampling locations.

c. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

*Broad leaf vegetation sampling of at least three different kinds of vegetation may be performed at the SITE BOUNDARY in each of two different direction sectors with the highest predicted D/Qs in lieu of the garden census. Controls for broad leaf vegetation sampling in Table 3.12-1, Part 4.c., shall be followed, including analysis of control samples.

SURVEILLANCE REQUIREMENTS

4.12.2 The Land Use Census shall be conducted during the growing season at least once per 12 months using that information that will provide the best results, such as by a door-to-door survey, aerial survey, or by consulting local agriculture authorities. The results of the Land Use Census shall be included in the Annual Radiological Environmental Operating Report pursuant to Control 6.9.1.3.

3/4.12.3 INTERLABORATORY COMPARISON PROGRAM

CONTROLS

3.12.3 In accordance with [plant name] TS 6.8.4.h.3), analyses shall be performed on all radioactive materials, supplied as part of an Interlaboratory Comparison Program that has been approved by the Commission, that correspond to samples required by Table 3.12-1.

APPLICABILITY: At all times.

ACTION:

a. With analyses not being performed as required above, report the corrective actions taken to prevent a recurrence to the Commission in the Annual Radiological Environmental Operating Report pursuant to Control 6.9.1.3.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.12.3 The Interlaboratory Comparison Program shall be described in the ODCM. A summary of the results obtained as part of the above required Interlaboratory Comparison Program shall be included in the Annual Radiological Environmental Operating Report pursuant to Control 6.9.1.3.

BASES FOR

SECTIONS 3.0 AND 4.0

CONTROLS

AND

SURVEILLANCE REQUIREMENTS

NOTE

The BASES contained in succeeding pages summarize the reasons for the Controls in Sections 3.0 and 4.0, but are not part of these Controls.

3/4.3.3.10 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

3/4.3.3.11 RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

3/4.11.1 LIQUID EFFLUENTS

3/4.11.1.1 CONCENTRATION

This control is provided to ensure that the concentration of radioactive materials released in liquid waste effluents to UNRESTRICTED AREAS will be less than the concentration levels specified in 10 CFR Part 20, Appendix B, Table II, Column 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water in UNRESTRICTED AREAS will result in exposures within: (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC, and (2) the limits of 10 CFR Part 20.106(e) to the population. The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

This control applies to the release of radioactive materials in liquid effluents from all units at the site.

The required detection capabilities for radioactive materials in liquid waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD, and other detection limits can be found in Currie, L. A., "Lower Limit of Detection: Definition and Elaboration of a Proposed Position for Radiological Effluent and Environmental Measurements," NUREG/CR-4007 (September 1984), and in the HASL Procedures Manual, HASL-300.

3/4.11.1.2 DOSE

This control is provided to implement the requirements of Sections II.A, III.A, and IV.A of Appendix I, 10 CFR Part 50. The Control implements the guides set forth in Section II.A of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." Also, for fresh water sites with drinking water supplies that can be potentially affected by plant operations, there is reasonable assurance that the operation of the facility will not result in radionuclide concentrations in the finished drinking water that are in excess of the requirements of 40 CFR Part 141. The dose calculation methodology and parameters in the ODCM implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of

DOSE (Continued)

Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

This control applies to the release of radioactive materials in liquid effluents from each unit at the site. For units with shared Radwaste Systems, the liquid effluents from the shared system are to be proportioned among the units sharing that system.

3/4.11.1.3 LIQUID RADWASTE TREATMENT SYSTEM

The OPERABILITY of the Liquid Radwaste Treatment System ensures that this system will be available for use whenever liquid effluents require treatment prior to release to the environment. The requirement that the appropriate portions of this system be used when specified provides assurance that the releases of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable." This control implements the requirements of 10 CFR 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50 and the design objective given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the Liquid Radwaste Treatment System were specified as a suitable fraction of the dose design objectives set forth in Section II.A of Appendix I, 10 CFR Part 50 for liquid effluents.

This control applies to the release of radioactive materials in liquid effluents from each unit at the site. For units with shared Radwaste Systems, the liquid effluents from the shared system are to be proportioned among the units sharing that system.

3/4.11.2 GASEOUS EFFLUENTS

3/4.11.2.1 DOSE RATE

This control is provided to ensure that the dose at any time at and beyond the SITE BOUNDARY from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 to UNRESTRICTED AREAS. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 20, Appendix B, Table II, Column I. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of a MEMBER OF THE PUBLIC in an UNRESTRICTED AREA, either within or outside the SITE BOUNDARY, to annual average concentrations exceeding the limits specified in Appendix B, Table II of 10 CFR Part 20 (10 CFR Part 20.106(b)). For MEMBERS OF THE PUBLIC who may at times be within the SITE BOUNDARY, the occupancy of that MEMBER OF THE PUBLIC will usually be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the SITE BOUNDARY. Examples of calculations for such MEMBERS OF THE PUBLIC, with the appropriate occupancy factors, shall be given in the ODCM. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to a MEMBER OF THE PUBLIC at or beyond the SITE BOUNDARY to less than or equal to 500 mrems/year to the whole body or to less than or equal to 3000 mrems/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrems/year.

This control applies to the release of radioactive materials in gaseous effluents from all units at the site.

The required detection capabilities for radioactive material in gaseous waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD, and other detection limits can be found in Currie, L. A., "Lower Limit of Detection: Definition and Elaboration of a Proposed Position for Radiological Effluent and Environmental Measurements," NUREG/CR-4007 (September 1984), and in the HASL Procedures Manual, HASL-300.

3/4.11.2.2 DOSE - NOBLE GASES

This control is provided to implement the requirements of Sections II.B, III.A and IV.A of Appendix I, 10 CFR Part 50. The control implements the guides set forth in Section I.B of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The Surveillance Requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The dose calculation

DOSE-NOBLE GASES (Continued)

methodology and parameters established in the ODCM for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision I, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors," Revision 1, July 1977. The ODCM equations provided for determining the air doses at and beyond the SITE BOUNDARY are based upon the historical average atmospheric conditions.

This control applies to the release of radioactive materials in gaseous effluents from each unit at the site. For units with shared Radwaste Treatment Systems, the gaseous effluents from the shared system are proportioned among the units sharing that system.

3/4.11.2.3 DOSE - IODINE-131, IODINE-133, TRITIUM, AND RADIOACTIVE MATERIAL IN PARTICULATE FORM

This control is provided to implement the requirements of Sections II.C, III.A and IV.A of Appendix I, 10 CFR Part 50. The Controls are the guides set forth in Section II.C of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The ODCM calculational methods specified in the Surveillance Requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The ODCM calculational methodology and parameters for calculating the doses due to the actual release rates of the subject materials are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," Revision 1, July 1977. These equations also provide for determining the actual doses based upon the historical average atmospheric conditions. The release rate controls for Iodine-131 Iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days are dependent upon the existing radionuclide pathways to man in the

DOSE - IODINE-131, IODINE-133, TRITIUM, AND RADIOACTIVE MATERIAL IN PARTICULATE FORM (Continued)

areas at and beyond the SITE BOUNDARY. The pathways that were examined in the development of the calculations were: (1) individual inhalation of airborne radionuclides, (2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, (3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and (4) deposition on the ground with subsequent exposure of man.

This control applies to the release of radioactive materials in gaseous effluents from each unit at the site. For units with shared Radwaste Treatment Systems, the gaseous effluents from the shared system are proportioned among the units sharing that system.

3/4.11.2.4 AND 3/4.11.2.5 GASEOUS RADWASTE TREATMENT SYSTEM AND VENTILATION EXHAUST TREATMENT SYSTEM

The OPERABILITY of the WASTE GAS HOLDUP SYSTEM and the VENTILATION EXHAUST TREATMENT SYSTEM ensures that the systems will be available for use whenever gaseous effluents require treatment prior to release to the environment. The requirement that the appropriate portions of these systems be used, when specified, provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." This control implements the requirements of 10 CFR 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50 and the design objectives given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the dose design objectives set forth in Sections II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents.

This control applies to the release of radioactive materials in gaseous effluents from each unit at the site. For units with shared Radwaste Treatment Systems, the gaseous effluents from the shared system are proportioned among the units sharing that system.

3/4 11.2.6 NOT USED

3/4 11.2.7 NOT USED

3/4.11.2.8 MARK I CONTAINMENT

This specification provides reasonable assurance that releases from drywell purging operations will not exceed the annual dose limits of 10 CFR part 20 for unrestricted areas.

3/4.11.3 NOT USED

3/4.11.4 TOTAL DOSE

This control is provided to meet the dose limitations of 10 CFR Part 190 that have been incorporated into 10 CFR Part 20 by 46 FR 18525. The control requires the preparation and submittal of a Special Report whenever the calculated doses due to releases of radioactivity and to radiation from uranium fuel cycle sources exceed 25 mrems to the whole body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems. For sites containing up to four reactors, it is highly unlikely that the resultant dose to a MEMBER OF THE PUBLIC will exceed the dose limits of 40 CFR Part 190 if the individual reactors remain within twice the dose design objectives of Appendix I, and if direct radiation doses from the units

TOTAL DOSE (Continued)

(including outside storage tanks, etc.) are kept small. The Special Report will describe a course of action that should result in the limitation of the annual dose to a MEMBER OF THE PUBLIC to within the 40 CFR Part 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the MEMBER of the PUBLIC from other uranium fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 8 km must be considered. If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40 CFR Part 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR Part 190 have not already been corrected), in accordance with the provisions of 40 CFR 190.11 and 10 CFR 20.405c, is considered to be a timely request and fulfills the requirements of 40 CFR Part 190 until NRC staff action is completed. The variance only relates to the limits of 40 CFR Part 190, and does not apply in any way to the other requirements for dose limitation of 10 CFR Part 20, as addressed in Controls 3.11.1.1 and 3.11.2.1. An individual is not considered a MEMBER OF THE PUBLIC during any period in which he/she is engaged in carrying out any operation that is part of the nuclear fuel cycle.

BASES

3/4.12.1 MONITORING PROGRAM

The Radiological Environmental Monitoring Program required by this control provides representative measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposure of MEMBERS OF THE PUBLIC resulting from the plant operation. This monitoring program implements Section IV.B.2 of Appendix I to 10 CFR Part 50 and thereby supplements the Radiological Effluent Monitoring Program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and the modeling of the environmental exposure pathways. Guidance for this monitoring program is provided by the Radiological Assessment Branch Technical Position on Environmental Monitoring, Revision 1, November 1979. The initially specified monitoring program will be effective for at least the first 3 years of commercial operation. Following this period, program changes may be initiated based on operational experience.

The required detection capabilities for environmental sample analyses are tabulated in terms of the lower limits of detection (LLDs). The LLDs required by Table 4.12-1 are considered optimum for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as an _a priori_ (before the fact) limit representing the capability of a measurement system and not as an _a posteriori_ (after the fact) limit for a particular measurement.

Detailed discussion of the LLD, and other detection limits, can be found in Currie, L. A., "Lower Limit of Detection: Definition and Elaboration of a Proposed Position for Radiological Effluent and Environmental Measurements," NUREG/CR-4007 (September 1984), and in the HASL Procedures Manual, _HASL-300_.

3/4.12.2 LAND USE CENSUS

This control is provided to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the Radiological Environmental Monitoring Program given in the ODCM are made if required by the results of this census. The best information from the door-to-door survey, from aerial survey or from consulting with local agricultural authorities shall be used. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50. Restricting the census to gardens of greater than 50 m^2 provides assurance that significant exposure pathways via leafy vegetables will be identified and monitored since a garden of this size is the minimum required to produce the quantity (26 kg/year) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, the following assumptions were made: (1) 20% of the garden was used for growing broad leaf vegetation (i.e., similar to lettuce and cabbage), and (2) a vegetation yield of 2 kg/m^2.

3/4.12.3 INTERLABORATORY COMPARISON PROGRAM

The requirement for participation in an approved Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive materials in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring in order to demonstrate that the results are valid for the purposes of Section IV.B.2 of Appendix I to 10 CFR Part 50.

APPENDIX A

Radiological Assessment Branch Technical Position,
Revision 1, November 1979

Branch Technical Position

Background

Regulatory Guide 4.8, Environmental Technical Specifications for Nuclear Power Plants, issued for comment in December 1975, is being revised based on comments received. The Radiological Assessment Branch issued a Branch Position on the radiological portion of the environmental monitoring program in March, 1978. The position was formulated by an NRC working group which considered comments received after the issuance of the Regulatory Guide 4.8. This is Revision 1 of that Branch Position paper. The changes are marked by a vertical line in the right margin. The most significant change is the increase in direct radiation measurement stations.

10 CFR Parts 20 and 50 require that radiological environmental monitoring programs be established to provide data on measurable levels of radiation and radioactive materials in the site environs. In addition, Appendix I to 10 CFR Part 50 requires that the relationship between quantities of radioactive material released in effluents during normal operation, including anticipated operational occurrences, and resultant radiation doses to individuals from principals pathways of exposure be evaluated. These programs should be conducted to verify the effectiveness of in-plant measures used for controlling the release of radioactive materials. Surveillance should be established to identify changes in the use of unrestricted areas (e.g., for agricultrual purposes) to provide a basis for modifications in the monitoring programs for evaluating doses to individuals from principal pathways of exposure. NRC Regulatory Guide 4.1, Rev. 1, "Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants," provides an acceptable basis for the design of programs to monitor levels of radiation and radioactivity in the station environs.

This position sets forth an example of an acceptable minimum radiological monitoring program. Local site characteristics must be examined to determine if pathways not covered by this guide may significantly contribute to an individual's dose and should be included in the sampling program.

AN ACCEPTABLE RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Program Requirements

Environmental samples shall be collected and analyzed according to Table 1 at locations shown in Figure 1.[1] Analytical techniques used shall be such that the detection capabilities in Table 2 are achieved.

The results of the radiological environmental monitoring are intended to supplement the results of the radiological effluent monitoring by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and modeling of the environmental exposure pathways. Thus, the specified environmental monitoring program provides measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides which lead to the highest potential radiation exposures of individuals resulting from the station operation. The initial radiological environmental monitoring program should be conducted for the first three years of commercial operation (or other period corresponding to a maximum burnup in the initial core cycle). Following this period, program changes may be proposed based on operational experience.

The specified detection capabilities are state-of-the-art for routine environmental measurements in industrial laboratories.

Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunction, every effort shall be made to complete corrective action prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented in the annual report.

The laboratories of the licensee and licensee's contractors which perform analyses shall participate in the Environmental Protection Agency's (EPA's) Environmental Radioactivity Laboratory Intercomparisons Studies (Crosscheck) Program or equivalent program. This participation shall include all of the determinations (sample medium-radionuclide combination) that are offered by EPA and that also are included in the monitoring program. The results of analysis of these crosscheck samples shall be included in the annual report. The participants in the EPA crosscheck program may provide their EPA program code so that the NRC can review the EPA's participant data directly in lieu of submission in the annual report.

[1] It may be necessary to require special studies on a case-by-case and site specific basis to establish the relationship between quantities of radioactive material released in effluents, the concentrations in environmental media, and the resultant doses for important pathways.

If the results of a determination in the EPA crosscheck program (or equivalent program) are outside the specified control limits, the laboratory shall investigate the cause of the problem and take steps to correct it. The results of this investigation and corrective action shall be included in the annual report.

The requirement for the participation in the EPA crosscheck program, or similar program, is based on the need for independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices as part of the quality assurance program for environmental monitoring in order to demonstrate that the results are reasonably valid.

A census shall be conducted annually during the growing season to determine the location of the nearest milk animal and nearest garden greater than 50 square meters (500 sq. ft.) producing broad leaf vegetation in each of the 16 meteorological sectors within a distance of 8 km (5 miles).[2] For elevated releases as defined in Regulatory Guide 1.111, Rev. 1., the census shall also identify the locations of all milk animals, and gardens greater than 50 square meters producing broad leaf vegetation out to a distance of 5 km. (3 miles) for each radial sector.

If it is learned from this census that the milk animals or gardens are present at a location which yields a calculated thyroid dose greater than those previously sampled, or if the census results in changes in the location used in the radioactive effluent technical specifications for dose calculations, a written report shall be submitted to the Director of Operating Reactors, NRR (with a copy to the Director of the NRC Regional Office) within 30 days identifying the new location (distance and direction). Milk animal or garden locations resulting in higher calculated doses shall be added to the surveillance program as soon as practicable.

The sampling location (excluding the control sample location) having the lowest calculated dose may then be dropped from the surveillance program at the end of the grazing or growing season during which the census was conducted. Any location from which milk can no longer be obtained may be dropped from the surveillance program after notifying the NRC in writing that they are no longer obtainable at that location. The results of the land-use census shall be reported in the annual report.

The census of milk animals and gardens producing broad leaf vegetation is based on the requirement in Appendix I of 10 CFR Part 50 to "Identify changes in the use of unrestricted areas (e.g., for agricultural purposes) to permit modifications in monitoring programs for evaluating doses to individuals from principal pathways of exposure." The consumption of milk from animals grazing on contaminated pasture and of leafy vegetation contaminated by airborne

[2] Broad leaf vegetation sampling may be performed at the site boundary in a sector with the highest D/Q in lieu of the garden census.

radioiodine is a major potential source of exposure. Samples from milk animals are considered a better indicator of radioiodine in the environment then vegetation. If the census reveals milk animals are not present or are unavailable for sampling, then vegetation must be sampled.

The 50 square meter garden, considering 20% used for growing broad leaf vegetation (i.e., similar to lettuce and cabbage), and a vegetation yield of 2 kg/m^2, will produce the 26 kg/yr assumed in Regulatory Guide 1.109, Rev 1., for child consumption of leafy vegetation. The option to consider the garden to be broad leaf vegetation at the site boundary in a sector with the highest D/Q should be conservative and that location may be used to calculate doses due to radioactive effluent releases in place of the actual locations which would be determined by the census. This option does not apply to plants with elevated releases as defined in Regulatory Guide 1.111, Rev. 1.

The increase in the number of direct radiation stations is to better characterize the individual exposure (mrem) and population exposure (man-rem) in accordance with Criterion 64 - Monitoring radioactivity releases, of 10 CFR Part 50, Appendix A. The NRC will place a similar amount of stations in the area between the two rings designated in Table 1.

NOTE

Guidance on the subjects contained on pages 4 through 16 of the Radiological Assessment Branch Technical Position (RAB-BTP) has been modified and upgraded based on operating experience since Revision 1 was published in 1979. The current staff guidance for the following items has been incorporated in the Section 3/4-12 and Section 6 Controls of NUREG-1301 and 1302.

- Reporting Requirement
- Table 1: Operational Radiological Environmental Monitoring Report
- Table 2: Detection Capabilities for Environmental Sample Analysis
- Table 4: Reporting Levels for Radioactivity Concentrations in Environmental Samples

The following items remain unchanged:

- Footnote to Table 1 on page 10
- Table 3 of page 14
- Figure 1 of page 16

Pages 5, 6, 7, 8, 9, 11, 12, 13, 15

The above pages have been superceded by text and tables in NUREG-1301 and 1302.

TABLE 1 (Continued)

Note: In addition to the above guidance for operational monitoring, the following material is supplied for guidance on preoperational programs.

Preoperational Environmental Surveillance Program

A Preoperational Environmental Surveillance Program should be instituted two years prior to the institution of station plant operation.

The purposes of this program are:

1. To measure background levels and their variations along the anticipated critical pathways in the area surrounding the station.
2. To train personnel
3. To evaluate procedures, equipment and techniques

The elements (sampling media and type of analysis) of both preoperational and operational programs should be essentially the same. The duration of the preoperational program, for specific media, presented in the following table should be followed:

Duration of Preoperational Sampling Program for Specific Media

6 months	1 year	2 years
. airborne iodine	. airborne particulates	. direct radiation
. iodine in milk (while animals are in pasture)	. milk (remaining analyses)	. fish and invertebrates
	. surface water	. food products
	. groundwater	. sediment from shoreline
	. drinking water	

TABLE 3

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM ANNUAL SUMMARY

Name of Facility ______________________ Docket No. ________

Location of Facility ______________________ Reporting Period ________

(County, State)

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[a] (LLD)	All Indicator Locations Mean (f)[b] Range	Location with Highest Annual Mean: Name, Distance & Direction	Location with Highest Annual Mean: Mean (f)[b] Range	Control locations Mean (f)[b] Range	Number of Nonroutine Reported Measurements
Air Particulates (pCi/m^3)	Gross β 416	0.01	0.08(200/312) (0.05-2.0)	Middletown 5 miles 340°	0.10 (5/52) (0.08-2.0)	0.08 (8/104) (0.05-1.40)	1
	γ-Spec. 32						
	^{137}Cs	0.01	0.05 (4/24) (0.03-0.13)	Smithville 2.5 miles 160°	0.08 (2/4) (0.03-2.0)	<LLD	4
	^{131}I	0.07	0.12 (2/24) (0.09-0.18)	Podunk 4.0 miles 270°	0.20 (2/4) (0.10-0.31)	0.02 (2/4)	1
Fish pCi/kg (wet weight)	γ-Spec. 8						
	^{137}Cs	130	<LLD	-	<LLD	90 (1/4)	0
	^{134}Cs	130	<LLD	-	<LLD	<LLD	0
	^{60}Co	130	180 (3/4) (150-225)	River Mile 35	See Column 4	<LLD	0

[a]See Table 2, note b.

[b]Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses. (f)

Note: The example data are provided for illustrative purposes only.

[92]

Figure 1

(This figure shall be of a suitable scale to show the distance and direction of each monitoring station. A key shall be provided to indicate what is sampled at each location.)

APPENDIX B

"Appendix B - General Contents of the Offsite Dose Calculation Manual (ODCM) (Revision 1, February 1979)" to the paper authored by C. A. Willis and F. J. Congel, "Status of NRC Radiological Effluent Technical Specification Activities" presented at the Atomic Industrial Forum Conference on NEPA and Nuclear Regulation, October 4-7, 1981, Washington, D.C.

APPENDIX B

GENERAL CONTENTS OF THE OFFSITE DOSE CALCULATION MANUAL (ODCM*)
(Rev. 1, February 1979)

Section 1 - Set Points

Provide the equations and methodology to be used at the station or unit for each alarm and trip set point on each effluent release point according to the Specifications 3.3.3.8 and 3.3.3.9. The instrumentation for each alarm and trip set point, including radiation monitoring and sampling systems and effluent control features, should be identified by reference to the FSAR (or Final Hazard Summary). This information should be consistent with the recommendations of Section I of Standard Review Plan 11.5, NUREG-75/087, (Revision 1). If the alarm and/or trip set point value is variable, provide the equation to determine the set point value to be used, based on actual release conditions, that will assure that the Specification is met at each release point; and provide the value to be used when releases are not in progress. If dilution or dispersion is used, state the onsite equipment and measurement method used during release, the site related parameters and the set points used to assure that the Specification is met at each release point. The fixed and variable set points should consider the radioactive effluent to have a radionuclide distribution represented by normal and anticipated operational occurrences.

Section 2 - Liquid Effluent Concentration

Provide the equations and methodology to be used at the station or unit for each liquid release point according to the Specification 3.11.1.1. For systems with continuous or batch releases, and for systems designed to monitor and control both continuous and batch releases, provide the assumptions and parameters to be used to compare the output of the monitor with the liquid concentration specified. State the limitations for combined discharges to the same release point. In addition, describe the method and assumptions for obtaining representative samples from each batch and use of previous post-release analyses or composite sample analyses to meet the Specification.

Section 3 - Gaseous Effluent Dose Rate

Provide the equations and methodology to be used at the station or unit for each gaseous release point according to Specification 3.11.2.1. Consider the various pathways, release point elevations, site related parameters and radionuclide contribution to the dose impact limitation. Provide the

*The format for the ODCM is left up to the licensee and may be simplified by tables and grid printout. Each page should be numbered and indicate the facility approval and effective date.

dose factors to be used for the identified radionuclides released. Provide the annual average dispersion values (X/Q and D/Q), the site specific parameters and release point elevations.

Section 4 - Liquid Effluent Dose

Provide the equations and methodology to be used at the station or unit for each liquid release point according to the dose objectives given in Specification 3.11.1.2. The section should describe how the dose contributions are to be calculated for the various pathways and release points, the equations and assumptions to be used, the site specific parameters to be measured and used, the receptor location by direction and distance, and the method of estimating and updating cumulative doses due to liquid releases. The dose factors, pathway transfer factors, pathway usage factors, and dilution factors for the points of pathway origin, etc., should be given, as well as receptor age group, water and food consumption rate and other factors assumed or measured. Provide the method of determining the dilution factor at the discharge during any liquid effluent release and any site specific parameters used in these determinations.

Section 5 - Gaseous Effluent Dose

Provide the equations and methodology to be used at the station or unit for each gaseous release point according to the dose objectives given in Specifications 3.11.2.2 and 3.11.2.3. The section should describe how the dose contributions are to be calculated for the various pathways and release points, the equations and assumptions to be used, the site specific parameters to be measured and used, the receptor location by direction and distance, and the method to be used for estimating and updating cumulative doses due to gaseous releases. The location, direction and distance to the nearest residence, cow, goat, meat animal, garden, etc., should be given, as well as receptor age group, crop yield, grazing time and other factors assumed or measured. Provide the method of determining dispersion values (X/Q and D/Q) for releases and any site specific parameters and release point elevations used in these determinations.

Section 6 - Projected Doses

For liquid and gaseous radwaste treatment systems, provide the method of projecting doses due to effluent releases for the normal and alternate pathways of treatment according to the specifications, describing the components and subsystems to be used.

Section 7 - Operability of Equipment

Provide a flow diagram(s) defining the treatment paths and the components of the radioactive liquid, gaseous and solid waste management systems that are to be maintained and used, pursuant to 10 CFR 50.36a, to meet Technical Specifications 3.11.1.3, 3.11.2.4 and 3.11.3.1. Subcomponents of packaged equipment can be identified by a list. For operating reactors whose construction permit applications were filed prior to January 2, 1971, the flow diagram(s) shall be consistent with the information provided in conformance with Section V.B.1 of Appendix I to 10 CFR Part 50. For OL applications whose construction permits were filed after January 2, 1971, the flow diagram(s) shall be consistent with the information provided in Chapter 11 of the Final Safety Analysis Report (FSAR) or amendments thereto.

Section 8 - Sample Locations

Provide a map of the Radiological Environmental Monitoring Sample Locations indicating the numbered sampling locations given in Table 3.12-1. Further clarification on these numbered sampling locations can be provided by a list, indicating the direction and distance from the center of the building complex of the unit or station, and may include a discriptive name for identification purposes.

APPENDIX C

GENERIC LETTER 89-01

IMPLEMENTATION OF PROGRAMMATIC CONTROLS FOR RADIOLOGICAL EFFLUENT TECHNICAL SPECIFICATIONS IN THE ADMINISTRATIVE CONTROLS SECTION OF THE TECHNICAL SPECIFICATIONS AND THE RELOCATION OF PROCEDURAL DETAILS OF RETS TO THE OFFSITE DOSE CALCULATION MANUAL OR TO THE PROCESS CONTROL PROGRAM

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

January 31, 1989

TO ALL POWER REACTOR LICENSEES AND APPLICANTS

SUBJECT: IMPLEMENTATION OF PROGRAMMATIC CONTROLS FOR RADIOLOGICAL EFFLUENT TECHNICAL SPECIFICATIONS IN THE ADMINISTRATIVE CONTROLS SECTION OF THE TECHNICAL SPECIFICATIONS AND THE RELOCATION OF PROCEDURAL DETAILS OF RETS TO THE OFFSITE DOSE CALCULATION MANUAL OR TO THE PROCESS CONTROL PROGRAM (GENERIC LETTER 89-01)

The NRC staff has examined the contents of the Radiological Effluent Technical Specifications (RETS) in relation to the Commission's Interim Policy Statement on Technical Specification Improvements. The staff has determined that programmatic controls can be implemented in the Administrative Controls section of the Technical Specifications (TS) to satisfy existing regulatory requirements for RETS. At the same time, the procedural details of the current TS on radioactive effluents and radiological environmental monitoring can be relocated to the Offsite Dose Calculation Manual (ODCM). Likewise, the procedural details of the current TS on solid radioactive wastes can be relocated to the Process Control Program (PCP). These actions simplify the RETS, meet the regulatory requirements for radioactive effluents and radiological environmental monitoring, and are provided as a line-item improvement of the TS, consistent with the goals of the Policy Statement.

New programmatic controls for radioactive effluents and radiological environmental monitoring are incorporated in the TS to conform to the regulatory requirements of 10 CFR 20.106, 40 CFR Part 190, 10 CFR 50.36a, and Appendix I to 10 CFR Part 50. Existing programmatic requirements for the PCP are being retained in the TS. The procedural details included in licensees' present TS on radioactive effluents, solid radioactive wastes, environmental monitoring, and associated reporting requirements will be relocated to the ODCM or PCP as appropriate. Licensees will handle future changes to these procedural details in the ODCM and the PCP under the administrative controls for changes to the ODCM or PCP. Finally, the definitions of the ODCM and PCP are updated to reflect these changes.

Enclosure 1 provides guidance for the preparation of a license amendment request to implement these alternatives for RETS. Enclosure 2 provides a listing of existing RETS and a description of how each is addressed. Enclosure 3 provides model TS for programmatic controls for RETS and its associated reporting requirements. Finally, Enclosure 4 provides model specifications for retaining existing requirements for explosive gas monitoring instrumentation requirements that apply on a plant-specific basis. Licensees are encouraged to propose changes to TS that are consistent with the guidance provided in the enclosures. Conforming amendment requests will be expeditiously reviewed by the NRC Project Manager for the facility. Proposed amendments that deviate from this guidance will require a longer, more detailed review. Please contact the appropriate Project Manager if you have questions on this matter.

Sincerely,

Steven A. Varga
Acting Associate Director for Projects
Office of Nuclear Reactor Regulation

Enclosures:
1 through 4 as stated

GUIDANCE FOR THE IMPLEMENTATION OF PROGRAMMATIC CONTROLS FOR RETS IN THE ADMINISTRATIVE CONTROLS SECTION OF TECHNICAL SPECIFICATIONS AND THE RELOCATION OF PROCEDURAL DETAILS OF CURRENT RETS TO THE OFFSITE DOSE CALCULATION MANUAL OR PROCESS CONTROL PROGRAM

INTRODUCTION

This enclosure provides guidance for the preparation of a license amendment request to implement programmatic controls in Technical Specifications (TS) for radioactive effluents and for radiological environmental monitoring conforming to the applicable regulatory requirements. This will allow the relocation of existing procedural details of the current Radiological Effluent Technical Specifications (RETS) to the Offsite Dose Calculation Manual (ODCM). Procedural details for solid radioactive wastes will be relocated to the Process Control Program (PCP). A proposed amendment will (1) incorporate programmatic controls in the Administrative Controls section of the TS that satisfy the requirements of 10 CFR 20.106, 40 CFR Part 190, 10 CFR 50.36a. and Appendix I to 10 CFR Part 50, (2) relocate the existing procedural details in current specifications involving radioactive effluent monitoring instrumentation, the control of liquid and gaseous effluents, equipment requirements for liquid and gaseous effluents, radiological environmental monitoring, and radiological reporting details from the TS to the ODCM, (3) relocate the definition of solidification and existing procedural details in the current specification on solid radioactive wastes to the PCP, (4) simplify the associated reporting requirements, (5) simplify the administrative controls for changes to the ODCM and PCP, (6) add record retention requirements for changes to the ODCM and PCP, and (7) update the definitions of the ODCM and PCP consistent with these changes.

The NRC staff's intent in recommending these changes to the TS and the relocation of procedural details of the current RETS to the ODCM and PCP is to fulfill the goal of the Commission Policy Statement for Technical Specification Improvements. It is not the staff's intent to reduce the level of radiological effluent control. Rather, this amendment will provide programmatic controls for RETS consistent with regulatory requirements and allow relocation of the procedural details of current RETS to the ODCM or PCP. Therefore, future changes to these procedural details will be controlled by the controls for changes to the ODCM or PCP included in the Administrative Controls section of the TS. These procedural details are not required to be included in TS by 10 CFR 50.36a.

DISCUSSION

Enclosure 2 to Generic Letter 89- provides a summary listing of specifications that are included under the heading of RETS in the Standard Technical Specifications (STS) and their disposition. Most of these specifications will be addressed by programmatic controls in the Administrative Controls section of the TS. Some specifications under the heading of RETS are not covered by the new programmatic controls and will be retained as requirements in the existing plant TS. Examples include requirements for explosive gas monitoring instrumentation, limitations on the quantity of radioactivity in liquid or gaseous holdup or storage tanks or in the condenser exhaust for BWRs, or limitations on explosive gas mixtures in offgas treatment systems and storage tanks.

Licensees with nonstandard TS should follow the guidance provided in Enclosure 2 for the disposition of similar requirements in the format of their TS.

Because solid radioactive wastes are addressed under existing programmatic controls for the Process Control Program, which is a separate program from the new programmatic controls for liquid and gaseous radioactive effluents, the requirements for solid radioactive wastes and associated solid waste reporting requirements in current TS are included as procedural details that will be relocated to the PCP as part of this line-item improvement of TS. Also, the staff has concluded that records of licensee reviews performed for changes made to the ODCM and PCP should be documented and retained for the duration of the unit operating license. This approach is in lieu of the current requirements that the reasons for changes to the ODCM and PCP be addressed in the Semiannual Effluent Release Report.

The following items are to be included in a license amendment request to implement these changes. First, the model specifications in Enclosure 3 to Generic Letter 89- should be incorporated into the TS to satisfy the requirements of 10 CFR 20.106, 40 CFR Part 190, 10 CFR 50.36a, and Appendix I to 10 CFR Part 50. The definitions of the ODCM and PCP should be updated to reflect these changes. The programmatic and reporting requirements are general in nature and do not contain plant-specific details. Therefore, these changes to the Administrative Controls section of the TS are to replace corresponding requirements in plant TS that address these items. They should be proposed for incorporation into the plant's TS without change in substance to replace existing requirements. If necessary, only changes in format should be proposed. If the current TS include requirements for explosive gas monitoring instrumentation as part of the gaseous effluent monitoring instrumentation requirements, these requirements should be retained. Enclosure 4 to Generic Letter 89- provides model specifications for retaining such requirements.

Second, the procedural details covered in the licensee's current RETS, consisting of the limiting conditions for operation, their applicability, remedial actions, surveillance requirements, and the Bases section of the TS for these requirements, are to be relocated to the ODCM or PCP as appropriate and in a manner that ensures that these details are incorporated in plant operating procedures. The NRC staff does not intend to repeat technical reviews of the relocated procedural details because their consistency with the applicable regulatory requirements is a matter of record from past NRC reviews of RETS. If licensees make other than editorial changes in the procedural details being transferred to the ODCM, each change should be identified by markings in the margin and the requirements of new Specification 6.14a.(1) and (2) followed.

Finally, licensees should confirm in the amendment request that changes for relocating the procedural details of current RETS to either the ODCM or PCP have been prepared in accordance with the proposed changes to the Administrative Controls section of the TS so that they may be implemented immediately upon issuance of the proposed amendment. A complete and legible copy of the revised ODCM should be forwarded with the amendment request for NRC use as a reference. The NRC staff will not concur in or approve the revised ODCM.

Licensees should refer to "Generic Letter 89- " in the Subject line of license amendment requests implementing the guidance of this Generic Letter. This will facilitate the staff's tracking of licensees' responses to this Generic Letter.

SUMMARY

The license amendment request for the line-item improvements of the TS relative to the RETS will entail (1) the incorporation of programmatic controls for radioactive effluents and radiological environmental monitoring in the Administrative Controls section of the TS, (2) incorporatation of the procedural details of the current RETS in the ODCM or PCP as appropriate, and (3) confirmation that the guidance of this Generic Letter has been followed.

DISPOSITION OF SPECIFICATIONS AND ADMINISTRATIVE CONTROLS INCLUDED UNDER THE HEADING OF RETS IN THE STANDARD TECHNICAL SPECIFICATIONS

SPECIFICATION	TITLE	DISPOSITION OF EXISTING SPECIFICATION
1.17	OFFSITE DOSE CALCULATION MANUAL	Definition is updated to reflect the change in scope of the ODCM.
1.22	PROCESS CONTROL PROGRAM	Definition is updated to reflect the change in scope of the PCP.
1.32	SOLIDIFICATION	Definition is relocated to the PCP.
3/4.3.3.10	RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION	Programmatic controls are included in 6.8.4 g. Item 1). Existing specification procedural details are relocated to the ODCM.
3/4.3.3.11	RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION	Programmatic controls are included in 6.8.4 g. Item 1). Existing specification procedural details are relocated to the ODCM. Existing requirements for explosive gas monitoring instrumentation should be retained. Model specifications for these requirements are provided in Enclosure 4.
3/4.11.1.1	LIQUID EFFLUENTS: CONCENTRATION	Programmatic controls are included in 6.8.4 g. Items 2) and 3). Existing specification procedural details are relocated to the ODCM.
3/4.11.1.2	LIQUID EFFLUENTS: DOSE	Programmatic controls are included in 6.8.4 g. Items 4) and 5). Existing specification procedural details are relocated to the ODCM.
3/4.11.1.3	LIQUID EFFLUENTS: LIQUID RADWASTE TREATMENT SYSTEM	Programmatic controls are included in 6.8.4 g. Item 6). Existing specification procedural details are relocated to the ODCM.
3/4.11.1.4	LIQUID HOLDUP TANKS	Existing specification requirements to be retained.

DISPOSITION OF SPECIFICATIONS AND ADMINISTRATIVE CONTROLS
INCLUDED UNDER THE HEADING OF RETS IN THE STANDARD TECHNICAL SPECIFICATIONS (Cont.)

SPECIFICATION	TITLE	DISPOSITION OF EXISTING SPECIFICATION
3/4.11.2.1	GASEOUS EFFLUENTS: DOSE RATE	Programmatic controls are included in 6.8.4 g. Items 3) and 7). Existing specification procedural details are relocated to the ODCM.
3/4.11.2.2	GASEOUS EFFLUENTS: DOSE-NOBLE GASES	Programmatic controls are included in 6.8.4 g. Items 5) and 8). Existing specification procedural details are relocated to the ODCM.
3/4.11.2.3	GASEOUS EFFLUENTS: DOSE--IODINE-131, IODINE-133, TRITIUM, AND RADIOACTIVE MATERIAL IN PARTICULATE FORM	Programmatic controls are included in 6.8.4 g. Items 5) and 9). Existing specification procedural details are relocated to the ODCM.
3/4.11.2.4	GASEOUS EFFLUENTS: GASEOUS RADWASTE TREATMENT or VENTILATION EXHAUST TREATMENT SYSTEM	Programmatic controls are included in 6.8.4 g. Item 6). Existing specification procedural details are relocated to the ODCM.
3/4.11.2.5	EXPLOSIVE GAS MIXTURE	Existing specification requirements should be retained.
3/4.11.2.6	GAS STORAGE TANKS	Existing specification requirements should be retained.
3/4.11.2.7	MAIN CONDENSER (BWR)	Existing specification requirements should be retained.
3/4.11.2.8	PURGING AND VENTING (BWR Mark II containments)	Programmatic controls are included in 6.8.4 g. Item 10). Existing specification procedural details are relocated to the ODCM.
3/4.11.3	SOLID RADIOACTIVE WASTES	Existing specification procedural details are relocated to the PCP.
3/4.11.4	RADIOACTIVE EFFLUENTS: TOTAL DOSE	Programmatic controls are included in 6.8.4 g. Item 11). Existing specification procedural details are relocated to the ODCM.

DISPOSITION OF SPECIFICATIONS AND ADMINISTRATIVE CONTROLS
INCLUDED UNDER THE HEADING OF RETS IN THE STANDARD TECHNICAL SPECIFICATIONS (Cont.)

SPECIFICATION	TITLE	DISPOSITION OF EXISTING SPECIFICATION
3/4.12.1	RADIOLOGICAL ENVIRONMENTAL MONITORING: MONITORING PROGRAM	Programmatic controls are included in 6.8.4 h. Item 1). Existing specification procedural details are relocated to the ODCM.
3/4.12.2	RADIOLOGICAL ENVIRONMENTAL MONITORING: LAND USE CENSUS	Programmatic controls are included in 6.8.4 h. Item 2). Existing specification procedural details are relocated to the ODCM.
3/4.12.3	RADIOLOGICAL ENVIRONMENTAL MONITORING: INTERLABORATORY COMPARISON PROGRAM	Programmatic controls are included in 6.8.4 h. Item 3). Existing specification procedural details are relocated to the ODCM.
5.1.3	DESIGN FEATURES: SITE - MAP DEFINING UNRESTRICTED AREAS AND SITE BOUNDARY FOR RADIOACTIVE GASEOUS AND LIQUID EFFLUENTS	Existing specification requirements should be retained.
6.9.1.3	REPORTING REQUIREMENTS: ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT	Specification simplified and existing reporting details are relocated to the ODCM.
6.9.1.4	REPORTING REQUIREMENTS: SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT	Specification simplified and existing reporting details are relocated to the ODCM or PCP as appropriate.
6.13	PROCESS CONTROL PROGRAM	Specification requirements are simplified.
6.14	OFFSITE DOSE CALCULATION MANUAL	Specification requirements are simplified.
6.15	MAJOR CHANGES TO LIQUID, GASEOUS, AND SOLID RADWASTE TREATMENT SYSTEMS	Existing procedural details are relocated to the ODCM or PCP as appropriate.

TECHNICAL SPECIFICATIONS TO BE REVISED

1.17	DEFINITIONS: OFFSITE DOSE CALCULATION MANUAL
1.22	DEFINITIONS: PROCESS CONTROL PROGRAM
6.8.4 g.	PROCEDURES AND PROGRAMS: RADIOACTIVE EFFLUENT CONTROLS
6.8.4 h.	PROCEDURES AND PROGRAMS: RADIOLOGICAL ENVIRONMENTAL MONITORING
6.9.1.3	REPORTING REQUIREMENTS: ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT
6.9.1.4	REPORTING REQUIREMENTS: SEMIANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT
6.10	RECORD RETENTION
6.13	PROCESS CONTROL PROGRAM (PCP)
6.14	OFFSITE DOSE CALCULATION MANUAL (ODCM)

MODEL TECHNICAL SPECIFICATION REVISIONS
(To supplement or replace existing specifications)

1.0 DEFINITIONS

OFFSITE DOSE CALCULATION MANUAL

1.17 The OFFSITE DOSE CALCULATION MANUAL (ODCM) shall contain the methodology and parameters used in the calculation of offsite doses resulting from radioactive gaseous and liquid effluents, in the calculation of gaseous and liquid effluent monitoring Alarm/Trip Setpoints, and in the conduct of the Environmental Radiological Monitoring Program. The ODCM shall also contain (1) the Radioactive Effluent Controls and Radiological Environmental Monitoring Programs required by Section 6.8.4 and (2) descriptions of the information that should be included in the Annual Radiological Environmental Operating and Semiannual Radioactive Effluent Release Reports required by Specifications 6.9.1.3 and 6.9.1.4.

1.22 The PROCESS CONTROL PROGRAM (PCP) shall contain the current formulas, sampling, analyses, test, and determinations to be made to ensure that processing and packaging of solid radioactive wastes based on demonstrated processing of actual or simulated wet solid wastes will be accomplished in such a way as to assure compliance with 10 CFR Parts 20, 61, and 71, State regulations, burial ground requirements, and other requirements governing the disposal of solid radioactive waste.

6.0 ADMINISTRATIVE CONTROLS

6.8 PROCEDURES AND PROGRAMS

6.8.4 The following programs shall be established, implemented, and maintained:

g. Radioactive Effluent Controls Program

A program shall be provided conforming with 10 CFR 50.36a for the control of radioactive effluents and for maintaining the doses to MEMBERS OF THE PUBLIC from radioactive effluents as low as reasonably achievable. The program (1) shall be contained in the ODCM, (2) shall be implemented by operating procedures, and (3) shall include remedial actions to be taken whenever the program limits are exceeded. The program shall include the following elements:

1) Limitations on the operability of radioactive liquid and gaseous monitoring instrumentation including surveillance tests and setpoint determination in accordance with the methodology in the ODCM,

2) Limitations on the concentrations of radioactive material released in liquid effluents to UNRESTRICTED AREAS conforming to 10 CFR Part 20, Appendix B, Table II, Column 2,

3) Monitoring, sampling, and analysis of radioactive liquid and gaseous effluents in accordance with 10 CFR 20.106 and with the methodology and parameters in the ODCM,

4) Limitations on the annual and quarterly doses or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released from each unit to UNRESTRICTED AREAS conforming to Appendix I to 10 CFR Part 50,

5) Determination of cumulative and projected dose contributions from radioactive effluents for the current calendar quarter and current calendar year in accordance with the methodology and parameters in the ODCM at least every 31 days,

6) Limitations on the operability and use of the liquid and gaseous effluent treatment systems to ensure that the appropriate portions of these systems are used to reduce releases of radioactivity when the projected doses in a 31-day period would exceed 2 percent of the guidelines for the annual dose or dose commitment conforming to Appendix I to 10 CFR Part 50,

7) Limitations on the dose rate resulting from radioactive material released in gaseous effluents to areas beyond the SITE BOUNDARY conforming to the doses associated with 10 CFR Part 20, Appendix B, Table II, Column 1,

ADMINISTRATIVE CONTROLS

6.8.4 g. Radioactive Effluent Controls Program (Cont.)

8) Limitations on the annual and quarterly air doses resulting from noble gases released in gaseous effluents from each unit to areas beyond the SITE BOUNDARY conforming to Appendix I to 10 CFR Part 50,

9) Limitations on the annual and quarterly doses to a MEMBER OF THE PUBLIC from Iodine-131, Iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released from each unit to areas beyond the SITE BOUNDARY conforming to Appendix I to 10 CFR Part 50,

10) Limitations on venting and purging of the Mark II containment through the Standby Gas Treatment System to maintain releases as low as reasonably achievable (BWRs w/Mark II containments), and

11) Limitations on the annual dose or dose commitment to any MEMBER OF THE PUBLIC due to releases of radioactivity and to radiation from uranium fuel cycle sources conforming to 40 CFR Part 190.

h. Radiological Environmental Monitoring Program

A program shall be provided to monitor the radiation and radionuclides in the environs of the plant. The program shall provide (1) representative measurements of radioactivity in the highest potential exposure pathways, and (2) verification of the accuracy of the effluent monitoring program and modeling of environmental exposure pathways. The program shall (1) be contained in the ODCM, (2) conform to the guidance of Appendix I to 10 CFR Part 50, and (3) include the following:

1) Monitoring, sampling, analysis, and reporting of radiation and radionuclides in the environment in accordance with the methodology and parameters in the ODCM,

2) A Land Use Census to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the monitoring program are made if required by the results of this census, and

3) Participation in a Interlaboratory Comparison Program to ensure that independent checks on the precision and accuracy of the measurements of radioactive materials in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring.

ADMINISTRATIVE CONTROLS

6.9 REPORTING REQUIREMENTS

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT*

6.9.1.3 The Annual Radiological Environmental Operating Report covering the operation of the unit during the previous calendar year shall be submitted before May 1 of each year. The report shall include summaries, interpretations, and analysis of trends of the results of the Radiological Environmental Monitoring Program for the reporting period. The material provided shall be consistent with the objectives outlined in (1) the ODCM and (2) Sections IV.B.2, IV.B.3, and IV.C of Appendix I to 10 CFR Part 50.

SEMIANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**

6.9.1.4 The Semiannual Radioactive Effluent Release Report covering the operation of the unit during the previous 6 months of operation shall be submitted within 60 days after January 1 and July 1 of each year. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit. The material provided shall be (1) consistent with the objectives outlined in the ODCM and PCP and (2) in conformance with 10 CFR 50.36a and Section IV.B.1 of Appendix I to 10 CFR Part 50.

6.10 RECORD RETENTION

6.10.3 The following records shall be retained for the duration of the unit Operating License:

o. Records of reviews performed for changes made to the OFFSITE DOSE CALCULATION MANUAL and the PROCESS CONTROL PROGRAM.

6.13 PROCESS CONTROL PROGRAM (PCP)

Changes to the PCP:

a. Shall be documented and records of reviews performed shall be retained as required by Specification 6.10.3o. This documentation shall contain:

   1) Sufficient information to support the change together with the appropriate analyses or evaluations justifying the change(s) and

*A single submittal may be made for a multi-unit station.

**A single submittal may be made for a multi-unit station. The submittal should combine those sections that are common to all units at the station; however, for units with separate radwaste systems, the submittal shall specify the releases of radioactive material from each unit.

ADMINISTRATIVE CONTROLS

6.13 PROCESS CONTROL PROGRAM (PCP) (Cont.)

2) A determination that the change will maintain the overall conformance of the solidified waste product to existing requirements of Federal, State, or other applicable regulations.

b. Shall become effective after review and acceptance by the [URG] and the approval of the Plant Manager.

6.14 OFFSITE DOSE CALCULATION MANUAL (ODCM)

Changes to the ODCM:

a. Shall be documented and records of reviews performed shall be retained as required by Specification 6.10.3o. This documentation shall contain:

1) Sufficient information to support the change together with the appropriate analyses or evaluations justifying the change(s) and

2) A determination that the change will maintain the level of radioactive effluent control required by 10 CFR 20.106, 40 CFR Part 190, 10 CFR 50.36a, and Appendix I to 10 CFR Part 50 and not adversely impact the accuracy or reliability of effluent, dose, or setpoint calculations.

b. Shall become effective after review and acceptance by the [URG] and the approval of the Plant Manager.

c. Shall be submitted to the Commission in the form of a complete, legible copy of the entire ODCM as a part of or concurrent with the Semiannual Radioactive Effluent Release Report for the period of the report in which any change to the ODCM was made. Each change shall be identified by markings in the margin of the affected pages, clearly indicating the area of the page that was changed, and shall indicate the date (e.g., month/year) the change was implemented.

MODIFICATION OF THE SPECIFICATION FOR RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION TO RETAIN REQUIREMENTS FOR EXPLOSIVE GAS MONITORING INSTRUMENTATION

INSTRUMENTATION
EXPLOSIVE
~~RADIOACTIVE GASEOUS-EFFLUENT~~ MONITORING INSTRUMENTATION

LIMITING CONDITION FOR OPERATION

3.3.3.11 The explosive ~~radioactive gaseous-effluent~~ monitoring instrumentation channels shown in Table 3.3-13 shall be OPERABLE with their Alarm/Trip Setpoints set to ensure that the limits of Specifications ~~3.11.2.1 and~~ 3.11.2.5 are not exceeded. ~~The Alarm/Trip Setpoints of these channels meeting Specification 3.11.2.1 shall be determined and adjusted in accordance with the methodology and parameters in the ODCM.~~

APPLICABILITY: As shown in Table 3.3-13

ACTION:

a. With an explosive ~~radioactive gaseous-effluent~~ monitoring instrumentation channel Alarm/Trip Setpoint less conservative than required by the above specification~~, immediately suspend the release of radioactive gaseous effluents monitored by the affected channel, or~~ declare the channel inoperable and take the ACTION shown in Table 3.3-13.

b. With less than the minimum number of explosive ~~radioactive gaseous-effluent~~ monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 3.3-13. Restore the inoperable instrumentation to OPERABLE status within 30 days and, if unsuccessful ~~explain in the next Semi-annual Radioactive Effluent Release Report~~ prepare and submit a Special Report to the Commission pursuant to Specification ~~6.9.1.4~~ 6.9.2 to explain why this inoperability was not corrected in a timely manner.

c. The provisions of Specification 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.3.11 Each explosive ~~radioactive gaseous-effluent~~ monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, ~~SOURCE CHECK,~~ CHANNEL CALIBRATION and ANALOG CHANNEL OPERATIONAL TEST at the frequencies shown in Table 4.3-9.

TABLE 3.3-13

EXPLOSIVE ~~RADIOACTIVE GASEOUS EFFLUENT~~ MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
1. (Not used)			
2A. WASTE GAS HOLDUP SYSTEM Explosive Gas Monitoring System (for systems designed to withstand the effects of a hydrogen explosion)			
a. Hydrogen Monitor (Automatic Control)	1	**	49
b. Hydrogen or Oxygen Monitor (Process)	1	**	49
2B. WASTE GAS HOLDUP SYSTEM Explosive Gas Monitoring System (for systems not designed to withstand the effects of a hydrogen explosion)			
a. Hydrogen Monitors (Automatic Control, redundant)	2	**	50, 52
b. Hydrogen or Oxygen Monitors (Process, dual)	2	**	50

TABLE 3.3-13 (Continued)

* (Not used)

** During WASTE GAS HOLDUP SYSTEM operation.

ACTION STATEMENTS

ACTION 45 - (Not used)

ACTION 46 - (Not used)

ACTION 47 - (Not used)

ACTION 48 - (Not used)

ACTION 49 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, operation of this WASTE GAS HOLDUP SYSTEM may continue provided grab samples are collected at least once per 4 hours and analyzed within the following 4 hours.

ACTION 50 - With the number of channels OPERABLE one less than required by the Minimum Channels OPERABLE requirement, operation of this system may continue provided grab samples are taken and analyzed at least once per 24 hours. With both channels inoperable, operation may continue provided grab samples are taken and analyzed at least once per 4 hours during degassing operations and at least once per 24 hours during other operations.

ACTION 51 - (Not used)

ACTION 52 - With the number of channels OPERABLE one less than required by the Minimum Channels OPERABLE requirement, suspend oxygen supply to the recombiner.

TABLE 4.3-9

EXPLOSIVE ~~RADIOACTIVE GASEOUS EFFLUENT~~ MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	~~SOURCE CHECK~~	CHANNEL CALIBRATION	CHANNEL OPERATIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
1. (Not used)					
2A. WASTE GAS HOLDUP SYSTEM Explosive Gas Monitoring System (for systems designed to withstand the effects of a hydrogen explosion)					
a. Hydrogen Monitor (Automatic Control)	D	~~N.A.~~	Q(4)	M	**
b. Hydrogen or Oxygen Monitor (Process)	D	~~N.A.~~	Q(4) or Q(5)	M	**
2B. WASTE GAS HOLDUP SYSTEM Explosive Gas Monitoring System (for systems not designed to withstand the effects of a hydrogen explosion)					
a. Hydrogen Monitors (Automatic Control, redundant)	D	~~N.A.~~	Q(4)	M	**
b. Hydrogen or Oxygen Monitors (Process, dual)	D	~~N.A.~~	Q(4) or Q(5)	M	**

TABLE 4.3-9 (Continued)

TABLE NOTATIONS

* (Not used)

** During WASTE GAS HOLDUP SYSTEM operation.

(1) (Not used)

(2) (Not used)

(3) (Not used)

(4) The CHANNEL CALIBRATION shall include the use of standard gas samples containing a nominal:

a. One volume percent hydogen, balance nitrogen, and

c. Four volume percent hydrogen, balance nitrogen.

(5) The CHANNEL CALIBRATION shall include the use of standard gas samples containing a nominal:

a. One volume percent oxygen, balance nitrogen, and

b. Four volume percent oxygen, balance nitrogen.

NRC FORM 335 (2-89) NRCM 1102, 3201, 3202

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

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NUREG-1302

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Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors

Generic Letter 89-01, Supplement No. 1

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N/A

5. AUTHOR(S)

W. Wayne Meinke and Thomas H. Essig

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Division of Radiation Protection and Emergency Preparedness
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

9. SPONSORING ORGANIZATION – NAME AND ADDRESS *(If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)*

Same as above

10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

This report contains guidance which may be voluntarily used by licensees who choose to implement the provision of Generic Letter 89-01, which allows Radiological Effluent Technical Specifications (RETS) to be removed from the main body of the Technical Specifications and placed in the Offsite Dose Calculation Manual (ODCM). Guidance is provided for Standard Effluent Controls definitions, Controls for effluent monitoring instrumentation, Controls for effluent releases, Controls for radiological environmental monitoring, and the basis for Controls.

Guidance on the formulation of RETS has been available in draft form (NUREG-0472 and -0473) for a number of years; the current effort simply recasts those RETS into Standard Radiological Effluent Controls for application to the ODCM. Also included for completeness are: (1) radiological environmental monitoring program guidance previously which had been available as a Branch Technical Position (Rev. 1, November 1979); (2) existing ODCM guidance; and (3) a reproduction of Generic Letter 89-01.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

Generic Letter 89-01
Licensee Guidance
Effluent Controls
Effluent Monitoring
Radiological Environmental Monitoring
Boiling Water Reactors

13. AVAILABILITY STATEMENT

Unlimited

14. SECURITY CLASSIFICATION

(This Page) Unclassified

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NRC FORM 335 (2-89)

THIS DOCUMENT WAS PRINTED USING RECYCLED PAPER

	Drywell Reading	0.5 mile (0.8 km)		1 mile (1.61 km)		1.5 mile 2.41 km)		2.0 mile (3.22 km)	
	D (rem/h)	TEDE (rem)	Thyroid CDE (rem)	TEDE (rem)	Thyroid CDE (rem)	TEDE (rem)	Thyroid CDE (rem)	TEDE (rem)	Thyroid CDE (rem)
Unit 1	4,780	3.7E+00	3.4E+01	9.8E-01	9.1E+00	4.4E-01	4.1E+00	2.5E-01	2.4E+00
Unit 2	5,490	4.6E+00	5.8E+01	1.2E+00	1.6E+01	5.5E-01	7.0E+00	3.2E-01	4.1E+00
Unit 3	6,000	5.0E+00	6.4E+01	1.3E+00	1.7E+01	6.0E-01	7.7E+00	3.4E-01	4.4E+00
Sum (rem)		1.3E+01	1.6E+02	3.5E+00	4.2E+01	1.6E+00	1.9E+01	9.1E-01	1.1E+01

Notes:

* RASCAL runs based on plant drywell readings 22 MAR 1100
* Doses exceeding PAGs are underlined
* latest 22 MAR 0846 met data
* Units 1, 2 & 3 reactor shutdown 11 MAR 1446 ("Sprays Off")
* "Total failure" of 22 MAR 1100 assumed as data/time of drywell reading

From: LIA08 Hoc
Sent: Wednesday, March 23, 2011 5:23 AM
To: LIA06 Hoc
Subject: FW: Draft March 23 0600 Brieing Sheet for the Chairman
Attachments: March 23 0600EDT one pager (2).docx

From: McGinty, Tim
Sent: Wednesday, March 23, 2011 5:19 AM
To: McGinty, Tim; Virgilio, Martin; Carpenter, Cynthia; Boger, Bruce; LIA08 Hoc; RST01 Hoc; PMT09 Hoc
Subject: RE: Draft March 23 0600 Brieing Sheet for the Chairman

Sorry, attached ...

From: McGinty, Tim
Sent: Wednesday, March 23, 2011 5:18 AM
To: Virgilio, Martin; Carpenter, Cynthia; Boger, Bruce; LIA08 Hoc; RST01 Hoc; PMT09 Hoc
Subject: Draft March 23 0600 Brieing Sheet for the Chairman

Proposed additions highlighted in Yellow. Any comments by 5:30 a.m, please. Thanks, Tim McGinty

From: PMT09 Hoc
Sent: Tuesday, March 22, 2011 11:59 PM
To: PMT01 Hoc
Subject: Dose Projection Yokosuka _ Barge Sample Decayed_3-23-11_0435 JST (2).xlsx
Attachments: Dose Projection Yokosuka _ Barge Sample Decayed_3-23-11_0435 JST (2).xlsx

From: PMT02 Hoc
Sent: Tuesday, March 22, 2011 6:38 PM
To: PMT09 Hoc
Subject: FW: Dose Projection for Yokosuka
Attachments: Dose Projection Yokosuka _ Barge Sample Decayed_3-23-11_0435 JST.xlsx; SOFL Japan Event Updated 3.22.11.XLSM

-----Original Message-----
From: Hoc, PMT12
Sent: Tuesday, March 22, 2011 5:44 PM
To: PMT02 Hoc; PMT11 Hoc
Subject: FW: Dose Projection for Yokosuka

-----Original Message-----
From: Heytens, Troy R CIV SEA 08 NR [mailto: (b)(6)
Sent: Tuesday, March 22, 2011 5:38 PM
To: Hoc, PMT12; nitops@nnsa.doe.gov
Cc: Roros, John CIV NAVSEA, 08
Subject: FW: Dose Projection for Yokosuka

For NRC PMT, Attn: Tim Harris/Michele Hart

For DOE NITOPS: Attn: Dave Hoaglund

All,
Attached is the Dose projections for Yokosuka for your review and comment. The NR ECC Point of Contact for questions is Mr. Hallworth (202-781-5601).

Thanks,
Troy Heytens
NR ECC
(202) 781-6387

-----Original Message-----
From: Hallworth, John M CIV SEA 08 NR
Sent: Tuesday, March 22, 2011 5:32 PM
To: Roros, John CIV NAVSEA, 08; Heytens, Troy R CIV SEA 08 NR; Lentz, Frederick L CIV SEA 08 NR; Mueller, Troy J SES CIV NAVSEA 08 NR
Subject: Dose Projection for Yokosuka

Gentlemen,

Attached is the dose projection for Yokosuka based on the gamma analysis of the portable air sampler filter from the YR 95 barge, decayed to 3/22/11. Also attached is the Sum of Fractional Limits calculation used to develop the projection. These documents are being transmitted to and discussed with the NRC and DOE in parallel. If there are any questions, I can be reached in the ECC at 202 781 5601.

VR/
John M Hallworth
Naval Reactors

3/23/11 0302 hrs JST

Objective: The objective of this spreadsheet is to perform a hypothetical dose assessment for personnel at various distances from the source.

Assumptions:
1. The Thyroid CDE and CEDE dose estimates would not apply to personnel using KI
2. SOFL (Sum of Fractional Limits) Limit Based on barge sample at Yokosuka with Iodines ; Ba-137m and Y-90 were removed
3. All of the iodine dose is assumed to target the thyroid
4. NOTE: 1 AMAD was used in lieu of 5 AMAD for selection of DCFs in ICRP 68 for determination of the percent of iodines versus non-iodines. (See below). The selection of 5 AMAD versus 1 AMAD would change the percent of iodines and non-iodines in this spreadsheet.
5. When more than one ICRP 68 DCF is provided, the most conservative value for 1 AMAD was used.

Method:
1. Use actual radiation measurement data (air samples, direct gamma readings) to calcuate dose estimates.
2. The particulate airborne dose rate is derived from the airborne concentration with the iodines.
3. The thyroid dose is calulated based on the iodines.
4. Ratios based on dispersion factors are used to populate the dose estimates out to specific distances.
5. The airborne concentration level divided the SOFL air limit multiplied by the NR annual airborne radiation limit (500 mrem/yr) , then divided by the number of hours (2000 hours) will calculate the CEDE.

Input values

Airborne Conc.	7.72E-09 µCi/ml	Average airborne reading at Yokosuka, March 15 / 16, 2011 [Yokosuka dose assessment.xlsx file]
SOFL Limit	3.37E-09 µCi/ml	(SOFL Limit Based on barge sample at Yokosuka without Iodine)
Annual Limit	500 mrem	
Hours per Year	2000 hrs	
External Rad. Measurement	0.02 mR/hr	Reading at Yokosuka

This value is the external rad measurement, all others in column based on dispersion of this value
This value is based on the SOFL Limit, all others in column based on dispersion of this value
This value is based on the dose to the thyroid from iodine using ICRP-68 dose conversion factors and ratioing that value to the SOFL.

Iodine RN	Sample pCi	air concentration based on 3.37E-9 SOFL limit	Conversion (ml/m³)	Air Concentration . µCi/ml	Decay Corrected YR-95 Barge Converted to Air Sample	ICRP-68 CEDE (Sv/Bq)	Conversion (mrem/hr per Sv/Bq)	ICRP-68 CEDE (mrem/µCi)	Inhalation Rate (ml/hr)	Dose CEDE (mrem)	Percent of I and Percent of Non-I	Check of Values	
I-131	2.15E+03	1.52E-09	1.00E+12	2.15E-09	3.49E-09	7.60E-09	3.70E+09	2.81E+01	1.20E+06	1.18E-01			
I-132	4.79E+02	3.39E-10	1.00E+12	4.79E-10	7.78E-10	9.60E-11	3.70E+09	3.55E-01	1.20E+06	3.31E-04			
I-133	2.06E+00	1.46E-12	1.00E+12	2.06E-12	3.34E-12	1.50E-09	3.70E+09	5.55E+00	1.20E+06	2.23E-05			
										1.18E-01	1.55E-01	5.73E-01	8.88E-02
Te-132	7.87E+02	5.58E-10	1.00E+12	7.87E-10	1.28E-09	2.20E-09	3.70E+09	8.14E+00	1.20E+06	1.25E-02			
Cs-134	2.25E+02	1.59E-10	1.00E+12	2.25E-10	3.65E-10	6.80E-09	3.70E+09	2.52E+01	1.20E+06	1.10E-02			
Cs-137	5.56E+02	3.94E-10	1.00E+12	5.56E-10	9.03E-10	4.80E-09	3.70E+09	1.78E+01	1.20E+06	1.92E-02			
Ba-137m	0.00E+00	0.00E+00	1.00E+12	0.00E+00	0.00E+00	4.80E-09	3.70E+09	1.78E+01	1.20E+06	0.00E+00			
Sr-90	5.56E+02	3.94E-10	1.00E+12	5.56E-10	9.03E-10	1.50E-07	3.70E+09	5.55E+02	1.20E+06	6.01E-01			
Y-90	0.00E+00	0.00E+00	1.00E+12	0.00E+00	0.00E+00	1.50E-09	3.70E+09	5.55E+00	1.20E+06	0.00E+00			
										6.44E-01	8.45E-01	5.73E-01	4.84E-01
Total all	4.76E+03	3.37E-09		4.76E-09	7.72E-09								
						Total mrem I + non-RI				7.62E-01	1.00E+00		5.73E-01

Example calculation for establishing the Unit Conversion

Case for I-131	7.09E-09	Sv/Bq
	0.000709	mrem/Bq
	26233000	mrem/Ci
	26.233	mrem/µCi
	3.70E+09	conversion factor mrem/µCi per Sv/Bq

"For occupational exposure, the default value now recommended for AMAD is 5 µm which is considered to be more representative of work place aerosols than the 1 µm default value adopted by ICRP 30: For environmental exposure, the default AMAD is taken to be 1 µm" - Reference ICRP 66 paragraph 181.

Plume Predictive Model Based on Multiple Sources of Navy Measurements and Thumbrules

YR-95 (GW) Sample Decayed Corrected Seven Days To March 22, 2011 0700 JST 3/23/11 0302 hrs JST

Distance (Nautical Miles)	Meters	$\sigma_y{}^*\sigma_z$ (m²) (Category A)	Total Airborne Dose Rate (mrem/hour of inhalation)	Airborne Concentration µCi/mL	Non-RI Particulate Airborne Dose Rate CEDE (mrem/hour of inhalation)	Thyroid CDE from Iodine (mrem/hr of inhalation)	Thyroid CEDE from Iodine (mrem/hr of inhalation)	General Area (GA) Dose Rate (mrem/hour)
250	463000	1.37E+09	0.334	4.50E-09	0.282	1.04	0.05	0.01
225	416700	1.17E+09	0.392	5.28E-09	0.331	1.21	0.06	0.01
200	370400	9.79E+08	0.468	6.31E-09	0.396	1.45	0.07	0.02
175	324100	8.00E+08	0.573	7.72E-09	0.484	1.78	0.09	0.02
150	277800	6.33E+08	0.723	9.75E-09	0.612	2.24	0.11	0.03
125	231500	4.80E+08	0.954	1.29E-08	0.807	2.96	0.15	0.03
100	185200	3.42E+08	1.341	1.81E-08	1.133	4.16	0.21	0.05
90	166680	2.91E+08	1.575	2.12E-08	1.331	4.88	0.24	0.05
60	112972	1.56E+08	2.933	3.95E-08	2.480	9.10	0.45	0.10
50	92600	1.18E+08	3.888	5.24E-08	3.287	12.06	0.60	0.14
30	55560	5.30E+07	8.633	1.16E-07	7.298	26.78	1.34	0.30
20	37040	2.78E+07	16.453	2.22E-07	13.909	51.04	2.55	0.57
15	27780	1.75E+07	26.213	3.53E-07	22.161	81.32	4.07	0.92
10	18520	8.94E+06	51.244	6.91E-07	43.322	158.96	7.95	1.79
5	9260	2.72E+06	168.443	2.27E-06	142.405	522.53	26.13	5.88
1	1852	1.39E+05	3,303.399	4.45E-05	2792.752	10,247.51	512.38	115.36

The particulate airborne dose rate is derived from the airborn concentration with the iodines removed
The thyroid dose is calulated based on the iodines that were removed from the particulate aiborne sample data
This dose estimate assumes no KI was taken
Win d speed is taken into account by the Pasquill Stability Class assumption
Over 1000 samples have been taken that are consistent with this chart
Groundshine is not included because it is insignificant at larger distances, however it needs to be reevaluated inside 50 miles

<u>Input values</u>

Airborne Conc.	7.72E-09 µCi/ml	Average airborne reading at Yokosuka, March 15 / 16, 2011 [Yokosuka dose assessment.xlsx file]
SOFL Limit	3.37E-09 µCi/ml	(SOFL Limit Based on barge sample at Yokosuka without Iodine)
Annual Limit	500 mrem	
Hours per Year	2000 hrs	
External Rad. Measurement	0.02 mR/hr	Reading at Yokosuka [basis date & time needed]

This value is the external rad measurement, all others in column based on dispersion of this value
This value is based on the SOFL Limit, all others in column based on dispersion of this value
This value is based on the dose to the thyroid from iodine using ICRP-68 dose conversion factors and ratioing that value to the SOFL.

1 Hr TEDE (Non-RI CEDE + I CEDE + GA EDE) (mrem/hr)
0.35
0.41
0.48
0.59
0.75
0.99
1.39
1.63
3.04
4.03
8.94
17.04
27.14
53.06
174.41
3,420.49

Plume Predictive Model Based on Multiple Sources of Navy Measurements and Thumbrules

YR-95 (GW) Sample Decayed Corrected Seven Days To March 22, 2011 0700 JST 3/23/11 0302 hrs JST

Distance (Nautical Miles)	Meters	$\sigma_y{}^*\sigma_z$ (m²) (Category B)	Total Airborne Dose Rate (mrem/hour of inhalation)	Airborne Concentration µCi/mL	Non-RI Particulate Airborne Dose Rate CEDE (mrem/hour of inhalation)	Thyroid CDE from Iodine (mrem/hr of inhalation)	Thyroid CEDE from Iodine (mrem/hr of inhalation)	General Area (GA) Dose Rate (mrem/hour)
250	463000	5.98E+08	0.334	4.50E-09	0.282	1.04	0.05	0.01
225	416700	5.10E+08	0.392	5.28E-09	0.331	1.21	0.06	0.01
200	370400	4.27E+08	0.468	6.31E-09	0.396	1.45	0.07	0.02
175	324100	3.49E+08	0.573	7.72E-09	0.484	1.78	0.09	0.02
150	277800	2.76E+08	0.724	9.76E-09	0.612	2.25	0.11	0.03
125	231500	2.09E+08	0.954	1.29E-08	0.807	2.96	0.15	0.03
100	185200	1.49E+08	1.341	1.81E-08	1.133	4.16	0.21	0.05
90	166680	1.27E+08	1.573	2.12E-08	1.330	4.88	0.24	0.05
60	112972	6.81E+07	2.933	3.95E-08	2.480	9.10	0.45	0.10
50	92600	5.14E+07	3.888	5.24E-08	3.287	12.06	0.60	0.14
30	55560	2.31E+07	8.650	1.17E-07	7.313	26.83	1.34	0.30
20	37040	1.21E+07	16.514	2.23E-07	13.962	51.23	2.56	0.58
15	27780	7.62E+06	26.224	3.53E-07	22.170	81.35	4.07	0.92
10	18520	3.90E+06	51.237	6.91E-07	43.317	158.94	7.95	1.79
5	9260	1.19E+06	167.920	2.26E-06	141.962	520.91	26.05	5.86
1	1852	6.05E+04	3,302.882	4.45E-05	2792.315	10,245.91	512.30	115.34

The particulate airborne dose rate is derived from the airborn concentration with the iodines removed
The thyroid dose is calulated based on the iodines that were removed from the particulate aiborne sample data
This dose estimate assumes no KI was taken
Win d speed is taken into account by the Pasquill Stability Class assumption
Over 1000 samples have been taken that are consistent with this chart
Groundshine is not included because it is insignificant at larger distances, however it needs to be reevaluated inside 50 miles

Input values

Airborne Conc.	7.72E-09 µCi/ml	Average airborne reading at Yokosuka, March 15 / 16, 2011 [Yokosuka dose assessment.xlsx file]
SOFL Limit	3.37E-09 µCi/ml	(SOFL Limit Based on barge sample at Yokosuka without Iodine)
Annual Limit	500 mrem	
Hours per Year	2000 hrs	
External Rad. Measurement	0.02 mR/hr	Reading at Yokosuka [basis date & time needed]

This value is the external rad measurement, all others in column based on dispersion of this value
This value is based on the SOFL Limit, all others in column based on dispersion of this value
This value is based on the dose to the thyroid from iodine using ICRP-68 dose conversion factors and ratioing that value to the SOFL.

1 Hr TEDE (Non-RI CEDE + I CEDE + GA EDE) (mrem/hr)
0.35
0.41
0.48
0.59
0.75
0.99
1.39
1.63
3.04
4.03
8.96
17.10
27.15
53.05
173.87
3,419.95

Plume Predictive Model Based on Multiple Sources of Navy Measurements and Thumbrules

YR-95 (GW) Sample Decayed Corrected Seven Days To March 22, 2011 0700 JST 3/23/11 0302 hrs JST

Distance (Nautical Miles)	Meters	$\sigma_y{}^*\sigma_z$ (m²) (Category C)	Total Airborne Dose Rate (mrem/hour of inhalation)	Airborne Concentration µCi/mL	Non-RI Particulate Airborne Dose Rate CEDE (mrem/hour of inhalation)	Thyroid CDE from Iodine (mrem/hr of inhalation)	Thyroid CEDE from Iodine (mrem/hr of inhalation)	General Area (GA) Dose Rate (mrem/hour)
250	463000	2.84E+07	0.398	5.37E-09	0.337	1.24	0.06	0.01
225	416700	2.72E+07	0.415	5.59E-09	0.351	1.29	0.06	0.01
200	370400	2.26E+07	0.500	6.74E-09	0.422	1.55	0.08	0.02
175	324100	1.97E+07	0.573	7.72E-09	0.484	1.78	0.09	0.02
150	277800	1.68E+07	0.671	9.04E-09	0.567	2.08	0.10	0.02
125	231500	1.40E+07	0.809	1.09E-08	0.684	2.51	0.13	0.03
100	185200	1.11E+07	1.019	1.37E-08	0.862	3.16	0.16	0.04
90	166680	9.93E+06	1.137	1.53E-08	0.961	3.53	0.18	0.04
60	112972	6.78E+06	1.665	2.25E-08	1.408	5.17	0.26	0.06
50	92600	5.33E+06	2.117	2.85E-08	1.790	6.57	0.33	0.07
30	55560	3.05E+06	3.703	4.99E-08	3.131	11.49	0.57	0.13
20	37040	1.92E+06	5.880	7.93E-08	4.971	18.24	0.91	0.21
15	27780	1.36E+06	8.273	1.12E-07	6.994	25.66	1.28	0.29
10	18520	8.24E+05	13.699	1.85E-07	11.582	42.50	2.12	0.48
5	9260	3.22E+05	35.063	4.73E-07	29.643	108.77	5.44	1.22
1	1852	2.37E+04	476.657	6.43E-06	402.974	1,478.64	73.93	16.65

The particulate airborne dose rate is derived from the airborn concentration with the iodines removed
The thyroid dose is calulated based on the iodines that were removed from the particulate aiborne sample data
This dose estimate assumes no KI was taken
Win d speed is taken into account by the Pasquill Stability Class assumption
Over 1000 samples have been taken that are consistent with this chart
Groundshine is not included because it is insignificant at larger distances, however it needs to be reevaluated inside 50 miles

<u>Input values</u>

Airborne Conc.	7.72E-09 µCi/ml	Average airborne reading at Yokosuka, March 15 / 16, 2011 [Yokosuka dose assessment.xlsx file]
SOFL Limit	3.37E-09 µCi/ml	(SOFL Limit Based on barge sample at Yokosuka without Iodine)
Annual Limit	500 mrem	
Hours per Year	2000 hrs	
External Rad. Measurement	0.02 mR/hr	Reading at Yokosuka [basis date & time needed]

This value is the external rad measurement, all others in column based on dispersion of this value
This value is based on the SOFL Limit, all others in column based on dispersion of this value
This value is based on the dose to the thyroid from iodine using ICRP-68 dose conversion factors and ratioing that value to the SOFL.

1 Hr TEDE (Non-RI CEDE + I CEDE + GA EDE) (mrem/hr)
0.41
0.43
0.52
0.59
0.69
0.84
1.06
1.18
1.72
2.19
3.83
6.09
8.57
14.18
36.31
493.55

Plume Predictive Model Based on Multiple Sources of Navy Measurements and Thumbrules

YR-95 (GW) Sample Decayed Corrected Seven Days To March 22, 2011 0700 JST   3/23/11 0302 hrs JST

Distance (Nautical Miles)	Meters	$\sigma_y{}^*\sigma_z$ (m²) (Category D)	Total Airborne Dose Rate (mrem/hour of inhalation)	Airborne Concentration µCi/mL	Non-RI Particulate Airborne Dose Rate CEDE (mrem/hour of inhalation)	Thyroid CDE from Iodine (mrem/hr of inhalation)	Thyroid CEDE from Iodine (mrem/hr of inhalation)	General Area (GA) Dose Rate (mrem/hour)	1 Hr TEDE (Non-RI CEDE + I CEDE + GA EDE) (mrem/hr)
250	463000	5.67E+06	0.399	5.38E-09	0.337	1.24	0.06	0.01	0.41
225	416700	5.10E+06	0.444	5.98E-09	0.375	1.38	0.07	0.02	0.46
200	370400	4.53E+06	0.500	6.74E-09	0.423	1.55	0.08	0.02	0.52
175	324100	3.95E+06	0.573	7.72E-09	0.484	1.78	0.09	0.02	0.59
150	277800	3.38E+06	0.670	9.03E-09	0.566	2.08	0.10	0.02	0.69
125	231500	2.81E+06	0.807	1.09E-08	0.682	2.50	0.13	0.03	0.84
100	185200	2.23E+06	1.014	1.37E-08	0.857	3.15	0.16	0.04	1.05
90	166680	2.00E+06	1.130	1.52E-08	0.956	3.51	0.18	0.04	1.17
60	112972	1.32E+06	1.721	2.32E-08	1.455	5.34	0.27	0.06	1.78
50	92600	1.09E+06	2.083	2.81E-08	1.761	6.46	0.32	0.07	2.16
30	55560	6.30E+05	3.592	4.84E-08	3.037	11.14	0.56	0.13	3.72
20	37040	4.04E+05	5.606	7.56E-08	4.740	17.39	0.87	0.20	5.80
15	27780	2.92E+05	7.758	1.05E-07	6.559	24.07	1.20	0.27	8.03
10	18520	1.82E+05	12.455	1.68E-07	10.530	38.64	1.93	0.43	12.90
5	9260	7.69E+04	29.449	3.97E-07	24.897	91.35	4.57	1.03	30.49
1	1852	7.78E+03	290.911	3.92E-06	245.942	902.44	45.12	10.16	301.22

The particulate airborne dose rate is derived from the airborn concentration with the iodines removed
The thyroid dose is calulated based on the iodines that were removed from the particulate aiborne sample data
This dose estimate assumes no KI was taken
Win d speed is taken into account by the Pasquill Stability Class assumption
Over 1000 samples have been taken that are consistent with this chart
Groundshine is not included because it is insignificant at larger distances, however it needs to be reevaluated inside 50 miles

Input values

Airborne Conc.	7.72E-09 µCi/ml	Average airborne reading at Yokosuka, March 15 / 16, 2011 [Yokosuka dose assessment.xlsx file]
SOFL Limit	3.37E-09 µCi/ml	(SOFL Limit Based on barge sample at Yokosuka without Iodine)
Annual Limit	500 mrem	
Hours per Year	2000 hrs	
External Rad. Measurement	0.02 mR/hr	Reading at Yokosuka [basis date & time needed]

This value is the external rad measurement, all others in column based on dispersion of this value
This value is based on the SOFL Limit, all others in column based on dispersion of this value
This value is based on the dose to the thyroid from iodine using ICRP-68 dose conversion factors and ratioing that value to the SOFL.

Plume Predictive Model Based on Multiple Sources of Navy Measurements and Thumbrules

YR-95 (GW) Sample Decayed Corrected Seven Days To March 22, 2011 0700 JST **3/23/11 0302 hrs JST**

Distance (Nautical Miles)	Meters	$\sigma_y{}^*\sigma_z$ (m²) (Category E)	Total Airborne Dose Rate (mrem/hour of inhalation)	Airborne Concentration µCi/mL	Non-RI Particulate Airborne Dose Rate CEDE (mrem/hour of inhalation)	Thyroid CDE from Iodine (mrem/hr of inhalation)	Thyroid CEDE from Iodine (mrem/hr of inhalation)	General Area (GA) Dose Rate (mrem/hour)
250	463000	4.74E+06	0.398	5.37E-09	0.337	1.24	0.06	0.01
225	416700	4.26E+06	0.443	5.98E-09	0.375	1.38	0.07	0.02
200	370400	3.78E+06	0.500	6.74E-09	0.423	1.55	0.08	0.02
175	324100	3.30E+06	0.573	7.72E-09	0.484	1.78	0.09	0.02
150	277800	2.82E+06	0.670	9.04E-09	0.567	2.08	0.10	0.02
125	231500	2.34E+06	0.808	1.09E-08	0.683	2.51	0.13	0.03
100	185200	1.86E+06	1.017	1.37E-08	0.860	3.16	0.16	0.04
90	166680	1.67E+06	1.135	1.53E-08	0.959	3.52	0.18	0.04
60	112972	1.09E+06	1.734	2.34E-08	1.466	5.38	0.27	0.06
50	92600	8.98E+05	2.104	2.84E-08	1.779	6.53	0.33	0.07
30	55560	5.16E+05	3.661	4.94E-08	3.095	11.36	0.57	0.13
20	37040	3.27E+05	5.777	7.79E-08	4.884	17.92	0.90	0.20
15	27780	2.34E+05	8.080	1.09E-07	6.831	25.07	1.25	0.28
10	18520	1.43E+05	13.238	1.78E-07	11.192	41.07	2.05	0.46
5	9260	5.72E+04	33.034	4.45E-07	27.928	102.48	5.12	1.15
1	1852	4.55E+03	415.708	5.60E-06	351.447	1,289.57	64.48	14.52

The particulate airborne dose rate is derived from the airborn concentration with the iodines removed
The thyroid dose is calulated based on the iodines that were removed from the particulate aiborne sample data
This dose estimate assumes no KI was taken
Win d speed is taken into account by the Pasquill Stability Class assumption
Over 1000 samples have been taken that are consistent with this chart
Groundshine is not included because it is insignificant at larger distances, however it needs to be reevaluated inside 50 miles

<u>Input values</u>

Airborne Conc.	7.72E-09 µCi/ml	Average airborne reading at Yokosuka, March 15 / 16, 2011 [Yokosuka dose assessment.xlsx file]
SOFL Limit	3.37E-09 µCi/ml	(SOFL Limit Based on barge sample at Yokosuka without Iodine)
Annual Limit	500 mrem	
Hours per Year	2000 hrs	
External Rad. Measurement	0.02 mR/hr	Reading at Yokosuka [basis date & time needed]

This value is the external rad measurement, all others in column based on dispersion of this value
This value is based on the SOFL Limit, all others in column based on dispersion of this value
This value is based on the dose to the thyroid from iodine using ICRP-68 dose conversion factors and ratioing that value to the SOFL.

1 Hr TEDE (Non-RI CEDE + I CEDE + GA EDE) (mrem/hr)
0.41
0.46
0.52
0.59
0.69
0.84
1.05
1.17
1.80
2.18
3.79
5.98
8.37
13.71
34.20
430.44

Plume Predictive Model Based on Multiple Sources of Navy Measurements and Thumbrules

YR-95 (GW) Sample Decayed Corrected Seven Days To March 22, 2011 0700 JST 3/23/11 0302 hrs JST

Distance (Nautical Miles)	Meters	$\sigma_y{}^*\sigma_z$ (m²) (Category F)	Total Airborne Dose Rate (mrem/hour of inhalation)	Airborne Concentration µCi/mL	Non-RI Particulate Airborne Dose Rate CEDE (mrem/hour of inhalation)	Thyroid CDE from Iodine (mrem/hr of inhalation)	Thyroid CEDE from Iodine (mrem/hr of inhalation)	General Area (GA) Dose Rate (mrem/hour)
250	463000	3.16E+06	0.398	5.37E-09	0.337	1.24	0.06	0.01
225	416700	2.84E+06	0.444	5.98E-09	0.375	1.38	0.07	0.02
200	370400	2.52E+06	0.500	6.74E-09	0.423	1.55	0.08	0.02
175	324100	2.20E+06	0.573	7.72E-09	0.484	1.78	0.09	0.02
150	277800	1.88E+06	0.670	9.04E-09	0.567	2.08	0.10	0.02
125	231500	1.56E+06	0.808	1.09E-08	0.683	2.51	0.13	0.03
100	185200	1.24E+06	1.017	1.37E-08	0.860	3.16	0.16	0.04
90	166680	1.11E+06	1.135	1.53E-08	0.959	3.52	0.18	0.04
60	112972	7.27E+05	1.734	2.34E-08	1.466	5.38	0.27	0.06
50	92600	5.99E+05	2.104	2.84E-08	1.779	6.53	0.33	0.07
30	55560	3.44E+05	3.661	4.94E-08	3.095	11.36	0.57	0.13
20	37040	2.18E+05	5.777	7.79E-08	4.884	17.92	0.90	0.20
15	27780	1.56E+05	8.080	1.09E-07	6.831	25.07	1.25	0.28
10	18520	9.52E+04	13.238	1.78E-07	11.192	41.07	2.05	0.46
5	9260	3.81E+04	33.034	4.45E-07	27.928	102.48	5.12	1.15
1	1852	3.03E+03	415.708	5.60E-06	351.447	1,289.57	64.48	14.52

The particulate airborne dose rate is derived from the airborn concentration with the iodines removed
The thyroid dose is calulated based on the iodines that were removed from the particulate aiborne sample data
This dose estimate assumes no KI was taken
Win d speed is taken into account by the Pasquill Stability Class assumption
Over 1000 samples have been taken that are consistent with this chart
Groundshine is not included because it is insignificant at larger distances, however it needs to be reevaluated inside 50 miles

<u>Input values</u>

Airborne Conc.	7.72E-09 µCi/ml	Average airborne reading at Yokosuka, March 15 / 16, 2011 [Yokosuka dose assessment.xlsx file]
SOFL Limit	3.37E-09 µCi/ml	(SOFL Limit Based on barge sample at Yokosuka without Iodine)
Annual Limit	500 mrem	
Hours per Year	2000 hrs	
External Rad. Measurement	0.02 mR/hr	Reading at Yokosuka [basis date & time needed]

This value is the external rad measurement, all others in column based on dispersion of this value
This value is based on the SOFL Limit, all others in column based on dispersion of this value
This value is based on the dose to the thyroid from iodine using ICRP-68 dose conversion factors and ratioing that value to the SOFL.

1 Hr TEDE (Non-RI CEDE + I CEDE + GA EDE) (mrem/hr)
0.41
0.46
0.52
0.59
0.69
0.84
1.05
1.17
1.80
2.18
3.79
5.98
8.37
13.71
34.20
430.44

Radionuclide	Listed Half Life	Listed units	Half Life (years)	Old Air Limit uCi/ml	New Air Limit uCi/ml	Old Water Limit uCi/ml
Ac-225	1.00E+01	D	2.74E-02	2.00E-11	8.00E-12	7.00E-07
Ac-227	2.18E+01	Y	2.18E+01	3.00E-14	2.00E-14	5.00E-09
Ac-228	6.13E+00	H	7.00E-04	7.00E-10	6.00E-10	3.00E-05
Ag-106m	8.46E+00	D	2.32E-02	3.00E-08	2.00E-08	1.00E-05
Ag-108	2.37E+00	M	4.51E-06	2.00E-05	2.00E-05	-
Ag-108m	1.27E+02	Y	1.27E+02	1.00E-09	2.00E-09	9.00E-06
Ag-109m	3.96E+01	S	1.26E-06	1.00E-04	1.00E-04	6.00E-06
Ag-110	2.46E+01	S	7.79E-07	9.00E-06	9.00E-06	6.00E-06
Ag-110m	2.50E+02	D	6.85E-01	4.00E-09	7.00E-09	6.00E-06
Ag-111	7.46E+00	D	2.04E-02	4.00E-08	3.00E-08	2.00E-05
Al-26	7.20E+05	Y	7.20E+05	3.00E-09	3.00E-09	6.00E-06
Al-28	2.24E+00	M	4.26E-06	2.00E-07	2.00E-07	-
Am-241	4.32E+02	Y	4.32E+02	5.00E-13	5.00E-13	2.00E-08
Am-242	1.60E+01	H	1.83E-03	4.00E-09	4.00E-09	5.00E-05
Am-242m	1.52E+02	Y	1.52E+02	5.00E-13	5.00E-13	2.00E-08
Am-243	7.38E+03	Y	7.38E+03	5.00E-13	5.00E-13	2.00E-08
Am-244	1.01E+01	H	1.15E-03	7.00E-09	1.00E-08	-
Am-245	1.22E+02	M	2.33E-04	3.00E-06	5.00E-07	-
Am-246	2.50E+01	M	4.76E-05	4.00E-07	2.00E-07	-
Ar-37	3.50E+01	D	9.59E-02	3.00E-01	1.00E-01	-
Ar-39	2.69E+02	Y	2.69E+02	2.00E-05	4.00E-05	1.00E-06
Ar-41	1.83E+00	H	2.09E-04	3.00E-07	1.00E-07	-
As-72	2.60E+01	H	2.97E-03	6.00E-08	4.00E-08	2.00E-04
As-73	8.03E+01	D	2.20E-01	7.00E-08	8.00E-08	1.00E-04
As-74	1.78E+01	D	4.87E-02	3.00E-08	3.00E-08	2.00E-05
As-76	2.63E+01	H	3.00E-03	6.00E-08	6.00E-08	1.00E-05
As-77	3.88E+01	H	4.43E-03	2.00E-07	1.00E-07	-
At-211	7.21E+00	H	8.24E-04	2.00E-09	5.00E-10	2.00E-06
At-217	3.23E-02	S	1.02E-09	-	-	-
Au-194	3.95E+01	H	4.51E-03	2.00E-07	9.00E-08	4.00E-05
Au-195	1.83E+02	D	5.01E-01	2.00E-08	4.00E-08	7.00E-05
Au-195m	3.06E+01	S	9.70E-07	2.00E-06	2.00E-06	-
Au-196	6.18E+00	D	1.69E-02	-	-	-
Au-198	2.70E+00	D	7.39E-03	7.00E-08	5.00E-08	2.00E-05
Au-198m	2.27E+00	D	6.22E-03	5.00E-08	2.00E-08	1.00E-05
Au-199	3.14E+00	D	8.60E-03	2.00E-07	7.00E-08	4.00E-05
Ba-131	1.18E+01	D	3.23E-02	3.00E-07	1.00E-07	4.00E-05
Ba-133	1.05E+01	Y	1.05E+01	3.00E-08	3.00E-08	2.00E-05
Ba-133m	3.89E+01	H	4.44E-03	4.00E-07	2.00E-07	-
Ba-135m	2.87E+01	H	3.28E-03	5.00E-07	2.00E-07	4.00E-05
Ba-137m	2.55E+00	M	4.86E-06	7.00E-07	7.00E-07	0.00E+00
Ba-139	8.31E+01	M	1.58E-04	1.00E-06	1.00E-06	2.00E-04
Ba-140	1.28E+01	D	3.50E-02	6.00E-08	3.00E-08	8.00E-06
Ba-141	1.83E+01	M	3.48E-05	5.00E-07	1.00E-06	3.00E-04
Ba-142	1.07E+01	M	2.04E-05	5.00E-07	9.00E-07	7.00E-04
Be-10	1.60E+06	Y	1.60E+06	6.00E-10	6.00E-10	-

Be-7	5.34E+01	D	1.46E-01	8.00E-07	8.00E-07	6.00E-04
Bi-206	6.24E+00	D	1.71E-02	4.00E-08	2.00E-08	9.00E-06
Bi-207	3.34E+01	Y	3.34E+01	2.00E-08	1.00E-08	1.00E-05
Bi-208	3.68E+05	Y	3.68E+05	-	-	-
Bi-210	5.01E+00	D	1.37E-02	1.00E-09	9.00E-10	1.00E-05
Bi-211	2.13E+00	M	4.05E-06	1.00E-05	1.00E-05	-
Bi-212	6.06E+01	M	1.15E-04	1.00E-08	8.00E-10	7.00E-05
Bi-213	4.57E+01	M	8.69E-05	1.00E-08	7.00E-10	1.00E-04
Bi-214	1.99E+01	M	3.79E-05	3.00E-08	1.00E-09	3.00E-04
Bk-249	3.20E+02	D	8.77E-01	9.00E-11	1.00E-10	-
Bk-250	3.22E+00	H	3.68E-04	2.00E-08	2.00E-08	1.00E-04
Bk-251	5.70E+01	M	1.08E-04	-	-	-
Br-77	5.70E+01	H	6.51E-03	8.00E-07	2.00E-07	2.00E-04
Br-80	1.74E+01	M	3.31E-05	5.00E-06	2.00E-06	-
Br-80m	4.42E+00	H	5.05E-04	6.00E-07	5.00E-07	3.00E-04
Br-82	3.53E+01	H	4.03E-03	1.00E-07	3.00E-08	4.00E-05
Br-83	2.39E+00	H	2.73E-04	3.00E-06	6.00E-07	9.00E-04
Br-84	3.18E+01	M	6.05E-05	2.00E-07	5.00E-07	-
Br-85	1.72E+02	S	5.45E-06	5.00E-06	5.00E-06	-
C-11	2.05E+01	M	3.90E-05	4.00E-07	1.00E-05	-
C-14 (CO)	5.73E+03	Y	5.73E+03	7.00E-05	7.00E-05	-
C-14 (CO2)	5.73E+03	Y	5.73E+03	9.00E-06	8.00E-06	-
C-14 (ORG)	5.73E+03	Y	5.73E+03	1.00E-07	9.00E-08	3.00E-05
C-15	2.45E+00	S	7.77E-08	-	-	-
Ca-41	1.03E+05	Y	1.03E+05	2.00E-07	2.00E-07	6.00E-05
Ca-45	1.63E+02	D	4.46E-01	3.00E-08	2.00E-08	2.00E-05
Ca-47	4.54E+00	D	1.24E-02	4.00E-08	2.00E-08	1.00E-05
Ca-49	8.72E+00	M	1.66E-05	-	-	-
Cd-109	4.64E+02	D	1.27E+00	2.00E-09	2.00E-09	6.00E-06
Cd-111m	4.87E+01	M	9.27E-05	1.00E-06	1.00E-06	-
Cd-113	9.30E+15	Y	9.30E+15	9.00E-11	1.00E-10	-
Cd-113m	1.37E+01	Y	1.37E+01	1.00E-10	1.00E-10	5.00E-07
Cd-115	5.35E+01	H	6.10E-03	5.00E-08	4.00E-08	1.00E-05
Cd-115m	4.46E+01	D	1.22E-01	3.00E-09	3.00E-09	4.00E-06
Cd-117	2.49E+00	H	2.84E-04	4.00E-07	2.00E-07	6.00E-05
Cd-117m	3.36E+00	H	3.84E-04	2.00E-07	1.00E-07	6.00E-05
Ce-139	1.38E+02	D	3.77E-01	3.00E-08	4.00E-08	7.00E-05
Ce-141	3.25E+01	D	8.90E-02	2.00E-08	1.00E-08	3.00E-05
Ce-143	3.30E+01	H	3.77E-03	7.00E-08	5.00E-08	2.00E-05
Ce-144	2.84E+02	D	7.79E-01	6.00E-10	1.00E-09	3.00E-06
Cf-248	3.34E+02	D	9.14E-01	4.00E-12	5.00E-12	-
Cf-249	3.51E+02	Y	3.51E+02	2.00E-13	3.00E-13	-
Cf-250	1.31E+01	Y	1.31E+01	5.00E-13	7.00E-13	-
Cf-251	9.00E+02	Y	9.00E+02	2.00E-13	3.00E-13	-
Cf-252	2.64E+00	Y	2.64E+00	2.00E-12	1.00E-12	7.00E-08
Cf-253	1.78E+01	D	4.88E-02	7.00E-11	5.00E-11	-
Cf-254	6.05E+01	D	1.66E-01	7.00E-13	2.00E-12	3.00E-08
Cl-36	3.01E+05	Y	3.01E+05	1.00E-08	1.00E-08	2.00E-05
Cl-38	3.72E+01	M	7.08E-05	3.00E-07	5.00E-07	3.00E-04
Cm-242	1.63E+02	D	4.47E-01	1.00E-11	1.00E-11	7.00E-07
Cm-243	2.85E+01	Y	2.85E+01	3.00E-13	7.00E-13	-
Cm-244	1.81E+01	Y	1.81E+01	8.00E-13	9.00E-13	3.00E-08

Cm-245	8.50E+03	Y	8.50E+03	2.00E-13	5.00E-13	-
Cm-246	4.75E+03	Y	4.75E+03	2.00E-13	5.00E-13	-
Cm-247	1.56E+07	Y	1.56E+07	2.00E-13	5.00E-13	-
Cm-248	3.39E+05	Y	3.39E+05	1.00E-13	1.00E-13	5.00E-09
Cm-249	6.42E+01	M	1.22E-04	6.00E-07	8.00E-07	7.00E-04
Cm-250	6.90E+03	Y	6.90E+03	-	2.00E-14	-
Co-56	7.88E+01	D	2.16E-01	8.00E-09	1.00E-08	6.00E-06
Co-57	2.71E+02	D	7.42E-01	3.00E-08	9.00E-08	6.00E-05
Co-58	7.08E+01	D	1.94E-01	3.00E-08	3.00E-08	2.00E-05
Co-58m	9.15E+00	H	1.04E-03	3.00E-06	3.00E-06	8.00E-04
Co-60	5.27E+00	Y	5.27E+00	1.00E-09	3.00E-09	3.00E-06
Co-60m	1.05E+01	M	1.99E-05	1.00E-04	4.00E-05	-
Co-61	1.65E+00	H	1.88E-04	2.00E-06	6.00E-07	3.00E-04
Cr-49	4.21E+01	M	8.01E-05	5.00E-07	5.00E-07	4.00E-04
Cr-51	2.77E+01	D	7.59E-02	8.00E-07	1.00E-06	5.00E-04
Cs-126	1.64E+00	M	3.12E-06	4.00E-07	4.00E-07	-
Cs-129	3.21E+01	H	3.66E-03	1.00E-06	2.00E-07	3.00E-04
Cs-131	9.69E+00	D	2.65E-02	1.00E-06	7.00E-07	3.00E-04
Cs-132	6.48E+00	D	1.77E-02	2.00E-07	9.00E-08	4.00E-05
Cs-134	2.06E+00	Y	2.06E+00	4.00E-09	5.00E-09	9.00E-07
Cs-134m	2.90E+00	H	3.31E-04	6.00E-06	8.00E-07	-
Cs-135	2.30E+06	Y	2.30E+06	5.00E-08	5.00E-08	1.00E-05
Cs-136	1.32E+01	D	3.61E-02	3.00E-08	2.00E-08	6.00E-06
Cs-137	3.02E+01	Y	3.02E+01	7.00E-09	8.00E-09	1.00E-06
Cs-138	3.22E+01	M	6.13E-05	2.00E-07	5.00E-07	4.00E-04
Cs-139	9.40E+00	M	1.79E-05	1.00E-06	1.00E-06	-
Cu-61	3.41E+00	H	3.89E-04	5.00E-07	3.00E-07	2.00E-04
Cu-62	9.74E+00	M	1.85E-05	5.00E-07	5.00E-07	-
Cu-64	1.27E+01	H	1.45E-03	9.00E-07	3.00E-07	2.00E-04
Cu-67	6.19E+01	H	7.06E-03	2.00E-07	9.00E-08	6.00E-05
Dy-157	8.06E+00	H	9.20E-04	1.00E-06	5.00E-07	3.00E-04
Dy-165	2.33E+00	H	2.66E-04	2.00E-06	6.00E-07	2.00E-04
Dy-166	8.16E+01	H	9.32E-03	3.00E-08	3.00E-08	1.00E-05
Er-169	9.40E+00	D	2.58E-02	1.00E-07	6.00E-08	5.00E-05
Er-171	7.52E+00	H	8.58E-04	4.00E-07	1.00E-07	5.00E-05
Es-253	2.05E+01	D	5.61E-02	6.00E-11	2.00E-11	-
Es-254	2.76E+02	D	7.55E-01	4.00E-12	6.00E-12	-
Es-254m	3.93E+01	H	4.49E-03	4.00E-10	1.00E-10	-
Es-255	3.98E+01	D	1.09E-01	-	-	-
Eu-152	1.36E+01	Y	1.36E+01	1.00E-09	2.00E-09	1.00E-05
Eu-152m	9.32E+00	H	1.06E-03	3.00E-07	1.00E-07	4.00E-05
Eu-154	8.80E+00	Y	8.80E+00	8.00E-10	1.00E-09	7.00E-06
Eu-155	4.96E+00	Y	4.96E+00	5.00E-09	7.00E-09	5.00E-05
Eu-156	1.52E+01	D	4.16E-02	2.00E-08	1.00E-08	8.00E-06
F-18	1.10E+02	M	2.09E-04	4.00E-07	3.00E-07	7.00E-04
Fe-52	8.28E+00	H	9.45E-04	1.00E-07	1.00E-07	1.00E-05
Fe-55	2.70E+00	Y	2.70E+00	8.00E-08	6.00E-08	1.00E-04
Fe-59	4.46E+01	D	1.22E-01	1.00E-08	1.00E-08	1.00E-05
Fm-254	3.24E+00	H	3.70E-04	4.00E-09	6.00E-10	4.00E-05
Fm-255	2.01E+01	H	2.29E-03	9.00E-10	2.00E-10	7.00E-06
Fm-256	1.58E+02	M	3.00E-04	-	-	-
Fr-221	4.80E+00	M	9.13E-06	-	-	-

Fr-223	2.18E+01	M	4.15E-05	3.00E-08	4.00E-08	8.00E-06
Ga-66	9.40E+00	H	1.07E-03	1.00E-07	7.00E-08	1.00E-05
Ga-67	3.26E+00	D	8.93E-03	4.00E-07	2.00E-07	1.00E-04
Ga-68	6.80E+01	M	1.29E-04	5.00E-07	4.00E-07	2.00E-04
Ga-72	1.41E+01	H	1.61E-03	1.00E-07	5.00E-08	2.00E-05
Gd-148	7.50E+01	Y	7.50E+01	6.00E-13	5.00E-13	3.00E-07
Gd-152	1.10E+14	Y	1.10E+14	9.00E-13	7.00E-13	4.00E-07
Gd-153	2.42E+02	D	6.62E-01	6.00E-09	9.00E-09	6.00E-05
Gd-159	1.86E+01	H	2.12E-03	2.00E-07	1.00E-07	4.00E-05
Gd-162	9.70E+00	M	1.85E-05	1.00E-06	1.00E-06	-
Ge-68	2.88E+02	D	7.89E-01	4.00E-09	7.00E-09	6.00E-05
Ge-71	1.18E+01	D	3.23E-02	2.00E-06	5.00E-06	7.00E-03
Ge-77	1.13E+01	H	1.29E-03	2.00E-07	1.00E-07	1.00E-04
H-3 (ELEMENT)	1.23E+01	Y	1.23E+01	5.00E-02	2.00E-02	1.00E-03
H-3 (WATER)	1.23E+01	Y	1.23E+01	2.00E-06	2.00E-06	1.00E-03
Hf-175	7.00E+01	D	1.92E-01	4.00E-08	5.00E-08	4.00E-05
Hf-178m1	4.00E+00	S	1.27E-07	9.00E-11	-	3.00E-06
Hf-178m2	3.10E+01	Y	3.10E+01	9.00E-11	-	3.00E-06
Hf-178m	3.10E+01	Y	3.10E+01	9.00E-11	8.00E-11	3.00E-06
Hf-179m	2.51E+01	D	6.88E-02	2.00E-08	1.00E-08	1.00E-05
Hf-180m	5.52E+00	H	6.30E-04	9.00E-07	1.00E-07	1.00E-04
Hf-181	4.24E+01	D	1.16E-01	1.00E-08	1.00E-08	2.00E-05
Hf-182	9.00E+06	Y	9.00E+06	6.27E-11	-	4.32E-06
Hg-197	6.41E+01	H	7.32E-03	-	2.00E-07	-
Hg-197m	2.38E+01	H	2.72E-03	-	8.00E-08	-
Hg-203 (INORG)	4.66E+01	D	1.28E-01	5.00E-08	2.00E-08	3.00E-02
Hg-203 (ORG)	4.66E+01	D	1.28E-01	3.00E-08	7.00E-08	7.00E-06
Hg-203 (VAPOR)	4.66E+01	D	1.28E-01	3.00E-08	8.00E-09	-
Ho-166	2.68E+01	H	3.06E-03	7.00E-08	6.00E-08	-
Ho-166m	1.20E+03	Y	1.20E+03	3.00E-10	7.00E-10	9.00E-06
I-122	3.62E+00	M	6.89E-06	5.00E-07	5.00E-07	-
I-123	1.31E+01	H	1.50E-03	3.00E-07	2.00E-07	-
I-124	4.18E+00	D	1.15E-02	3.00E-09	4.00E-09	-
I-125	6.01E+01	D	1.65E-01	3.00E-09	3.00E-09	-
I-126	1.29E+01	D	3.54E-02	1.00E-09	2.00E-09	-
I-128	2.50E+01	M	4.75E-05	5.00E-06	1.00E-06	-
I-129	1.57E+07	Y	1.57E+07	1.00E-09	5.00E-10	2.00E-07
I-130	1.24E+01	H	1.41E-03	8.00E-08	3.00E-08	2.00E-05
I-131	8.04E+00	D	2.20E-02	6.00E-09	2.00E-09	1.00E-06
I-132	2.30E+00	H	2.63E-04	2.00E-07	2.00E-07	1.00E-04
I-133	2.08E+01	H	2.37E-03	3.00E-08	1.00E-08	7.00E-06
I-134	5.26E+01	M	1.00E-04	1.00E-07	3.00E-07	4.00E-04
I-135	6.61E+00	H	7.55E-04	7.00E-08	6.00E-08	3.00E-05
I-136	8.30E+01	S	2.63E-06	1.00E-07	1.00E-07	-
In-111	2.83E+00	D	7.75E-03	3.00E-07	1.00E-07	6.00E-05
In-113m	1.66E+00	H	1.89E-04	2.00E-06	1.00E-06	7.00E-04
In-114	7.19E+01	S	2.28E-06	1.00E-05	1.00E-05	-
In-114m	4.95E+01	D	1.36E-01	3.00E-09	5.00E-09	-
In-115	4.60E+15	Y	4.60E+15	6.00E-11	1.00E-10	5.00E-07
In-115m	4.36E+00	H	4.98E-04	2.00E-06	5.00E-07	2.00E-04
In-116m	5.42E+01	M	1.03E-04	2.00E-07	3.00E-07	3.00E-04
In-117	4.38E+01	M	8.33E-05	7.00E-07	5.00E-07	-

In-117m	1.17E+02	M	2.22E-04	1.00E-06	4.00E-07	2.00E-04
Ir-190	1.18E+01	D	3.23E-02	4.00E-08	2.00E-08	1.00E-05
Ir-190m1	1.20E+00	H	1.37E-04	-	5.00E-06	-
Ir-190m2	3.20E+00	H	3.65E-04	-	2.00E-07	-
Ir-192	7.40E+01	D	2.03E-01	9.00E-08	1.00E-08	1.00E-04
Ir-192m	2.40E+02	Y	2.40E+02	6.00E-10	-	4.38E-5 (15)
Ir-193m	1.19E+01	D	3.26E-02	-	-	-
Ir-194	1.92E+01	H	2.19E-03	8.00E-08	7.00E-08	1.00E-05
Ir-194m	1.71E+02	D	4.68E-01	4.00E-09	6.00E-09	9.00E-06
K-40	1.28E+09	Y	1.28E+09	2.00E-08	1.00E-08	4.00E-06
K-42	1.24E+01	H	1.41E-03	2.00E-07	2.00E-07	6.00E-05
K-43	2.26E+01	H	2.58E-03	4.00E-07	9.00E-08	9.00E-05
Kr-79	3.50E+01	H	4.00E-03	2.00E-06	5.00E-07	-
Kr-81	2.10E+05	Y	2.10E+05	5.00E-05	2.00E-05	-
Kr-83m	1.83E+00	H	2.09E-04	5.00E-03	2.00E-03	-
Kr-85	1.07E+01	Y	1.07E+01	1.00E-05	2.00E-05	3.00E-06
Kr-85m	4.48E+00	H	5.11E-04	3.00E-06	9.00E-07	-
Kr-87	7.63E+01	M	1.45E-04	5.00E-07	1.00E-07	-
Kr-88	2.84E+00	H	3.24E-04	2.00E-07	6.00E-08	-
Kr-89	3.16E+00	M	6.01E-06	2.00E-07	2.00E-07	-
Kr-90	3.23E+01	S	1.02E-06	3.00E-07	3.00E-07	-
La-138	1.05E+11	Y	1.05E+11	2.00E-11	-	1.16E-05
La-140	4.02E+01	H	4.59E-03	5.00E-08	3.00E-08	9.00E-06
La-141	3.94E+00	H	4.50E-04	4.00E-07	2.00E-07	5.00E-05
La-142	9.54E+01	M	1.82E-04	1.00E-07	2.00E-07	1.00E-04
Lu-176	3.75E+10	Y	3.75E+10	3.00E-10	-	9.35E-06
Lu-177	6.71E+00	D	1.84E-02	9.00E-08	5.00E-08	4.00E-05
Lu-177m	1.60E+02	D	4.39E-01	3.00E-09	4.00E-09	1.00E-05
Mg-27	9.46E+00	M	1.80E-05	5.00E-07	5.00E-07	-
Mg-28	2.09E+01	H	2.39E-03	5.00E-08	3.00E-08	9.00E-06
Mn-52	5.59E+00	D	1.53E-02	4.00E-08	2.00E-08	1.00E-05
Mn-52m	2.14E+01	M	4.07E-05	2.00E-07	5.00E-07	-
Mn-53	3.70E+06	Y	3.70E+06	5.00E-07	5.00E-07	7.00E-04
Mn-54	3.13E+02	D	8.57E-01	3.00E-08	4.00E-08	3.00E-05
Mn-56	2.58E+00	H	2.94E-04	2.00E-07	2.00E-07	7.00E-05
Mn-57	1.47E+00	M	2.80E-06	6.00E-06	6.00E-06	-
Mo-101	1.46E+01	M	2.78E-05	3.00E-07	6.00E-07	-
Mo-91	1.55E+01	M	2.95E-05	4.00E-07	4.00E-07	-
Mo-93	3.50E+03	Y	3.50E+03	7.00E-09	2.00E-08	5.00E-05
Mo-99	6.60E+01	H	7.54E-03	6.00E-08	5.00E-08	2.00E-05
N-13	9.97E+00	M	1.90E-05	4.00E-07	4.00E-07	-
N-16	7.13E+00	S	2.26E-07	7.00E-08	7.00E-08	-
Na-22	2.60E+00	Y	2.60E+00	3.00E-08	2.00E-08	6.00E-06
Na-24	1.50E+01	H	1.71E-03	9.00E-08	4.00E-08	5.00E-05
Nb-90	1.46E+01	H	1.67E-03	1.00E-08	3.00E-08	1.00E-05
Nb-91	1.00E+04	Y	1.00E+04	-	-	-
Nb-91m	6.10E+01	D	1.67E-01	1.00E-07	1.00E-07	1.00E-05
Nb-92	3.60E+07	Y	3.60E+07	-	-	-
Nb-92m	1.02E+01	D	2.78E-02	-	-	-
Nb-93m	1.46E+01	Y	1.46E+01	7.00E-09	6.00E-08	2.00E-04
Nb-94	2.03E+04	Y	2.03E+04	6.00E-10	2.00E-09	1.00E-05
Nb-94m	6.26E+00	M	1.19E-05	9.00E-05	9.00E-05	-

Nb-95	3.51E+01	D	9.61E-02	5.00E-08	4.00E-08	3.00E-05
Nb-95m	8.66E+01	H	9.89E-03	9.00E-08	6.00E-08	3.00E-05
Nb-96	2.34E+01	H	2.67E-03	1.00E-07	4.00E-08	2.00E-05
Nb-97	7.21E+01	M	1.37E-04	7.00E-07	5.00E-07	3.00E-04
Nb-97m	6.00E+01	S	1.90E-06	6.00E-07	6.00E-07	-
Nd-147	1.10E+01	D	3.01E-02	3.00E-08	2.00E-08	2.00E-05
Nd-149	1.73E+00	H	1.97E-04	1.00E-06	4.00E-07	1.00E-04
Ni-56	6.10E+00	D	1.67E-02	-	4.00E-08	2.00E-05
Ni-57	3.61E+01	H	4.12E-03	2.00E-07	5.00E-08	2.00E-05
Ni-59	7.50E+04	Y	7.50E+04	2.00E-07	6.00E-08	3.00E-04
Ni-63 (INORG)	1.00E+02	Y	1.00E+02	7.00E-08	1.00E-07	1.00E-04
Ni-63 (VAPOR)	1.00E+02	Y	1.00E+02	3.00E-08	2.00E-08	-
Ni-65 (INORG)	2.52E+00	H	2.88E-04	1.00E-06	4.00E-07	1.00E+04
Ni-65 (VAPOR)	2.52E+00	H	2.88E-04	7.00E-07	8.00E-08	-
Np-235	3.96E+02	D	1.09E+00	5.00E-08	1.00E-07	-
Np-236	1.15E+05	Y	1.15E+05	-	4.00E-12	-
Np-236m	2.25E+01	H	2.57E-03	-	-	-
Np-237	2.14E+06	Y	2.14E+06	4.00E-13	8.00E-13	2.00E-08
Np-238	2.12E+00	D	5.80E-03	4.00E-09	1.00E-08	2.00E-05
Np-239	2.36E+00	D	6.45E-03	1.00E-07	5.00E-08	-
Np-240	6.50E+01	M	1.24E-04	4.00E-07	2.00E-07	3.00E-04
Np-240m	7.40E+00	M	1.41E-05	1.00E-06	1.00E-06	-
O-15	1.22E+02	S	3.88E-06	4.00E-07	4.00E-07	-
Os-185	9.36E+01	D	2.56E-01	2.00E-08	4.00E-08	3.00E-05
Os-186	2.00E+15	Y	2.00E+15	-	-	-
Os-190m	9.90E+00	M	1.88E-05	3.00E-07	3.00E-07	-
Os-191	1.54E+01	D	4.22E-02	6.00E-08	3.00E-08	-
Os-191m	1.30E+01	H	1.49E-03	7.00E-07	4.00E-07	2.00E-04
Os-193	3.00E+01	H	3.42E-03	1.00E-07	8.00E-08	-
Os-194	6.00E+00	y	6.00E+00	3.00E-10	-	6.30E-06
P-32	1.43E+01	D	3.92E-02	2.00E-08	1.00E-08	9.00E-06
P-33	2.54E+01	D	6.96E-02	1.00E-07	4.00E-08	8.00E-05
Pa-230	1.74E+01	D	4.77E-02	1.00E-10	9.00E-11	-
Pa-231	3.28E+04	Y	3.28E+04	2.00E-13	1.00E-13	6.00E-09
Pa-233	2.70E+01	D	7.40E-02	2.00E-08	1.00E-08	2.00E-05
Pa-234	6.70E+00	H	7.65E-04	1.00E-07	7.00E-08	3.00E-05
Pa-234m	1.17E+00	M	2.23E-06	4.00E-06	4.00E-06	-
Pb-203	5.20E+01	H	5.94E-03	4.00E-07	2.00E-07	7.00E-05
Pb-204m	6.69E+01	M	1.27E-04	2.00E-07	2.00E-07	-
Pb-205	1.51E+07	Y	1.51E+07	6.00E-08	9.00E-08	5.00E-05
Pb-209	3.25E+00	H	3.71E-04	2.00E-06	9.00E-07	3.00E-04
Pb-210	2.23E+01	Y	2.23E+01	2.00E-11	1.00E-11	1.00E-08
Pb-211	3.61E+01	M	6.87E-05	3.00E-08	4.00E-09	2.00E-04
Pb-212	1.06E+01	H	1.21E-03	1.00E-09	5.00E-10	2.00E-06
Pb-214	2.68E+01	M	5.10E-05	3.00E-08	4.00E-09	1.00E-04
Pd-103	1.70E+01	D	4.65E-02	1.00E-07	1.00E-07	-
Pd-107	6.50E+06	Y	6.50E+06	2.00E-08	1.00E-07	-
Pd-109	1.35E+01	H	1.54E-03	2.00E-07	1.00E-07	3.00E-05
Pm-143	2.65E+02	D	7.26E-01	3.00E-08	5.00E-08	7.00E-05
Pm-144	3.63E+02	D	9.95E-01	5.00E-09	1.00E-08	2.00E-05
Pm-145	1.77E+01	Y	1.77E+01	7.00E-09	1.00E-08	1.00E-04
Pm-146	2.02E+03	D	5.53E+00	2.00E-09	4.00E-09	2.00E-05

Pm-147	2.62E+00	Y	2.62E+00	6.00E-09	1.00E-08	7.00E-05
Pm-148	5.37E+00	D	1.47E-02	2.00E-08	2.00E-08	7.00E-06
Pm-148m	4.13E+01	D	1.13E-01	1.00E-08	1.00E-08	1.00E-05
Pm-149	5.31E+01	H	6.06E-03	8.00E-08	6.00E-08	2.00E-05
Pm-151	2.84E+01	H	3.24E-03	1.00E-07	8.00E-08	2.00E-05
Po-209	1.02E+02	Y	1.02E+02	-	-	-
Po-210	1.38E+02	D	3.79E-01	2.00E-11	2.00E-11	4.00E-08
Po-211	5.16E-01	S	1.64E-08	5.00E-05	5.00E-05	-
Po-212	2.98E-07	S	9.45E-15	-	-	-
Po-213	4.20E-06	S	1.33E-13	-	-	-
Po-214	1.64E-04	S	5.19E-12	-	-	-
Po-215	1.78E-03	S	5.64E-11	-	-	-
Po-216	1.46E-01	S	4.63E-09	-	-	-
Po-218	3.05E+00	M	5.80E-06	-	-	-
Pr-142	1.91E+01	H	2.18E-03	8.00E-08	7.00E-08	1.00E-05
Pr-143	1.36E+01	D	3.72E-02	3.00E-08	2.00E-08	2.00E-05
Pr-144	1.73E+01	M	3.29E-05	5.00E-06	1.00E-06	6.00E-04
Pr-144m	7.20E+00	M	1.37E-05	9.00E-05	9.00E-05	-
Pt-191	2.71E+00	D	7.42E-03	3.00E-07	1.00E-07	5.00E-05
Pt-193	5.00E+01	Y	5.00E+01	1.00E-06	2.00E-06	-
Pt-193m	4.33E+00	D	1.19E-02	2.00E-07	2.00E-07	-
Pt-195m	4.02E+00	D	1.10E-02	2.00E-07	1.00E-07	-
Pt-197	1.83E+01	H	2.09E-03	4.00E-07	3.00E-07	4.00E-05
Pt-197m	9.44E+01	M	1.80E-04	2.00E-06	7.00E-07	2.00E-04
Pu-236	2.85E+00	Y	2.85E+00	7.00E-13	1.00E-12	-
Pu-237	4.53E+01	D	1.24E-01	1.00E-07	1.00E-07	2.00E-04
Pu-238	8.78E+01	Y	8.78E+01	5.00E-13	6.00E-13	2.00E-08
Pu-239	2.41E+04	Y	2.41E+04	5.00E-13	5.00E-13	2.00E-08
Pu-240	6.57E+03	Y	6.57E+03	5.00E-13	5.00E-13	2.00E-08
Pu-241	1.44E+01	Y	1.44E+01	3.00E-11	2.00E-11	1.00E-06
Pu-242	3.76E+05	Y	3.76E+05	5.00E-13	5.00E-13	7.00E-08
Pu-243	4.96E+00	H	5.66E-04	1.00E-06	5.00E-07	2.00E-04
Pu-244	8.26E+07	Y	8.26E+07	2.00E-13	5.00E-13	-
Pu-245	1.06E+01	H	1.21E-03	2.00E-07	8.00E-08	3.00E-05
Pu-246	1.09E+01	D	2.97E-02	-	8.00E-09	-
Ra-222	3.80E+01	S	1.20E-06	-	-	-
Ra-223	1.14E+01	D	3.13E-02	3.00E-11	9.00E-12	1.00E-07
Ra-224	3.62E+00	D	9.92E-03	7.00E-11	2.00E-11	2.00E-07
Ra-225	1.48E+01	D	4.05E-02	3.00E-11	1.00E-11	2.00E-07
Ra-226	1.60E+03	Y	1.60E+03	3.00E-11	2.00E-11	6.00E-08
Ra-228	5.75E+00	Y	5.75E+00	5.00E-11	1.00E-11	6.00E-08
Rb-81	4.58E+00	H	5.23E-04	8.00E-07	2.00E-07	5.00E-04
Rb-82	1.25E+00	M	2.38E-06	2.00E-07	2.00E-07	-
Rb-83	8.62E+01	D	2.36E-01	4.00E-08	5.00E-08	9.00E-06
Rb-84	3.29E+01	D	9.01E-02	3.00E-08	3.00E-08	7.00E-06
Rb-86	1.87E+01	D	5.11E-02	3.00E-08	4.00E-08	7.00E-06
Rb-87	4.73E+10	Y	4.73E+10	6.00E-08	7.00E-08	1.00E-05
Rb-88	1.78E+01	M	3.39E-05	7.00E-07	1.00E-06	4.00E-04
Rb-89	1.54E+01	M	2.94E-05	2.00E-07	1.00E-06	-
Rb-90	1.57E+02	S	4.98E-06	2.00E-07	2.00E-07	-
Rb-90m	2.58E+02	S	8.18E-06	1.00E-07	1.00E-07	-
Re-182	6.40E+01	H	7.31E-03	-	3.00E-08	9.00E-05

Re-182m	1.27E+01	H	1.45E-03	4.00E-07	4.00E-07	-
Re-183	7.00E+01	D	1.92E-01	-	-	-
Re-184	3.80E+01	D	1.04E-01	6.00E-08	3.00E-08	3.00E-05
Re-184m	1.69E+02	D	4.63E-01	2.00E-08	1.00E-08	3.00E-05
Re-186	9.06E+01	H	1.03E-02	7.00E-08	4.00E-08	3.00E-05
Re-187	4.70E+10	Y	4.70E+10	4.00E-06	1.00E-05	8.00E-03
Re-188	1.70E+01	H	1.94E-03	1.00E-07	7.00E-08	2.00E-05
Rh-103m	5.61E+01	M	1.07E-04	4.00E-05	2.00E-05	6.00E-03
Rh-105	3.54E+01	H	4.04E-03	2.00E-07	1.00E-07	-
Rh-105m	4.50E+01	S	1.43E-06	1.00E-05	1.00E-05	-
Rh-106	2.99E+01	S	9.49E-07	2.00E-06	2.00E-06	1.00E-04
Rn-218	3.50E-02	S	1.11E-09	-	-	-
Rn-219	3.96E+00	S	1.26E-07	-	-	-
Rn-220 (Sep)	5.56E+01	S	1.76E-06	7.00E-07	7.00E-07	-
Rn-220 (Equ)	5.56E+01	S	1.76E-06	8.00E-10	8.00E-10	-
Rn-222 (Sep)	3.82E+00	D	1.05E-02	4.00E-07	4.00E-07	-
Rn-222 (Equ)	3.82E+00	D	1.05E-02	3.00E-09	3.00E-09	-
Ru-103	3.94E+01	D	1.08E-01	3.00E-08	2.00E-08	3.00E-05
Ru-105	4.44E+00	H	5.07E-04	5.00E-07	2.00E-07	7.00E-05
Ru-106	3.68E+02	D	1.01E+00	5.00E-10	1.00E-09	3.00E-06
Ru-97	2.90E+00	D	7.95E-03	5.00E-07	2.00E-07	1.00E-04
S-35	8.74E+01	D	2.40E-01	9.00E-08	5.00E-08	1.00E-04
S-35 (GAS)	8.74E+01	D	2.40E-01	6.00E-07	4.00E-07	-
Sb-117	2.80E+00	H	3.20E-04	3.00E-06	1.00E-06	9.00E-04
Sb-122	2.70E+00	D	7.40E-03	4.00E-08	4.00E-08	1.00E-05
Sb-124	6.02E+01	D	1.65E-01	1.00E-08	1.00E-08	7.00E-06
Sb-125	2.77E+00	Y	2.77E+00	2.00E-08	1.00E-08	3.00E-05
Sb-126	1.24E+01	D	3.40E-02	2.00E-08	1.00E-08	7.00E-06
Sb-126m	1.90E+01	M	3.61E-05	3.00E-07	7.00E-07	-
Sb-127	3.85E+00	D	1.05E-02	4.00E-08	3.00E-08	1.00E-05
Sb-129	4.40E+00	H	5.02E-04	3.00E-07	1.00E-07	4.00E-05
Sc-44	3.93E+00	H	4.48E-04	2.00E-07	1.00E-07	5.00E-05
Sc-46	8.38E+01	D	2.30E-01	1.00E-08	1.00E-08	1.00E-05
Sc-46m	1.87E+01	S	5.94E-07	5.00E-06	5.00E-06	-
Sc-47	3.42E+00	D	9.38E-03	1.00E-07	7.00E-08	-
Sc-48	4.37E+01	H	4.99E-03	6.00E-08	2.00E-08	1.00E-05
Sc-49	5.74E+01	M	1.09E-04	2.00E-06	8.00E-07	3.00E-04
Se-73	7.15E+00	H	8.16E-04	4.00E-07	1.00E-07	4.00E-05
Se-75	1.20E+02	D	3.28E-01	3.00E-08	3.00E-08	7.00E-06
Se-79	6.50E+04	Y	6.50E+04	2.00E-08	1.00E-08	8.00E-06
Si-31	1.57E+02	M	2.99E-04	1.00E-06	5.00E-07	1.00E-04
Si-32	3.30E+02	Y	3.30E+02	2.00E-10	1.00E-09	-
Sm-145	3.40E+02	D	9.31E-01	2.00E-07	-	7.35E-05
Sm-147	1.06E+11	Y	1.06E+11	3.00E-12	2.00E-12	4.00E-07
Sm-151	9.00E+01	Y	9.00E+01	7.00E-09	7.00E-09	2.00E-04
Sm-153	4.67E+01	H	5.33E-03	1.00E-07	8.00E-08	3.00E-05
Sn-113	1.15E+02	D	3.15E-01	2.00E-08	2.00E-08	3.00E-05
Sn-117m	1.36E+01	D	3.73E-02	6.00E-08	2.00E-08	3.00E-05
Sn-119m	2.93E+02	D	8.03E-01	4.00E-08	3.00E-08	6.00E-05
Sn-121	3.10E-03	Y	5.50E+01	5.00E-07	2.00E-07	8.00E-05
Sn-121m	5.50E+01	Y	3.10E-03	2.00E-08	1.00E-08	5.00E-05
Sn-123	1.29E+02	D	3.54E-01	7.00E-09	1.00E-08	9.00E-06

Sn-123m	4.01E+01	M	7.63E-05	6.00E-06	7.00E-07	7.00E-04
Sn-125	9.64E+00	D	2.64E-02	2.00E-08	2.00E-08	6.00E-06
Sn-126	1.00E+05	Y	1.00E+05	2.00E-09	3.00E-09	4.00E-06
Sr-82	2.50E+01	D	6.85E-02	-	7.00E-09	-
Sr-85	6.48E+01	D	1.78E-01	7.00E-08	8.00E-08	4.00E-05
Sr-85m	6.77E+01	M	1.29E-04	2.00E-06	3.00E-06	3.00E-03
Sr-87m	2.81E+00	H	3.20E-04	5.00E-06	9.00E-07	6.00E-04
Sr-89	5.06E+01	D	1.38E-01	6.00E-09	1.00E-08	8.00E-06
Sr-90	2.86E+01	Y	2.86E+01	2.00E-10	7.00E-10	5.00E-07
Sr-91	9.50E+00	H	1.08E-03	1.00E-07	9.00E-08	2.00E-05
Sr-92	2.71E+00	H	3.09E-04	3.00E-07	1.00E-07	4.00E-05
Sr-93	7.30E+00	M	1.39E-05	2.00E-07	2.00E-07	-
Ta-182	1.15E+02	D	3.14E-01	6.00E-09	7.00E-09	1.00E-05
Tb-157	1.50E+02	Y	1.50E+02	1.00E-08	2.00E-08	-
Tb-160	7.23E+01	D	1.98E-01	1.00E-08	1.00E-08	1.00E-05
Tb-162	7.76E+00	M	1.48E-05	-	-	-
Tc-101	1.42E+01	M	2.70E-05	1.00E-06	1.00E-06	-
Tc-95	2.00E+01	H	2.28E-03	5.00E-07	1.00E-07	1.00E-04
Tc-95m	6.10E+01	D	1.67E-01	-	6.00E-08	5.00E-05
Tc-96	4.28E+00	D	1.17E-02	9.00E-08	3.00E-08	3.00E-05
Tc-96m	5.15E+01	M	9.80E-05	1.00E-05	2.00E-06	2.00E-03
Tc-97	2.60E+06	Y	2.60E+06	2.00E-07	3.00E-07	5.00E-04
Tc-97m	8.90E+01	D	2.44E-01	5.00E-08	2.00E-08	6.00E-05
Tc-98	4.20E+06	Y	4.20E+06	1.00E-08	9.00E-09	1.00E-05
Tc-99	2.13E+05	Y	2.13E+05	3.00E-08	1.00E-08	6.00E-05
Tc-99m	6.02E+00	H	6.87E-04	3.00E-06	1.00E-06	1.00E-03
Te-121	1.68E+01	D	4.60E-02	1.00E-07	1.00E-07	4.00E-05
Te-121m	1.54E+02	D	4.22E-01	8.00E-09	1.00E-08	-
Te-123	1.00E+13	Y	1.00E+13	8.00E-09	2.00E-09	-
Te-123m	1.20E+02	D	3.28E-01	9.00E-09	1.00E-08	-
Te-125m	5.80E+01	D	1.59E-01	3.00E-08	1.00E-08	2.00E-05
Te-127	9.35E+00	H	1.07E-03	7.00E-07	3.00E-07	1.00E-04
Te-127m	1.09E+02	D	2.99E-01	1.00E-08	9.00E-09	9.00E-06
Te-129	6.96E+01	M	1.32E-04	3.00E-06	7.00E-07	4.00E-04
Te-129m	3.36E+01	D	9.21E-02	1.00E-08	1.00E-08	7.00E-06
Te-131	2.50E+01	M	4.76E-05	2.00E-07	7.00E-07	-
Te-131m	3.00E+01	H	3.42E-03	2.00E-08	3.00E-08	-
Te-132	7.82E+01	H	8.93E-03	2.00E-08	1.00E-08	9.00E-06
Te-133	1.25E+01	M	2.37E-05	5.00E-07	9.00E-07	-
Te-133m	5.54E+01	M	1.05E-04	2.00E-07	2.00E-07	-
Te-134	4.18E+01	M	7.95E-05	5.00E-07	2.00E-07	-
Th-226	3.09E+01	M	5.88E-05	6.00E-09	4.00E-10	-
Th-227	1.87E+01	D	5.13E-02	1.00E-11	7.00E-12	2.00E-06
Th-228	1.91E+00	Y	1.91E+00	7.00E-13	2.00E-12	2.00E-07
Th-229	7.34E+03	Y	7.34E+03	1.00E-13	2.00E-13	2.00E-08
Th-230	7.70E+04	Y	7.70E+04	6.00E-13	3.00E-13	1.00E-07
Th-231	2.55E+01	H	2.91E-03	3.00E-07	1.00E-07	5.00E-05
Th-232	1.41E+10	Y	1.41E+10	1.00E-13	3.00E-13	3.00E-08
Th-233	2.23E+01	M	4.24E-05	1.00E-05	1.00E-05	-
Th-234	2.41E+01	D	6.60E-02	6.00E-09	9.00E-09	5.00E-06
Ti-44	4.73E+01	Y	4.73E+01	2.00E-10	7.00E-10	4.00E-06
Ti-45	3.08E+00	H	3.52E-04	5.00E-07	2.00E-07	1.00E-04

Ti-51	5.75E+00	M	1.09E-05	1.00E-06	1.00E-06	-
Tl-200	2.61E+01	H	2.98E-03	3.00E-07	8.00E-08	1.00E-04
Tl-201	7.31E+01	H	8.34E-03	9.00E-07	4.00E-07	2.00E-04
Tl-202	1.22E+01	D	3.35E-02	2.00E-07	1.00E-07	5.00E-05
Tl-204	3.78E+00	Y	3.78E+00	9.00E-08	9.00E-08	2.00E-05
Tl-207	4.77E+00	M	9.08E-06	4.00E-06	4.00E-06	-
Tl-208	3.05E+00	M	5.81E-06	1.00E-07	1.00E-07	-
Tl-209	2.20E+00	M	4.19E-06	2.00E-07	2.00E-07	-
Tl-210	1.30E+00	M	2.47E-06	1.00E-07	1.00E-07	-
Tm-170	1.29E+02	D	3.52E-01	9.00E-09	1.00E-08	1.00E-05
Tm-171	1.92E+00	Y	1.92E+00	2.00E-08	2.00E-08	2.00E-04
U-230	2.08E+01	D	5.70E-02	1.00E-11	4.00E-12	-
U-231	4.20E+00	D	1.15E-02	2.00E-07	1.00E-07	-
U-232	7.20E+01	Y	7.20E+01	3.00E-13	2.00E-12	6.00E-08
U-233	1.59E+05	Y	1.59E+05	2.00E-12	7.00E-12	3.00E-07
U-234	2.45E+05	Y	2.45E+05	2.00E-12	7.00E-12	3.00E-07
U-235	7.04E+08	Y	7.04E+08	2.00E-12	8.00E-12	3.00E-07
U-236	2.34E+07	Y	2.34E+07	2.00E-12	7.00E-12	3.00E-07
U-237	6.75E+00	D	1.85E-02	6.00E-08	3.00E-08	3.00E-05
U-238	4.47E+09	Y	4.47E+09	2.00E-12	8.00E-12	3.00E-07
U-239	2.34E+01	M	4.45E-05	6.00E-06	9.00E-07	9.00E-04
U-240	1.41E+01	H	1.61E-03	1.00E-07	6.00E-08	2.00E-05
V-48	1.60E+01	D	4.38E-02	3.00E-08	2.00E-08	9.00E-06
V-49	3.30E+02	D	9.04E-01	7.00E-07	1.00E-06	-
V-52	3.75E+00	M	7.13E-06	3.00E-07	3.00E-07	-
W-181	1.21E+02	D	3.31E-01	1.00E-06	1.00E-06	2.00E-04
W-185	7.51E+01	D	2.06E-01	3.00E-07	2.00E-07	4.00E-05
W-187	2.38E+01	H	2.72E-03	4.00E-07	1.00E-07	3.00E-05
W-188	6.94E+01	D	1.90E-01	5.00E-07	6.00E-08	7.00E-06
Xe-122	2.01E+01	H	2.29E-03	8.00E-06	2.00E-06	-
Xe-123	2.14E+00	H	2.44E-04	7.00E-07	2.00E-07	-
Xe-125	1.68E+01	H	1.92E-03	2.00E-06	5.00E-07	-
Xe-127	3.64E+01	D	9.97E-02	1.00E-06	5.00E-07	-
Xe-129m	8.89E+00	D	2.44E-02	2.00E-05	6.00E-06	-
Xe-131m	1.18E+01	D	3.24E-02	5.00E-05	1.00E-05	-
Xe-133	5.25E+00	D	1.44E-02	1.00E-05	4.00E-06	-
Xe-133m	2.19E+00	D	6.00E-03	1.00E-05	4.00E-06	-
Xe-135	9.11E+00	H	1.04E-03	2.00E-06	5.00E-07	-
Xe-135m	1.54E+01	M	2.92E-05	1.00E-06	3.00E-07	-
Xe-137	3.83E+00	M	7.29E-06	2.00E-06	2.00E-06	-
Xe-138	1.41E+01	M	2.69E-05	4.00E-07	1.00E-07	-
Y-86	1.47E+01	H	1.68E-03	1.00E-07	4.00E-08	-
Y-87	8.03E+01	H	9.17E-03	1.00E-07	8.00E-08	-
Y-88	1.07E+02	D	2.92E-01	1.00E-08	1.00E-08	1.00E-05
Y-89m	1.57E+01	S	4.98E-07	4.13E-06	-	1.08E-03
Y-90	6.41E+01	H	7.32E-03	2.00E-08	3.00E-08	7.00E-06
Y-90m	3.19E+00	H	3.64E-04	5.00E-07	4.00E-07	-
Y-91	5.85E+01	D	1.60E-01	5.00E-09	9.00E-09	8.00E-06
Y-91m	4.97E+01	M	9.46E-05	9.00E-07	2.00E-06	2.00E-03
Y-92	3.54E+00	H	4.04E-04	3.00E-07	2.00E-07	4.00E-05
Y-93	1.01E+01	H	1.15E-03	1.00E-07	9.00E-08	2.00E-05
Yb-169	3.20E+01	D	8.76E-02	3.00E-08	2.00E-08	2.00E-05

Yb-175	4.19E+00	D	1.15E-02	1.00E-07	8.00E-08	-
Zn-62	9.26E+00	H	1.06E-03	1.00E-07	8.00E-08	2.00E-05
Zn-65	2.44E+02	D	6.70E-01	1.00E-08	2.00E-08	5.00E-06
Zn-69	5.56E+01	M	1.06E-04	6.00E-06	7.00E-07	3.00E-04
Zn-69m	1.38E+01	H	1.57E-03	3.00E-07	1.00E-07	6.00E-05
Zr-86	1.65E+01	H	1.88E-03	1.00E-07	5.00E-08	2.00E-05
Zr-88	8.34E+01	D	2.28E-01	9.00E-09	1.00E-08	5.00E-05
Zr-89	7.84E+01	H	8.95E-03	1.00E-07	6.00E-08	2.00E-05
Zr-93	1.53E+06	Y	1.53E+06	6.00E-10	3.00E-10	4.00E-05
Zr-95	6.40E+01	D	1.75E-01	9.00E-09	9.00E-09	2.00E-05
Zr-97	1.69E+01	H	1.93E-03	5.00E-08	4.00E-08	9.00E-06

Notes:
(1) From original master table.
(2) From 10cfr835 Appendix A.
(3) From 10cfr20 Appendix A.
(4) From 10cfr835 Appendix C.
(5) From the Health Physics and Radiological Health Handbook.
(6) Calculated from photon data.
(7) Gamma conversion factor calculated from out of range photon energies.
(8) From INEEL table.
(9) From manual entry table.
(10) From Health Physics Journal, Vol. 53, No. 2 (August), Pg. 138
(11) Calculated from beta, electron, & positron data.
(12) From LAB-RC-0288 Appendix A
(13) In a gas state
(14) Manually entered from Health Physics Journal, Vol. 63, No. 4 (Oct. 1992), Table 5 - page 447.
(15) Manually entered based upon work in TWR
(16) Adapted from FGR 11

New Water Limit uCi/ml	HP-210 Eff. cpm/pCi	mRem/hr per pCi/cm2 Beta Skin	mRem/hr per pCi Beta @ 2"	Gamma @ 2"	mRem/hr per pCi/cm2 Effective Whole Body @ 1m	Skin Total @ 1m
7.00E-07	3.78E-02	1.90E-04	2.18E-06	7.66E-08	1.87E-06	3.45E-06
5.00E-09	1.92E-04	0.00E+00	0.00E+00	3.50E-09	2.41E-08	9.83E-08
3.00E-05	5.45E-01	8.46E-03	4.03E-05	3.38E-49	1.03E-04	5.73E-04
1.00E-05	1.46E-02	7.17E-05	2.62E-07	7.75E-07	3.12E-04	4.26E-04
-	5.10E-01	8.46E-03	2.56E-05	6.51E-09	2.06E-06	9.43E-04
9.00E-06	1.73E-02	1.06E-04	3.99E-07	5.09E-07	1.89E-04	2.63E-04
6.00E-06	1.78E-01	1.90E-03	1.94E-05	4.03E-08	1.02E-06	2.87E-06
6.00E-06	5.53E-01	9.31E-03	2.19E-05	8.23E-09	3.55E-06	1.69E-03
6.00E-06	1.09E-01	1.99E-03	1.34E-05	6.61E-07	3.04E-04	4.17E-04
2.00E-05	4.29E-01	8.68E-03	3.13E-05	7.89E-09	3.23E-06	3.58E-04
6.00E-06	4.16E-01	7.41E-03	2.18E-05	5.99E-07	2.84E-04	9.26E-04
-	5.59E-01	9.82E-03	2.17E-05	3.53E-07	1.80E-04	2.01E-03
2.00E-08	4.97E-02	9.31E-06	1.18E-07	1.26E-07	3.35E-06	7.29E-06
5.00E-05	2.89E-01	5.50E-03	3.27E-05	8.10E-08	2.06E-06	3.43E-05
2.00E-08	5.42E-02	0.00E+00	6.67E-09	7.33E-08	3.16E-07	2.25E-06
2.00E-08	3.91E-02	1.73E-05	8.56E-07	1.25E-07	7.43E-06	1.21E-05
-	6.22E-01	1.09E-02	1.02E-04	4.69E-07	9.31E-05	2.09E-04
-	4.28E-01	9.13E-03	4.18E-05	3.47E-08	4.05E-06	1.70E-04
-	4.93E-01	9.44E-03	3.27E-05	3.18E-07	1.08E-04	6.91E-04
-	3.01E-04	0.00E+00	0.00E+00	3.96E-07	8.97E-10	1.08E-08
1.00E-06	3.55E-01	6.82E-03	3.55E-05	0.00E+00	0.00E+00	3.09E-05
-	4.78E-01	9.10E-03	2.84E-05	2.78E-07	1.31E-04	7.93E-04
2.00E-04	4.98E-01	8.69E-03	1.97E-05	4.66E-07	2.05E-04	1.79E-03
1.00E-04	9.24E-02	0.00E+00	0.00E+00	5.60E-08	1.10E-06	5.38E-06
2.00E-05	2.90E-01	5.50E-03	1.91E-05	2.18E-07	8.95E-05	4.37E-04
1.00E-05	5.42E-01	9.62E-03	2.34E-05	1.10E-07	4.86E-05	1.59E-03
-	3.61E-01	7.49E-03	3.60E-05	2.52E-09	1.06E-06	7.54E-05
2.00E-06	3.15E-03	0.00E+00	0.00E+00	9.06E-08	5.12E-06	7.40E-06
-	5.47E-07	0.00E+00	-	6.41E-11	2.78E-08	3.74E-08
4.00E-05	4.16E-02	6.76E-04	2.68E-06	2.64E-07	1.19E-04	1.74E-04
7.00E-05	4.32E-02	5.70E-04	5.76E-06	3.50E-08	1.11E-05	1.64E-05
-	2.11E-01	2.25E-03	1.18E-05	6.12E-08	2.50E-05	3.31E-05
-	4.85E-02	8.76E-04	5.94E-06	1.47E-07	5.81E-05	7.71E-05
2.00E-05	4.30E-01	8.04E-03	3.41E-05	1.17E-07	4.86E-05	3.37E-04
1.00E-05	-	-	-	-	-	-
4.00E-05	3.16E-01	6.17E-03	6.38E-05	2.76E-08	1.15E-05	1.49E-05
4.00E-05	8.03E-02	1.39E-03	1.16E-05	1.84E-07	5.63E-05	7.96E-05
2.00E-05	9.21E-02	4.01E-04	3.72E-06	1.82E-07	4.75E-05	6.64E-05
-	3.11E-01	6.81E-03	2.99E-05	4.99E-08	7.91E-06	1.21E-05
4.00E-05	3.13E-01	6.89E-03	3.09E-05	4.40E-08	7.10E-06	1.09E-05
0.00E+00	5.43E-02	9.31E-04	2.69E-06	1.60E-07	6.94E-05	2.18E-04
2.00E-04	5.69E-01	1.01E-02	2.56E-05	1.14E-08	4.40E-06	1.38E-03
8.00E-06	3.90E-01	7.19E-03	3.67E-05	6.58E-08	2.26E-05	2.61E-04
3.00E-04	5.66E-01	1.03E-02	2.86E-05	2.31E-07	1.02E-04	1.38E-03
7.00E-04	4.96E-01	8.92E-03	3.25E-05	2.28E-07	1.00E-04	6.97E-04
2.00E-05	3.43E-01	6.76E-03	3.69E-05	0.00E+00	0.00E+00	1.71E-05

6.00E-04	1.26E-04	-	-	1.38E-08	5.87E-06	7.84E-06
9.00E-06	1.78E-01	3.29E-03	1.80E-05	1.01E-06	3.67E-04	5.55E-04
1.00E-05	7.28E-02	1.13E-03	2.82E-06	5.33E-07	1.72E-04	4.17E-04
-	8.78E-03	1.57E-05	2.97E-08	6.08E-07	2.60E-04	3.41E-04
1.00E-05	4.47E-01	8.04E-03	3.03E-05	0.00E+00	0.00E+00	4.59E-04
-	1.40E-02	3.13E-04	1.26E-06	1.89E-08	5.79E-06	7.65E-06
7.00E-05	3.41E-01	5.50E-03	1.70E-05	7.79E-08	2.02E-05	7.15E-04
1.00E-04	4.72E-01	8.04E-03	3.09E-05	4.65E-08	1.65E-05	5.63E-04
3.00E-04	5.05E-01	8.46E-03	2.77E-05	3.36E-07	1.60E-04	1.11E-03
-	5.40E-02	3.47E-04	7.88E-06	0.00E+00	0.00E+00	0.00E+00
1.00E-04	4.05E-01	8.20E-03	3.67E-05	2.71E-07	9.77E-05	3.36E-04
-	4.35E-01	8.96E-03	3.12E-05	0.00E+00	0.00E+00	3.96E-04
2.00E-04	9.61E-03	1.15E-04	7.89E-07	2.85E-07	3.79E-05	5.24E-05
-	5.14E-01	9.05E-03	2.32E-05	3.21E-08	8.72E-06	1.14E-03
3.00E-04	8.74E-02	0.00E+00	0.00E+00	2.81E-07	1.86E-06	7.46E-06
4.00E-05	2.87E-01	5.78E-03	4.42E-05	6.48E-07	2.95E-04	3.99E-04
9.00E-04	4.15E-01	8.43E-03	3.22E-05	2.07E-09	8.73E-07	2.75E-04
-	5.29E-01	9.54E-03	2.45E-05	3.54E-07	1.80E-04	1.72E-03
-	5.50E-01	9.74E-03	2.31E-05	1.57E-08	7.40E-06	1.52E-03
6.00E-03	4.47E-01	8.57E-03	2.97E-05	2.87E-07	1.20E-04	5.59E-04
-	-	-	-	-	-	-
-	-	-	-	-	-	-
3.00E-05	1.18E-01	1.11E-03	2.01E-05	0.00E+00	0.00E+00	0.00E+00
-	3.42E-03	9.84E-03	1.31E-04	4.69E-07	-	-
6.00E-05	4.34E-04	0.00E+00	0.00E+00	3.83E-07	2.35E-09	2.83E-08
2.00E-05	1.89E-01	3.26E-03	4.42E-05	1.20E-14	2.44E-14	2.35E-13
1.00E-05	4.06E-01	7.94E-03	3.31E-05	2.34E-07	1.09E-04	4.47E-04
-	5.52E-01	9.69E-03	2.39E-05	5.35E-07	2.94E-04	1.72E-03
6.00E-06	1.96E-03	1.82E-03	0.00E+00	7.38E-08	1.08E-06	4.36E-06
-	2.14E-01	4.63E-03	3.17E-05	1.25E-07	3.57E-05	4.66E-05
-	2.19E-01	4.43E-03	5.51E-05	0.00E+00	0.00E+00	0.00E+00
5.00E-07	3.29E-01	6.35E-03	3.93E-05	0.00E+00	0.00E+00	2.09E-05
1.00E-05	4.03E-01	8.17E-03	3.36E-05	6.02E-08	2.39E-05	3.22E-04
4.00E-06	5.15E-01	8.46E-03	2.65E-05	5.08E-09	2.38E-06	9.31E-04
6.00E-05	4.26E-01	7.92E-03	3.48E-05	2.58E-07	1.16E-04	6.74E-04
6.00E-05	3.34E-01	6.79E-03	3.93E-05	4.34E-07	2.14E-04	3.65E-04
7.00E-05	5.87E-02	1.18E-03	8.37E-06	8.22E-08	2.00E-05	2.73E-05
3.00E-05	3.42E-01	7.19E-03	5.36E-05	2.93E-08	9.94E-06	1.82E-05
2.00E-05	4.80E-01	8.04E-03	3.15E-05	1.02E-07	3.24E-05	5.45E-04
3.00E-06	2.17E-01	3.77E-03	5.47E-05	9.33E-09	2.44E-06	3.26E-06
-	3.49E-03	0.00E+00	0.00E+00	1.82E-08	7.67E-08	5.76E-07
-	6.47E-02	8.04E-04	3.88E-06	1.66E-07	4.00E-05	5.43E-05
-	3.76E-03	1.99E-06	5.31E-08	1.79E-08	7.81E-08	5.71E-07
-	3.09E-01	6.22E-03	4.20E-05	1.72E-07	1.54E-05	2.27E-05
7.00E-08	3.54E-03	2.03E-06	4.40E-08	1.67E-08	7.23E-08	5.31E-07
-	1.92E-01	3.88E-03	4.89E-05	3.08E-10	1.30E-09	9.74E-09
3.00E-08	0.00E+00	-	-	1.94E-14	2.63E-12	4.50E-12
2.00E-05	3.73E-01	7.19E-03	3.42E-05	4.01E-09	5.31E-12	9.75E-05
3.00E-04	5.27E-01	9.54E-03	2.26E-05	2.87E-07	1.51E-04	1.86E-03
7.00E-07	5.84E-03	0.00E+00	0.00E+00	2.89E-08	1.07E-07	8.39E-07
-	2.28E-01	4.65E-03	2.55E-05	1.90E-07	1.65E-05	2.45E-05
3.00E-08	4.87E-03	0.00E+00	0.00E+00	2.58E-08	9.45E-08	7.48E-07

-	1.16E-01	2.45E-04	1.31E-05	1.81E-07	9.67E-06	1.59E-05
-	4.74E-03	0.00E+00	0.00E+00	2.30E-08	8.37E-08	6.66E-07
-	2.54E-02	4.65E-04	1.96E-06	1.07E-07	3.82E-05	5.07E-05
5.00E-09	3.70E-03	0.00E+00	0.00E+00	1.82E-08	6.70E-08	5.28E-07
7.00E-04	3.88E-01	8.25E-03	3.47E-05	5.93E-09	2.21E-06	1.94E-04
-	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6.00E-06	1.13E-01	1.82E-03	5.20E-06	7.70E-07	3.76E-04	6.89E-04
6.00E-05	1.25E-02	2.96E-04	1.54E-06	6.05E-08	1.62E-05	2.11E-05
2.00E-05	5.59E-02	1.18E-03	5.32E-06	2.46E-07	1.12E-04	1.53E-04
8.00E-04	1.67E-03	0.00E+00	0.00E+00	3.90E-11	4.08E-08	4.86E-07
3.00E-06	2.32E-01	4.19E-03	5.34E-05	5.48E-07	2.58E-04	3.48E-04
-	1.26E-01	2.25E-05	6.33E-08	1.34E-09	5.35E-07	3.34E-06
3.00E-04	4.90E-01	9.05E-03	2.90E-05	3.38E-08	1.15E-05	6.41E-04
4.00E-04	5.00E-01	8.88E-03	2.51E-05	3.00E-07	1.24E-04	1.11E-03
5.00E-04	8.79E-04	0.00E+00	0.00E+00	9.35E-09	3.88E-06	5.16E-06
-	4.61E-01	8.12E-03	1.69E-05	3.21E-07	1.32E-04	1.87E-03
3.00E-04	1.29E-02	8.44E-05	2.99E-07	1.44E-07	3.33E-05	4.80E-05
3.00E-04	2.72E-03	0.00E+00	0.00E+00	4.98E-08	2.23E-06	5.67E-06
4.00E-05	1.45E-02	1.97E-04	9.59E-07	2.30E-07	8.25E-05	1.21E-04
9.00E-07	2.61E-01	5.08E-03	2.78E-05	4.00E-07	1.79E-04	2.87E-04
-	2.15E-01	4.51E-03	3.59E-05	2.82E-08	3.25E-06	5.31E-06
1.00E-05	1.39E-01	1.90E-03	4.09E-05	0.00E+00	0.00E+00	0.00E+00
6.00E-06	2.94E-01	5.50E-03	5.91E-05	5.38E-07	2.44E-04	3.36E-04
1.00E-06	3.10E-01	6.30E-03	4.16E-05	0.00E+00	0.00E+00	3.20E-05
4.00E-04	5.65E-01	9.90E-03	2.25E-05	5.07E-07	2.44E-04	2.03E-03
-	5.52E-01	9.79E-03	2.05E-05	6.31E-08	3.10E-05	2.03E-03
2.00E-04	3.01E-01	5.51E-03	1.70E-05	2.27E-07	9.61E-05	5.54E-04
-	5.45E-01	9.60E-03	2.09E-05	2.83E-07	1.19E-04	1.97E-03
2.00E-04	1.95E-01	3.89E-03	2.02E-05	5.28E-08	2.21E-05	5.32E-05
6.00E-05	3.15E-01	6.29E-03	4.97E-05	3.50E-08	1.49E-05	2.30E-05
3.00E-04	1.39E-02	1.10E-04	4.99E-07	1.24E-07	4.30E-05	5.77E-05
2.00E-04	4.76E-01	9.19E-03	3.00E-05	9.17E-09	3.10E-06	5.86E-04
1.00E-05	3.13E-01	5.55E-03	5.03E-05	2.29E-08	4.99E-06	7.66E-06
5.00E-05	2.30E-01	4.76E-03	5.34E-05	5.04E-13	5.64E-10	4.49E-09
5.00E-05	5.46E-01	9.79E-03	3.93E-05	1.19E-07	4.63E-05	4.45E-04
-	1.37E-03	0.00E+00	0.00E+00	1.02E-08	8.15E-08	3.76E-07
-	3.88E-02	9.72E-06	1.91E-07	2.21E-07	1.32E-06	7.62E-06
-	3.37E-01	6.80E-03	4.60E-05	2.25E-07	6.53E-05	1.72E-04
-	1.73E-01	3.47E-03	4.56E-05	1.26E-09	5.64E-09	4.12E-08
1.00E-05	1.91E-01	3.34E-03	2.12E-05	2.98E-07	1.27E-04	2.52E-04
4.00E-05	3.99E-01	7.04E-03	2.10E-05	8.50E-08	3.57E-05	8.00E-04
7.00E-06	4.29E-01	7.91E-03	5.58E-05	3.02E-07	1.37E-04	3.56E-04
5.00E-05	1.26E-01	1.23E-03	2.43E-05	2.67E-08	8.05E-06	1.07E-05
8.00E-06	4.16E-01	7.44E-03	4.30E-05	2.95E-07	1.43E-04	6.60E-04
7.00E-04	3.66E-01	7.87E-03	3.29E-05	2.78E-07	1.16E-04	2.14E-04
1.00E-05	2.51E-01	4.75E-03	1.85E-05	2.09E-07	8.84E-05	2.53E-04
1.00E-04	9.62E-04	0.00E+00	0.00E+00	5.40E-07	2.52E-08	3.03E-07
1.00E-05	2.51E-01	4.65E-03	4.32E-05	2.65E-07	1.24E-04	1.71E-04
4.00E-05	4.55E-03	1.65E-05	2.32E-07	1.66E-08	8.35E-08	5.62E-07
7.00E-06	1.34E-01	2.95E-04	5.07E-06	1.29E-07	8.27E-07	4.61E-06
-	-	-	-	0.00E+00	0.00E+00	0.00E+00
-	1.71E-02	4.65E-04	2.22E-06	1.77E-08	3.91E-06	5.04E-06

8.00E-06	4.95E-01	8.46E-03	3.76E-05	1.32E-07	6.69E-06	3.60E-04
1.00E-05	3.05E-01	5.32E-03	1.15E-05	5.19E-07	2.54E-04	1.45E-03
1.00E-04	6.78E-02	1.10E-03	1.12E-05	4.45E-08	1.86E-05	2.51E-05
2.00E-04	4.95E-01	8.04E-03	2.13E-05	2.65E-07	1.11E-04	1.33E-03
2.00E-05	4.45E-01	8.49E-03	3.11E-05	5.83E-07	2.88E-04	9.60E-04
3.00E-07	-	-	-	-	-	-
4.00E-07	-	-	-	0.00E+00	0.00E+00	0.00E+00
6.00E-05	8.37E-02	4.65E-04	3.23E-06	6.90E-08	1.43E-05	2.12E-05
4.00E-05	4.16E-01	8.48E-03	3.29E-05	1.57E-08	4.90E-06	2.75E-04
-	4.37E-01	8.64E-03	3.24E-05	1.23E-07	5.06E-05	3.56E-04
6.00E-05	1.46E-03	0.00E+00	0.00E+00	2.42E-08	1.31E-07	1.57E-06
7.00E-03	1.48E-03	0.00E+00	0.00E+00	2.45E-08	1.33E-07	1.60E-06
1.00E-04	5.11E-01	9.37E-03	2.89E-05	2.86E-07	1.23E-04	1.10E-03
1.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-	-
4.00E-05	5.61E-02	9.90E-04	4.40E-06	1.20E-07	4.80E-05	6.30E-05
-	2.44E-01	4.10E-03	3.38E-05	4.53E-07	-	-
-	9.55E-02	1.98E-03	1.05E-05	5.04E-07	-	-
3.00E-06	3.39E-01	6.08E-03	4.43E-05	9.58E-07	-	-
1.00E-05	-	-	-	-	-	-
1.00E-04	-	-	-	-	-	-
2.00E-05	4.13E-01	7.71E-03	6.68E-05	1.57E-07	6.56E-05	9.05E-05
-	1.76E-01	2.27E-03	2.89E-05	1.18E-07	-	-
-	1.35E-01	2.80E-04	5.06E-06	2.77E-08	9.06E-06	1.36E-05
-	4.18E-01	8.35E-03	5.95E-05	3.05E-08	1.20E-05	1.68E-05
3.00E-05	2.24E-01	4.06E-03	5.24E-05	1.01E-07	2.85E-05	3.67E-05
7.00E-06	2.24E-01	4.06E-03	5.24E-05	1.01E-07	-	-
-	-	-	-	-	-	-
-	5.90E-01	9.93E-03	3.31E-05	9.28E-09	3.23E-06	1.06E-03
9.00E-06	2.44E-01	3.51E-03	2.90E-05	4.25E-07	1.87E-04	2.83E-04
-	4.25E-01	7.47E-03	1.61E-05	2.81E-07	1.13E-04	1.60E-03
-	4.63E-02	1.35E-03	6.74E-06	1.11E-07	2.09E-05	2.83E-05
-	1.32E-01	2.26E-03	5.67E-06	3.03E-07	1.17E-04	4.71E-04
-	1.12E-02	0.00E+00	0.00E+00	1.10E-07	2.78E-06	7.59E-06
-	1.69E-01	3.38E-03	1.37E-05	1.56E-07	5.38E-05	1.98E-04
-	5.22E-01	9.22E-03	2.32E-05	2.39E-08	8.93E-06	1.19E-03
2.00E-07	9.95E-02	1.27E-03	1.83E-05	5.03E-08	2.47E-06	6.02E-06
2.00E-05	3.98E-01	8.09E-03	3.51E-05	5.61E-07	2.47E-04	5.54E-04
1.00E-06	3.36E-01	6.43E-03	4.11E-05	1.13E-07	4.59E-05	8.62E-05
1.00E-04	4.79E-01	8.12E-03	2.99E-05	5.71E-07	2.60E-04	9.96E-04
7.00E-06	4.51E-01	8.04E-03	3.07E-05	1.64E-07	7.01E-05	6.05E-04
4.00E-04	5.20E-01	8.46E-03	2.74E-05	6.29E-07	2.93E-04	1.29E-03
3.00E-05	4.26E-01	7.61E-03	3.28E-05	3.44E-07	1.64E-04	6.41E-04
-	5.70E-01	1.00E-02	2.03E-05	5.06E-07	2.52E-04	2.54E-03
6.00E-05	5.39E-02	1.40E-03	6.34E-06	4.37E-07	5.02E-05	6.64E-05
7.00E-04	1.55E-01	3.22E-03	1.12E-05	9.72E-08	3.10E-05	4.32E-05
-	5.52E-01	9.65E-03	2.44E-05	9.21E-09	3.68E-06	1.21E-03
-	2.55E-01	5.66E-03	3.22E-05	6.03E-08	1.11E-05	1.59E-05
5.00E-07	2.97E-01	6.29E-03	4.28E-05	0.00E+00	0.00E+00	2.86E-06
2.00E-04	2.20E-01	4.72E-03	1.79E-05	7.89E-08	1.97E-05	3.43E-05
3.00E-04	4.05E-01	8.14E-03	3.30E-05	5.42E-07	2.57E-04	6.01E-04
-	4.15E-01	8.68E-03	4.12E-05	2.01E-07	8.25E-05	2.21E-04

2.00E-04	3.98E-01	7.63E-03	2.41E-05	4.53E-08	1.12E-05	5.53E-04
1.00E-05	1.02E-01	1.99E-03	1.18E-05	3.97E-07	1.66E-04	2.30E-04
-	7.57E-04	0.00E+00	0.00E+00	1.21E-07	-	-
-	1.84E-02	2.59E-04	1.95E-06	1.64E-07	-	-
1.00E-04	3.69E-01	7.28E-03	4.42E-05	2.37E-07	9.88E-05	1.63E-04
-	8.04E-04	0.00E+00	0.00E+00	1.22E-07	-	-
-	1.74E-01	6.01E-04	1.66E-05	1.51E-10	1.08E-07	8.25E-07
1.00E-05	5.51E-01	9.77E-03	2.50E-05	2.48E-08	1.07E-05	1.25E-03
9.00E-06	3.07E-01	5.85E-03	6.45E-05	6.47E-07	2.77E-04	3.94E-04
4.00E-06	4.38E-01	7.66E-03	2.46E-05	3.27E-08	1.55E-05	6.70E-04
6.00E-05	5.56E-01	9.81E-03	2.12E-05	5.73E-08	2.75E-05	1.88E-03
9.00E-05	4.06E-01	8.11E-03	3.24E-05	2.68E-07	1.15E-04	3.79E-04
-	3.10E-02	5.09E-04	2.37E-06	2.41E-07	3.01E-05	4.66E-05
-	2.62E-03	0.00E+00	0.00E+00	1.74E-07	1.54E-06	4.65E-06
-	3.40E-02	0.00E+00	0.00E+00	4.75E-08	1.30E-07	1.23E-06
3.00E-06	3.76E-01	7.53E-03	3.43E-05	6.26E-10	2.62E-07	1.12E-04
-	3.56E-01	7.33E-03	3.01E-05	6.41E-08	2.04E-05	1.82E-04
-	5.40E-01	9.68E-03	2.23E-05	1.73E-07	8.40E-05	1.80E-03
-	3.73E-01	7.34E-03	3.77E-05	4.10E-07	2.01E-04	5.92E-04
-	5.45E-01	9.67E-03	2.27E-05	3.89E-07	1.89E-04	1.94E-03
-	5.75E-01	1.02E-02	2.57E-05	3.07E-07	1.37E-04	1.92E-03
-	8.20E-02	1.42E-03	1.76E-05	3.71E-07	-	-
9.00E-06	5.06E-01	8.46E-03	2.82E-05	4.94E-07	2.42E-04	1.08E-03
5.00E-05	5.51E-01	9.75E-03	2.34E-05	9.05E-09	4.30E-06	1.44E-03
1.00E-04	5.32E-01	9.49E-03	2.53E-05	5.41E-07	2.77E-04	1.55E-03
-	5.44E-01	1.16E-02	9.55E-05	2.57E-07	-	-
4.00E-05	2.98E-01	6.12E-03	4.64E-05	1.13E-08	4.49E-06	7.97E-06
1.00E-05	5.39E-01	8.28E-03	7.05E-05	3.13E-07	1.24E-04	1.62E-04
-	5.44E-01	9.59E-03	2.52E-05	2.15E-07	1.01E-04	1.24E-03
9.00E-06	3.11E-01	5.82E-03	4.12E-05	3.52E-07	1.45E-04	2.00E-04
1.00E-05	1.22E-01	2.03E-03	9.95E-06	8.04E-07	3.73E-04	5.13E-04
-	5.43E-01	9.47E-03	2.12E-05	5.78E-07	2.58E-04	2.02E-03
7.00E-04	8.73E-04	0.00E+00	0.00E+00	5.73E-07	1.80E-08	2.17E-07
3.00E-05	4.67E-03	0.00E+00	0.00E+00	2.05E-07	9.55E-05	1.30E-04
7.00E-05	5.00E-01	9.16E-03	2.63E-05	3.69E-07	1.82E-04	1.36E-03
-	5.56E-01	9.81E-03	2.26E-05	4.49E-08	8.47E-06	1.63E-03
-	4.91E-01	9.33E-03	3.30E-05	3.54E-07	1.62E-04	8.64E-04
-	5.23E-01	9.22E-03	1.93E-05	2.81E-07	1.14E-04	2.05E-03
5.00E-05	1.95E-03	0.00E+00	0.00E+00	1.18E-07	6.59E-07	4.21E-06
2.00E-05	4.45E-01	8.04E-03	3.29E-05	4.52E-08	1.81E-05	5.06E-04
-	4.86E-01	9.08E-03	2.76E-05	2.87E-07	1.20E-04	8.40E-04
-	5.58E-01	9.82E-03	1.87E-05	5.70E-07	3.69E-04	2.85E-03
6.00E-06	3.24E-01	7.19E-03	3.19E-05	5.36E-07	2.38E-04	3.36E-04
5.00E-05	5.11E-01	9.35E-03	2.69E-05	7.75E-07	4.04E-04	1.36E-03
1.00E-05	3.83E-01	6.94E-03	2.79E-05	9.76E-07	4.37E-04	1.14E-03
-	2.39E-03	4.70E-06	4.45E-08	1.31E-07	8.36E-07	4.70E-06
1.00E-05	2.08E-01	3.66E-03	3.62E-05	1.06E-07	4.99E-06	9.46E-06
-	8.63E-03	2.53E-05	7.33E-08	5.05E-07	1.71E-04	2.37E-04
-	6.08E-03	0.00E+00	0.00E+00	3.57E-07	1.08E-04	1.51E-04
2.00E-04	2.68E-02	0.00E+00	0.00E+00	2.10E-08	1.17E-07	7.52E-07
1.00E-05	2.97E-01	5.92E-03	4.35E-05	3.92E-07	1.80E-04	2.49E-04
-	3.72E-02	4.31E-05	1.37E-07	8.11E-08	9.15E-07	6.24E-06

3.00E-05	1.01E-01	9.73E-04	2.16E-05	1.92E-07	8.81E-05	1.22E-04
3.00E-05	2.75E-01	6.77E-03	2.79E-05	9.46E-08	7.86E-06	4.51E-05
2.00E-05	3.86E-01	7.86E-03	3.53E-05	6.10E-07	2.78E-04	4.94E-04
3.00E-04	4.77E-01	8.04E-03	2.85E-05	1.74E-07	7.72E-05	7.41E-04
-	1.36E-02	1.73E-04	5.05E-07	1.87E-07	8.41E-05	1.43E-04
2.00E-05	4.32E-01	7.19E-03	4.08E-05	5.58E-08	1.69E-05	1.47E-04
1.00E-04	5.44E-01	9.95E-03	3.72E-05	1.20E-07	4.65E-05	6.57E-04
2.00E-05	1.20E-02	8.82E-05	5.43E-07	4.35E-07	1.98E-04	2.65E-04
2.00E-05	1.81E-01	3.31E-03	1.29E-05	4.31E-07	2.01E-04	3.75E-04
3.00E-04	1.15E-03	0.00E+00	0.00E+00	4.67E-07	4.74E-08	5.70E-07
1.00E-04	0.00E+00	0.00E+00	2.20E-10	0.00E+00	0.00E+00	0.00E+00
-	-	-	-	-	-	-
1.00E-04	4.86E-01	8.93E-03	2.82E-05	1.19E-07	5.61E-05	9.59E-04
-	-	-	-	-	-	-
-	6.29E-03	3.86E-07	8.85E-09	1.03E-07	5.39E-07	2.93E-06
-	3.97E-01	6.30E-03	5.72E-05	4.19E-07	1.79E-05	3.06E-05
-	1.55E-01	3.17E-03	2.08E-05	9.46E-08	6.74E-06	1.44E-05
2.00E-08	1.18E-01	2.88E-04	3.51E-06	1.85E-07	3.66E-06	8.60E-06
2.00E-05	3.31E-01	5.08E-03	4.20E-05	2.22E-07	6.11E-05	3.25E-04
-	4.90E-01	9.73E-03	7.89E-05	2.05E-07	2.18E-05	3.40E-05
3.00E-04	7.23E-01	1.27E-02	8.24E-05	5.66E-07	1.33E-04	3.18E-04
-	5.22E-01	8.04E-03	2.77E-05	1.69E-07	3.79E-05	9.30E-04
-	5.50E-01	9.60E-03	2.47E-05	2.87E-07	1.20E-04	1.35E-03
3.00E-05	1.60E-02	1.35E-04	6.29E-07	1.94E-07	8.28E-05	1.22E-04
-	-	-	-	0.00E+00	0.00E+00	0.00E+00
-	1.59E-01	2.66E-03	1.51E-05	4.47E-07	1.89E-04	2.70E-04
-	2.37E-01	1.82E-03	1.95E-05	2.72E-08	9.59E-06	1.36E-05
2.00E-04	1.49E-01	1.98E-04	5.32E-06	2.15E-09	6.77E-07	1.56E-06
-	4.85E-01	8.97E-03	3.46E-05	2.09E-08	8.29E-06	3.68E-04
-	2.30E-02	1.61E-04	1.81E-07	3.17E-09	-	-
9.00E-06	5.39E-01	8.88E-03	2.52E-05	0.00E+00	0.00E+00	1.10E-03
8.00E-05	1.88E-01	3.22E-03	4.28E-05	0.00E+00	0.00E+00	0.00E+00
-	1.02E-01	8.83E-04	5.84E-06	3.53E-07	7.59E-05	1.08E-04
6.00E-09	3.70E-02	2.79E-04	1.56E-06	1.50E-07	4.07E-06	7.91E-06
2.00E-05	3.71E-01	6.77E-03	6.18E-05	1.98E-07	2.68E-05	3.74E-05
3.00E-05	9.20E-01	1.79E-02	1.26E-04	7.93E-07	2.22E-04	4.61E-04
-	5.57E-01	8.88E-03	2.45E-05	4.11E-09	1.29E-06	1.27E-03
7.00E-05	8.81E-02	1.79E-03	8.81E-06	2.71E-07	3.81E-05	5.05E-05
-	8.52E-02	1.44E-03	4.26E-06	5.40E-07	2.38E-04	4.78E-04
5.00E-05	7.30E-04	0.00E+00	0.00E+00	9.72E-08	8.61E-08	1.01E-06
3.00E-04	3.39E-01	6.77E-03	3.87E-05	0.00E+00	0.00E+00	3.96E-05
1.00E-08	4.07E-02	0.00E+00	5.78E-12	1.01E-07	3.36E-07	1.56E-06
2.00E-04	4.69E-01	8.04E-03	2.95E-05	1.46E-08	5.94E-06	6.21E-04
2.00E-06	3.59E-01	8.04E-03	6.99E-05	1.09E-07	1.87E-05	2.59E-05
1.00E-04	4.63E-01	9.31E-03	4.72E-05	1.29E-07	3.06E-05	1.23E-04
-	2.09E-03	0.00E+00	0.00E+00	9.20E-08	1.16E-06	5.39E-06
-	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.00E-05	4.35E-01	8.76E-03	3.09E-05	1.94E-10	8.08E-08	3.79E-04
7.00E-05	6.57E-03	1.38E-05	3.66E-08	1.07E-07	3.57E-05	5.22E-05
2.00E-05	1.62E-02	1.40E-04	4.08E-07	4.38E-07	1.80E-04	2.58E-04
1.00E-04	1.73E-02	3.45E-06	2.77E-07	3.58E-08	3.26E-06	6.11E-06
2.00E-05	1.43E-01	2.87E-03	1.26E-05	2.16E-07	8.76E-05	1.71E-04

7.00E-05	1.54E-01	2.28E-03	4.84E-05	1.07E-12	4.63E-10	5.65E-10
7.00E-06	5.09E-01	9.37E-03	2.65E-05	1.32E-07	6.10E-05	1.12E-03
1.00E-05	3.11E-01	6.18E-03	4.36E-05	5.28E-07	2.31E-04	3.44E-04
2.00E-05	4.36E-01	8.84E-03	3.10E-05	3.43E-09	1.41E-06	3.94E-04
2.00E-05	4.24E-01	8.33E-03	3.84E-05	1.05E-07	4.07E-05	2.75E-04
-	4.44E-04	9.10E-06	5.22E-08	1.45E-09	4.07E-07	5.47E-07
4.00E-08	3.89E-08	0.00E+00	-	2.11E-12	9.77E-10	1.32E-09
-	2.78E-05	0.00E+00	-	1.97E-09	8.90E-07	1.21E-06
-	-	0.00E+00	-	0.00E+00	0.00E+00	0.00E+00
-	1.30E-07	0.00E+00	-	7.62E-12	3.51E-09	4.77E-09
-	3.62E-07	0.00E+00	-	2.07E-11	9.58E-09	1.30E-08
-	3.95E-07	0.00E+00	-	4.23E-11	1.78E-08	2.36E-08
-	6.39E-08	0.00E+00	-	3.59E-12	1.66E-09	2.26E-09
-	-	0.00E+00	-	0.00E+00	0.00E+00	0.00E+00
1.00E-05	5.47E-01	9.64E-03	2.47E-05	1.20E-08	5.81E-06	1.27E-03
2.00E-05	4.13E-01	7.61E-03	3.23E-05	2.26E-15	1.03E-12	2.70E-04
6.00E-04	5.53E-01	9.31E-03	2.20E-05	6.81E-09	3.39E-06	1.70E-03
-	8.91E-02	0.00E+00	0.00E+00	1.47E-08	1.13E-06	2.29E-06
5.00E-05	1.07E-01	1.07E-03	1.10E-05	9.75E-08	3.60E-05	5.15E-05
-	7.37E-04	0.00E+00	0.00E+00	1.18E-07	6.36E-08	7.65E-07
-	2.48E-01	4.88E-03	3.62E-05	6.88E-09	1.48E-06	2.82E-06
-	2.94E-01	5.53E-03	4.40E-05	3.00E-08	9.52E-06	1.48E-05
4.00E-05	4.67E-01	7.74E-03	4.54E-05	8.36E-09	3.10E-06	4.51E-05
2.00E-04	4.58E-01	7.96E-03	3.21E-05	2.86E-08	1.03E-05	1.76E-05
-	1.37E-02	0.00E+00	0.00E+00	3.56E-08	1.13E-07	9.25E-07
2.00E-04	1.51E-02	1.20E-05	2.35E-07	1.54E-07	6.73E-06	1.15E-05
2.00E-08	7.67E-03	0.00E+00	0.00E+00	3.16E-08	9.78E-08	8.17E-07
2.00E-08	5.11E-03	0.00E+00	0.00E+00	1.21E-08	4.31E-08	3.19E-07
2.00E-08	7.82E-03	0.00E+00	0.00E+00	3.00E-08	9.35E-08	7.79E-07
1.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.00E-08	6.41E-03	0.00E+00	0.00E+00	2.49E-08	7.78E-08	6.46E-07
2.00E-04	3.19E-01	5.92E-03	4.23E-05	3.71E-08	3.24E-06	1.57E-05
-	5.37E-03	0.00E+00	0.00E+00	2.16E-08	6.61E-08	5.60E-07
3.00E-05	4.71E-01	9.93E-03	5.21E-05	1.55E-07	4.94E-05	2.57E-04
-	1.21E-01	1.96E-03	2.79E-05	4.04E-08	1.25E-05	1.66E-05
-	1.07E-03	2.26E-05	9.75E-08	3.13E-09	1.13E-06	1.47E-06
1.00E-07	1.27E-01	2.33E-03	1.07E-05	1.30E-07	1.72E-05	2.31E-05
2.00E-07	3.74E-03	1.02E-04	4.36E-07	4.39E-72	1.25E-06	1.61E-06
2.00E-07	2.29E-01	4.02E-03	5.59E-05	6.16E-08	1.69E-06	3.90E-06
6.00E-08	6.58E-03	1.78E-04	8.98E-07	4.85E-09	8.62E-07	1.11E-06
6.00E-08	3.37E-09	0.00E+00	0.00E+00	9.15E-13	7.60E-14	9.14E-13
5.00E-04	2.66E-01	5.15E-03	2.20E-05	3.35E-07	7.27E-05	2.80E-04
-	5.33E-01	9.38E-03	1.99E-05	3.11E-07	1.28E-04	2.05E-03
9.00E-06	9.50E-03	0.00E+00	0.00E+00	3.09E-07	5.88E-05	8.21E-05
7.00E-06	1.59E-01	2.72E-03	8.73E-06	3.44E-07	1.03E-04	3.53E-04
7.00E-06	5.27E-01	8.46E-03	2.60E-05	2.16E-08	1.02E-05	1.05E-03
1.00E-05	1.93E-01	3.65E-03	4.66E-05	0.00E+00	0.00E+00	0.00E+00
4.00E-04	5.50E-01	9.73E-03	1.99E-05	1.29E-07	6.54E-05	2.23E-03
-	5.36E-01	9.62E-03	2.44E-05	4.38E-07	2.16E-04	1.62E-03
-	5.52E-01	9.74E-03	2.06E-05	3.77E-07	2.00E-04	2.26E-03
-	5.48E-01	9.61E-03	2.22E-05	6.56E-07	3.30E-04	2.13E-03
9.00E-05	5.37E-01	5.08E-03	4.18E-05	4.56E-07	1.96E-04	2.62E-04

-	1.50E-01	2.09E-03	1.93E-05	2.95E-07	1.30E-04	2.00E-04
-	1.87E-01	2.05E-03	1.73E-05	6.30E-08	2.01E-05	2.82E-05
3.00E-05	1.00E-01	1.64E-03	1.36E-05	2.33E-07	1.03E-04	1.46E-04
3.00E-05	2.80E-01	2.65E-03	3.12E-05	1.14E-07	4.64E-05	6.30E-05
3.00E-05	4.31E-01	8.70E-03	3.30E-05	7.27E-09	2.71E-06	3.37E-04
8.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.00E-05	5.80E-01	1.03E-02	2.96E-05	1.62E-08	7.03E-06	1.20E-03
6.00E-03	6.54E-02	0.00E+00	0.00E+00	1.02E-08	1.31E-07	6.07E-07
-	2.88E-01	5.50E-03	4.19E-05	2.35E-08	9.54E-06	2.41E-05
-	2.19E-01	6.77E-03	3.67E-05	6.29E-08	4.21E-06	7.50E-06
1.00E-04	5.55E-01	9.31E-03	2.12E-05	5.53E-08	2.39E-05	1.89E-03
-	1.76E-06	-	-	2.02E-10	8.81E-08	1.19E-07
-	9.94E-03	2.06E-04	1.00E-06	2.10E-08	7.02E-06	9.18E-06
-	1.23E-06	-	-	1.44E-10	6.11E-08	8.22E-08
-	1.23E-06	-	-	1.44E-10	6.11E-08	8.22E-08
-	9.42E-07	-	-	1.09E-10	4.57E-08	6.12E-08
-	9.42E-07	-	-	1.09E-10	4.57E-08	6.12E-08
3.00E-05	1.61E-01	2.45E-03	4.55E-05	1.33E-07	5.69E-05	8.14E-05
7.00E-05	4.56E-01	8.04E-03	3.08E-05	2.07E-07	9.15E-05	6.04E-04
3.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.00E-04	1.45E-02	2.56E-04	1.30E-06	1.77E-07	2.94E-05	4.07E-05
1.00E-04	1.16E-01	1.31E-03	2.49E-05	0.00E+00	0.00E+00	0.00E+00
-	-	-	-	-	-	-
9.00E-04	4.67E-02	9.26E-04	6.29E-06	1.22E-07	2.23E-05	3.08E-05
1.00E-05	4.94E-01	9.19E-03	2.65E-05	1.22E-07	5.16E-05	9.02E-04
7.00E-06	3.90E-01	6.77E-03	3.44E-05	4.27E-07	2.01E-04	6.83E-04
3.00E-05	1.82E-01	3.13E-03	3.50E-05	1.52E-07	5.04E-05	7.65E-05
7.00E-06	3.74E-01	6.77E-03	3.84E-05	7.19E-07	3.19E-04	7.38E-04
-	4.73E-01	7.61E-03	2.27E-05	4.18E-07	1.84E-04	1.15E-03
1.00E-05	4.14E-01	7.61E-03	3.37E-05	1.78E-07	7.72E-05	3.75E-04
4.00E-05	4.09E-01	7.19E-03	3.50E-05	3.43E-07	1.60E-04	5.99E-04
5.00E-05	5.01E-01	8.90E-03	2.43E-05	5.33E-07	2.36E-04	1.27E-03
1.00E-05	2.57E-01	5.08E-03	4.86E-05	4.67E-07	2.20E-04	2.99E-04
-	1.06E-01	2.31E-03	1.58E-05	2.68E-08	1.19E-05	1.45E-05
-	3.07E-01	6.24E-03	4.16E-05	3.21E-08	1.43E-05	2.74E-05
1.00E-05	3.68E-01	7.28E-03	3.66E-05	7.57E-07	3.58E-04	5.38E-04
3.00E-04	5.55E-01	9.70E-03	2.41E-05	2.08E-10	1.05E-07	1.30E-03
4.00E-05	3.73E-01	6.19E-03	1.81E-05	4.39E-07	1.31E-04	7.34E-04
7.00E-06	1.84E-02	3.81E-04	2.29E-06	3.44E-07	4.90E-05	6.44E-05
8.00E-06	1.27E-01	1.61E-03	1.68E-05	0.00E+00	0.00E+00	0.00E+00
1.00E-04	5.14E-01	9.44E-03	2.63E-05	1.93E-10	9.07E-08	9.13E-04
-	1.61E-01	2.37E-03	4.22E-05	0.00E+00	0.00E+00	0.00E+00
-	-	-	-	-	-	-
4.00E-07	-	-	-	0.00E+00	0.00E+00	0.00E+00
2.00E-04	4.44E-06	2.20E-06	1.96E-08	3.61E-11	5.93E-10	3.27E-09
3.00E-05	4.44E-01	7.96E-03	4.02E-05	3.61E-08	7.96E-06	8.92E-05
3.00E-05	2.14E-03	0.00E+00	0.00E+00	7.17E-08	1.73E-06	4.66E-06
3.00E-05	3.12E-01	6.78E-03	4.74E-05	1.01E-07	1.94E-05	2.59E-05
6.00E-05	1.29E-01	0.00E+00	7.70E-07	4.13E-08	6.82E-07	2.31E-06
8.00E-05	2.52E-01	5.40E-03	5.10E-05	0.00E+00	0.00E+00	1.70E-05
5.00E-05	5.92E-02	1.20E-03	1.10E-05	3.10E-08	8.50E-07	3.70E-06
9.00E-06	4.92E-01	9.33E-03	2.76E-05	1.57E-09	7.42E-07	7.98E-04

7.00E-04	-	-	-	-	-	-
6.00E-06	5.08E-01	9.06E-03	2.61E-05	6.92E-08	3.30E-05	1.24E-03
4.00E-06	2.35E-01	3.09E-03	5.17E-05	5.04E-08	6.97E-06	1.00E-05
-	8.42E-03	0.00E+00	0.00E+00	1.58E-07	4.69E-07	4.02E-06
4.00E-05	1.28E-02	5.50E-05	1.80E-07	3.04E-07	6.03E-05	8.84E-05
3.00E-03	1.20E-02	2.20E-04	1.12E-06	8.89E-08	2.73E-05	3.49E-05
6.00E-04	7.79E-02	1.61E-03	5.51E-06	1.19E-07	3.87E-05	5.36E-05
8.00E-06	5.11E-01	8.46E-03	2.65E-05	3.26E-11	1.54E-08	9.09E-04
5.00E-07	3.37E-01	6.77E-03	3.75E-05	0.00E+00	0.00E+00	1.97E-05
2.00E-05	4.90E-01	8.46E-03	2.69E-05	1.66E-07	7.68E-05	1.00E-03
4.00E-05	3.34E-01	6.85E-03	3.98E-05	2.88E-07	1.36E-04	2.43E-04
-	6.05E-01	1.09E-02	3.18E-05	5.42E-07	2.44E-04	1.63E-03
1.00E-05	4.18E-01	7.52E-03	6.60E-05	3.09E-07	1.39E-04	1.93E-04
-	1.06E-03	0.00E+00	0.00E+00	3.59E-09	5.24E-07	1.02E-06
1.00E-05	4.49E-01	7.61E-03	5.18E-05	2.65E-07	1.20E-04	2.80E-04
-	5.59E-01	9.78E-03	3.75E-05	2.85E-07	1.28E-04	8.55E-04
-	4.83E-01	9.32E-03	2.93E-05	1.02E-07	4.18E-05	6.94E-04
1.00E-04	6.00E-03	1.18E-05	3.06E-08	3.10E-07	9.09E-05	1.29E-04
5.00E-05	1.97E-02	2.79E-04	1.47E-06	2.87E-07	7.86E-05	1.09E-04
3.00E-05	1.35E-02	1.21E-05	3.14E-08	7.25E-07	2.85E-04	3.92E-04
2.00E-03	2.77E-02	0.00E+00	0.00E+00	6.56E-08	4.99E-06	8.49E-06
5.00E-04	2.04E-03	0.00E+00	0.00E+00	1.12E-07	7.27E-07	4.29E-06
6.00E-05	1.99E-01	2.60E-03	3.15E-05	7.75E-08	6.33E-07	3.26E-06
1.00E-05	2.63E-01	5.37E-03	4.83E-05	3.60E-07	1.62E-04	2.23E-04
6.00E-05	2.04E-01	4.53E-03	4.65E-05	1.84E-13	7.06E-11	8.81E-11
1.00E-03	2.96E-02	8.88E-04	4.66E-06	4.91E-08	1.66E-05	2.08E-05
4.00E-05	6.30E-03	4.77E-05	1.40E-07	2.15E-07	6.64E-05	9.53E-05
-	1.71E-01	1.57E-03	1.89E-05	9.92E-08	2.60E-05	3.45E-05
-	1.45E-03	0.00E+00	0.00E+00	3.98E-08	8.06E-07	2.39E-06
-	2.22E-01	3.30E-03	2.70E-05	7.79E-08	1.85E-05	2.42E-05
2.00E-05	2.84E-01	4.23E-03	3.55E-05	9.13E-08	2.37E-06	6.38E-06
1.00E-04	3.57E-01	6.77E-03	3.66E-05	1.40E-09	5.83E-07	7.22E-05
9.00E-06	1.81E-01	1.99E-03	2.04E-05	2.93E-08	7.57E-07	4.56E-06
4.00E-04	4.98E-01	8.46E-03	2.78E-05	2.71E-08	6.46E-06	7.70E-04
7.00E-06	3.18E-01	5.50E-03	3.07E-05	2.96E-08	4.16E-06	3.32E-04
-	5.73E-01	9.73E-03	3.31E-05	1.20E-07	4.95E-05	1.12E-03
-	3.23E-01	6.35E-03	4.36E-05	3.63E-07	1.61E-04	2.83E-04
9.00E-06	1.95E-01	2.96E-03	4.89E-05	1.12E-07	2.80E-05	3.77E-05
-	5.47E-01	9.85E-03	2.58E-05	2.34E-07	1.04E-04	1.36E-03
-	5.32E-01	9.17E-03	2.54E-05	5.46E-07	2.49E-04	1.36E-03
-	3.12E-01	5.58E-03	5.00E-05	2.56E-07	1.03E-04	1.39E-04
-	4.52E-02	9.03E-04	7.82E-06	2.60E-08	1.05E-06	1.71E-06
2.00E-06	5.37E-02	6.35E-04	3.19E-06	1.70E-07	1.35E-05	1.95E-05
2.00E-07	4.65E-02	1.69E-04	3.36E-06	3.17E-53	3.14E-07	9.12E-07
2.00E-08	1.86E-01	2.12E-03	1.65E-05	2.94E-07	1.19E-05	1.94E-05
1.00E-07	3.06E-02	0.00E+00	1.58E-07	2.75E-08	1.03E-07	5.88E-07
5.00E-05	3.33E-01	3.47E-03	5.53E-05	2.18E-07	2.17E-06	7.32E-06
3.00E-08	2.39E-02	7.61E-06	4.45E-08	2.74E-08	7.57E-08	5.53E-07
-	4.76E-01	9.25E-03	3.19E-05	3.83E-08	4.14E-06	4.94E-04
5.00E-06	1.24E-01	1.31E-03	2.88E-05	3.02E-08	1.13E-06	2.02E-06
4.00E-06	2.12E-02	3.82E-05	8.20E-07	5.79E-08	1.89E-05	2.46E-05
1.00E-04	3.98E-01	7.46E-03	2.42E-05	2.45E-07	1.02E-04	5.88E-04

-	5.54E-01	9.73E-03	2.39E-05	1.06E-07	4.46E-05	1.40E-03
1.00E-04	3.98E-02	5.89E-04	2.26E-06	3.33E-07	1.47E-04	2.09E-04
2.00E-04	6.44E-02	9.73E-04	7.65E-06	3.51E-08	1.21E-05	1.72E-05
5.00E-05	2.19E-02	3.17E-04	1.08E-06	1.40E-07	5.64E-05	7.76E-05
2.00E-05	3.63E-01	7.19E-03	3.46E-05	4.46E-10	1.46E-07	1.54E-04
-	4.84E-01	8.04E-03	2.81E-05	5.22E-10	2.45E-07	7.00E-04
-	5.41E-01	9.22E-03	3.01E-05	6.82E-07	3.44E-04	1.29E-03
-	5.72E-01	9.31E-03	2.88E-05	5.17E-07	2.22E-04	1.32E-03
-	6.32E-01	1.14E-02	3.95E-05	6.81E-07	2.99E-04	1.40E-03
1.00E-05	4.43E-01	8.81E-03	3.67E-05	2.48E-09	7.05E-07	2.75E-04
2.00E-04	1.23E-02	2.72E-04	9.43E-07	3.84E-10	8.88E-08	1.36E-07
-	4.66E-02	2.51E-05	1.24E-06	3.65E-08	2.27E-07	9.94E-07
-	1.18E-01	1.19E-04	1.59E-06	3.14E-07	9.84E-06	1.85E-05
6.00E-08	3.05E-02	1.27E-05	7.36E-08	3.56E-53	1.17E-07	8.46E-07
3.00E-07	3.24E-03	2.88E-06	5.83E-08	1.16E-62	5.68E-08	2.98E-07
3.00E-07	2.14E-02	8.88E-06	5.73E-08	3.10E-08	9.20E-08	7.25E-07
3.00E-07	5.32E-02	4.65E-04	4.01E-06	1.36E-07	1.94E-05	2.59E-05
3.00E-07	1.52E-02	8.04E-06	6.22E-08	2.95E-08	8.36E-08	6.83E-07
3.00E-05	3.95E-01	6.61E-03	7.87E-05	2.35E-07	1.82E-05	2.76E-05
3.00E-07	1.36E-02	6.77E-04	5.60E-08	2.61E-08	7.36E-08	6.04E-07
9.00E-04	4.72E-01	9.10E-03	3.09E-05	5.37E-08	6.36E-06	4.91E-04
2.00E-05	2.92E-01	5.08E-03	4.76E-05	1.14E-07	4.53E-07	3.44E-06
9.00E-06	2.11E-01	3.81E-03	1.61E-05	6.81E-07	3.15E-04	4.86E-04
-	6.89E-04	0.00E+00	0.00E+00	6.62E-07	8.60E-09	1.03E-07
-	5.58E-01	9.79E-03	2.25E-05	3.04E-07	1.44E-04	1.78E-03
2.00E-04	4.93E-03	0.00E+00	0.00E+00	2.06E-08	5.24E-06	7.86E-06
4.00E-05	2.68E-01	5.73E-03	4.69E-05	8.09E-12	3.52E-09	2.01E-07
3.00E-05	4.24E-01	8.14E-03	3.87E-05	1.32E-07	5.62E-05	2.71E-04
7.00E-06	2.28E-01	4.75E-03	5.30E-05	5.35E-10	2.19E-07	2.84E-07
-	8.05E-03	7.38E-05	5.14E-07	7.20E-08	8.31E-06	1.31E-05
-	1.86E-01	3.49E-03	1.58E-05	2.10E-07	7.13E-05	3.36E-04
-	4.27E-02	7.35E-04	4.31E-06	1.42E-07	3.18E-05	4.39E-05
-	4.76E-02	9.48E-04	5.82E-06	1.38E-07	3.39E-05	4.55E-05
-	3.15E-01	6.71E-03	3.87E-05	9.12E-08	5.37E-06	1.19E-05
-	2.81E-01	6.13E-03	4.14E-05	3.75E-08	2.06E-06	4.69E-06
-	3.08E-01	4.92E-03	5.56E-05	4.12E-08	5.72E-06	9.09E-06
-	3.13E-01	6.94E-03	3.45E-05	4.49E-08	4.71E-06	8.13E-06
-	4.31E-01	8.91E-03	3.54E-05	7.58E-08	3.08E-05	2.80E-04
-	9.41E-02	1.83E-03	5.50E-06	1.28E-07	5.04E-05	1.86E-04
-	5.55E-01	9.83E-03	2.00E-05	4.95E-08	2.14E-05	2.11E-03
-	4.74E-01	8.91E-03	3.22E-05	2.49E-07	1.20E-04	9.70E-04
-	1.82E-01	3.06E-03	8.59E-06	9.31E-07	3.90E-04	8.56E-04
-	4.71E-03	3.19E-05	1.25E-07	2.75E-07	5.44E-05	7.73E-05
1.00E-05	1.08E-02	1.71E-05	6.46E-08	7.13E-07	2.83E-04	3.81E-04
-	8.62E-03	7.92E-05	1.95E-07	3.26E-07	-	-
7.00E-06	5.55E-01	8.88E-03	2.33E-05	0.00E+00	0.00E+00	1.43E-03
-	5.35E-02	1.06E-03	3.78E-06	1.95E-07	7.66E-05	1.36E-04
8.00E-06	5.16E-01	8.46E-03	2.63E-05	8.00E-10	3.76E-07	9.45E-04
2.00E-03	2.59E-02	4.76E-04	1.38E-06	1.52E-07	6.21E-05	1.27E-04
4.00E-05	5.50E-01	9.77E-03	2.12E-05	5.88E-08	2.75E-05	1.87E-03
2.00E-05	5.52E-01	9.78E-03	2.23E-05	2.07E-08	9.70E-06	1.66E-03
2.00E-05	2.12E-01	3.72E-03	2.07E-05	1.31E-07	4.02E-05	5.51E-05

-	2.61E-01	5.49E-03	4.11E-05	1.22E-08	4.83E-06	7.30E-06
2.00E-05	4.15E-02	5.39E-04	2.51E-06	1.33E-07	5.32E-05	7.70E-05
5.00E-06	7.48E-03	9.73E-05	5.52E-07	1.32E-07	6.21E-05	8.49E-05
8.00E-04	4.16E-01	8.43E-03	3.20E-05	1.73E-12	7.19E-10	2.69E-04
6.00E-05	2.46E-02	4.80E-04	1.54E-06	1.18E-07	4.96E-05	7.51E-05
2.00E-05	2.25E-02	3.34E-04	1.55E-06	3.53E-07	3.51E-05	5.26E-05
5.00E-05	1.49E-02	2.48E-04	8.45E-07	2.53E-07	4.66E-05	6.56E-05
2.00E-05	1.13E-01	2.00E-03	6.87E-06	3.94E-07	1.31E-04	2.84E-04
4.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.00E-05	2.56E-01	5.08E-03	4.88E-05	1.86E-07	8.49E-05	1.19E-04
9.00E-06	5.33E-01	8.46E-03	2.61E-05	4.33E-08	1.97E-05	1.10E-03

CEDE mRem/pCi Ingestion	CEDE mRem/pCi Inhalation	RSICC Alpha from Decay Data Nuclide Probability	HPS N13.12-1999 Group Number	HPS N13.12-1999 Screening Level pCi/100cm^2	HPS N13.12-1999 Surface Screening Level pCi/100cm^2
9.50E-05	1.00E-02	1.00138	2	2.70E+03	2.70E+03
1.40E-02	6.70E+00	0	3	2.70E+04	2.70E+04
2.10E-06	2.90E-04	0	3	2.70E+04	2.70E+04
6.10E-06	7.10E-06	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
7.50E-06	2.00E-04	0	3	2.70E+04	2.70E+04
0.00E+00	0.00E+00	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
1.10E-05	5.30E-05	0	2	2.70E+03	2.70E+03
4.50E-06	5.90E-06	0	3	2.70E+04	2.70E+04
1.30E-05	7.90E-05	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
4.50E-03	5.20E-01	0.999739	1	2.70E+02	2.70E+02
1.20E-06	6.10E-05	0	1	2.70E+02	2.70E+02
4.20E-03	5.10E-01	0	1	2.70E+02	2.70E+02
4.50E-03	5.20E-01	0.998955	1	2.70E+02	2.70E+02
2.00E-06	1.70E-05	0	1	2.70E+02	2.70E+02
1.80E-07	6.60E-08	0	1	2.70E+02	2.70E+02
1.50E-07	4.90E-08	0	1	2.70E+02	2.70E+02
-	-	0	3	2.70E+04	2.70E+04
0.00E+00	1.00E-08	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
5.60E-06	3.50E-06	0	3	2.70E+04	2.70E+04
6.10E-07	3.10E-06	0	3	2.70E+04	2.70E+04
3.30E-06	6.50E-06	0	3	2.70E+04	2.70E+04
4.80E-06	3.40E-06	0	3	2.70E+04	2.70E+04
1.10E-06	9.90E-07	0	3	2.70E+04	2.70E+04
4.10E-05	9.30E-05	0	3	2.70E+04	2.70E+04
-	-	1	2	2.70E+03	2.70E+03
2.00E-06	4.20E+12	0	3	2.70E+04	2.70E+04
1.10E-06	1.20E-05	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
2.30E-06	2.90E-06	0	3	2.70E+04	2.70E+04
5.70E-06	5.00E-06	0	3	2.70E+04	2.70E+04
1.80E-06	1.50E-06	0	3	2.70E+04	2.70E+04
1.60E-06	6.70E-07	0	3	2.70E+04	2.70E+04
3.20E-06	6.90E-06	0	3	2.70E+04	2.70E+04
2.00E-06	5.60E-07	0	3	2.70E+04	2.70E+04
1.60E-06	4.40E-07	0	3	2.70E+04	2.70E+04
0.00E+00	0.00E+00	0	3	2.70E+04	2.70E+04
3.90E-07	1.60E-07	0	3	2.70E+04	2.70E+04
8.40E-06	3.60E-06	0	3	2.70E+04	2.70E+04
2.00E-07	7.40E-08	0	3	2.70E+04	2.70E+04
1.00E-07	3.60E-08	0	3	2.70E+04	2.70E+04
4.20E-06	3.50E-04	0	3	2.70E+04	2.70E+04

1.10E-07	2.70E-07	0	3	2.70E+04	2.70E+04
8.00E-06	5.90E-06	0	3	2.70E+04	2.70E+04
4.90E-06	1.40E-05	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
5.90E-06	1.90E-04	0	3	2.70E+04	2.70E+04
-	-	0.99727	2	2.70E+03	2.70E+03
9.90E-07	2.10E-05	0.359197	2	2.70E+03	2.70E+03
6.80E-07	1.70E-05	0	3	2.70E+04	2.70E+04
2.40E-07	6.30E-06	0	3	2.70E+04	2.70E+04
6.00E-06	1.30E-03	0	1	2.70E+02	2.70E+02
5.00E-07	6.90E-06	0	1	2.70E+02	2.70E+02
-	-	0	1	2.70E+02	2.70E+02
3.10E-07	2.60E-07	0	3	2.70E+04	2.70E+04
5.50E-08	2.70E-08	0	3	2.70E+04	2.70E+04
2.30E-07	3.50E-07	0	3	2.70E+04	2.70E+04
1.70E-06	1.30E-06	0	3	2.70E+04	2.70E+04
7.30E-08	8.00E-08	0	3	2.70E+04	2.70E+04
1.50E-07	8.70E-08	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	4	2.70E+05	2.70E+05
-	-	0	4	2.70E+05	2.70E+05
2.10E-06	2.10E-06	0	4	2.70E+05	2.70E+05
-	-	0	3	2.70E+04	2.70E+04
1.20E-06	1.30E-06	0	3	2.70E+04	2.70E+04
3.00E-06	6.10E-06	0	4	2.70E+05	2.70E+05
6.20E-06	5.50E-06	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
1.20E-05	1.00E-04	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
1.60E-04	1.60E-03	0	3	2.70E+04	2.70E+04
1.50E-04	1.40E-03	0	3	2.70E+04	2.70E+04
4.70E-06	3.80E-06	0	3	2.70E+04	2.70E+04
1.50E-05	6.50E-05	0	3	2.70E+04	2.70E+04
1.10E-06	4.30E-07	0	3	2.70E+04	2.70E+04
1.10E-06	4.10E-07	0	3	2.70E+04	2.70E+04
1.10E-06	7.50E-06	0	3	2.70E+04	2.70E+04
2.60E-06	8.50E-06	0	3	2.70E+04	2.70E+04
4.20E-06	3.20E-06	0	3	2.70E+04	2.70E+04
2.00E-05	3.50E-04	0	3	2.70E+04	2.70E+04
2.80E-04	4.30E-02	0.99998	1	2.70E+02	2.70E+02
4.60E-03	5.50E-01	1.00011	1	2.70E+02	2.70E+02
1.90E-03	2.20E-01	0.999338	1	2.70E+02	2.70E+02
4.60E-03	5.60E-01	0.9792	1	2.70E+02	2.70E+02
9.40E-04	1.30E-01	0.970466	1	2.70E+02	2.70E+02
9.20E-06	3.00E-03	0.0031	1	2.70E+02	2.70E+02
2.50E-03	2.80E-01	0	1	2.70E+02	2.70E+02
3.00E-06	2.00E-05	0	3	2.70E+04	2.70E+04
2.00E-07	1.20E-07	0	3	2.70E+04	2.70E+04
1.10E-04	1.70E-02	1.000399	1	2.70E+02	2.70E+02
2.90E-03	3.50E-01	1.004404	1	2.70E+02	2.70E+02
2.30E-03	2.70E-01	1.000259	1	2.70E+02	2.70E+02

4.50E-03	5.40E-01	0.99999	1	2.70E+02	2.70E+02
4.50E-03	5.40E-01	0.99974	1	2.70E+02	2.70E+02
4.10E-03	4.90E-01	1	1	2.70E+02	2.70E+02
1.60E-02	1.90E+00	0.917457	1	2.70E+02	2.70E+02
9.50E-08	2.20E-07	0	1	2.70E+02	2.70E+02
-	-	0.25	1	2.70E+02	2.70E+02
1.20E-05	2.60E-05	0	3	2.70E+04	2.70E+04
1.10E-06	7.50E-06	0	3	2.70E+04	2.70E+04
3.50E-06	7.10E-06	0	2	2.70E+03	2.70E+03
8.80E-08	7.50E-08	0	3	2.70E+04	2.70E+04
2.60E-05	1.50E-04	0	2	2.70E+03	2.70E+03
3.60E-09	1.90E-09	0	3	2.70E+04	2.70E+04
2.60E-07	8.90E-08	0	3	2.70E+04	2.70E+04
1.70E-07	6.10E-08	0	3	2.70E+04	2.70E+04
1.30E-07	2.60E-07	0	4	2.70E+05	2.70E+05
-	-	0	3	2.70E+04	2.70E+04
2.20E-07	1.50E-07	0	3	2.70E+04	2.70E+04
2.40E-07	1.60E-07	0	3	2.70E+04	2.70E+04
1.90E-06	1.20E-06	0	3	2.70E+04	2.70E+04
7.40E-05	4.70E-05	0	2	2.70E+03	2.70E+03
4.20E-08	3.60E-08	0	3	2.70E+04	2.70E+04
7.10E-06	4.50E-06	0	3	2.70E+04	2.70E+04
1.10E-05	7.50E-06	0	3	2.70E+04	2.70E+04
5.00E-05	3.20E-05	0	2	2.70E+03	2.70E+03
1.60E-07	8.80E-08	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
4.10E-07	1.70E-07	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
4.30E-07	2.30E-07	0	3	2.70E+04	2.70E+04
1.10E-06	1.10E-06	0	3	2.70E+04	2.70E+04
2.70E-07	7.60E-08	0	3	2.70E+04	2.70E+04
3.60E-07	1.10E-07	0	3	2.70E+04	2.70E+04
6.20E-06	6.90E-06	0	3	2.70E+04	2.70E+04
1.40E-06	2.00E-06	0	3	2.70E+04	2.70E+04
1.40E-06	5.00E-07	0	3	2.70E+04	2.70E+04
2.40E-05	3.30E-03	0.999946	1	2.70E+02	2.70E+02
1.50E-04	3.60E-02	0.995646	1	2.70E+02	2.70E+02
1.50E-05	4.70E-04	0.003299	1	2.70E+02	2.70E+02
-	-	0.08	1	2.70E+02	2.70E+02
6.00E-06	2.20E-04	0	2	2.70E+03	2.70E+03
1.90E-06	7.60E-07	0	3	2.70E+04	2.70E+04
9.10E-06	2.60E-04	0	2	2.70E+03	2.70E+03
1.30E-06	3.90E-05	0	3	2.70E+04	2.70E+04
8.70E-06	1.10E-05	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
5.40E-06	2.00E-06	0	3	2.70E+04	2.70E+04
5.80E-07	2.60E-06	0	4	2.70E+05	2.70E+05
6.60E-06	1.50E-05	0	3	2.70E+04	2.70E+04
1.60E-06	4.90E-05	0.998415	1	2.70E+02	2.70E+02
9.70E-06	2.30E-04	1.000352	1	2.70E+02	2.70E+02
-	-	0.081	1	2.70E+02	2.70E+02
-	-	1.00815	2	2.70E+03	2.70E+03

8.60E-06	6.10E-06	0	3	2.70E+04	2.70E+04
4.70E-06	1.70E-06	0	3	2.70E+04	2.70E+04
7.20E-07	4.80E-07	0	3	2.70E+04	2.70E+04
3.30E-07	1.20E-07	0	3	2.70E+04	2.70E+04
4.40E-06	1.70E-06	0	3	2.70E+04	2.70E+04
2.10E-04	3.30E-01	0	3	2.70E+04	2.70E+04
1.50E-04	2.40E-01	1	2	2.70E+03	2.70E+03
1.10E-06	2.10E-05	0	3	2.70E+04	2.70E+04
1.90E-06	8.90E-07	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
1.10E-06	4.90E-05	0	3	2.70E+04	2.70E+04
9.60E-09	1.20E-07	0	3	2.70E+04	2.70E+04
5.60E-07	8.90E-07	0	3	2.70E+04	2.70E+04
0.00E+00	4.40E-12	0	4	2.70E+05	2.70E+05
6.30E-08	6.30E-08	0	4	2.70E+05	2.70E+05
1.60E-06	4.90E-06	0	3	2.70E+04	2.70E+04
2.10E-05	2.46E-03	0	3	2.70E+04	2.70E+04
2.10E-05	2.46E-03	0	3	2.70E+04	2.70E+04
2.10E-05	2.46E-03	0	3	2.70E+04	2.70E+04
4.80E-06	8.60E-06	0	3	2.70E+04	2.70E+04
6.90E-07	2.20E-07	0	3	2.70E+04	2.70E+04
4.30E-06	1.30E-05	0	3	2.70E+04	2.70E+04
1.59E-05	3.32E-03	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
2.10E-06	4.50E-06	0	3	2.70E+04	2.70E+04
1.00E-05	6.50E-06	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
5.50E-06	2.80E-06	0	3	2.70E+04	2.70E+04
7.80E-06	7.20E-04	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
4.90E-07	2.70E-07	0	3	2.70E+04	2.70E+04
3.10E-05	1.90E-05	0	3	2.70E+04	2.70E+04
3.80E-05	2.40E-05	0	4	2.70E+05	2.70E+05
7.10E-05	4.30E-05	0	3	2.70E+04	2.70E+04
8.50E-08	4.50E-08	0	3	2.70E+04	2.70E+04
2.80E-04	1.80E-04	0	3	2.70E+04	2.70E+04
4.30E-06	2.50E-06	0	3	2.70E+04	2.70E+04
5.30E-05	3.20E-05	0	3	2.70E+04	2.70E+04
5.70E-07	3.30E-07	0	3	2.70E+04	2.70E+04
1.00E-05	5.40E-06	0	3	2.70E+04	2.70E+04
1.90E-07	1.10E-07	0	3	2.70E+04	2.70E+04
2.00E-06	1.10E-06	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
1.20E-06	7.70E-07	0	4	2.70E+05	2.70E+05
1.00E-07	3.40E-08	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
1.50E-05	7.80E-05	0	3	2.70E+04	2.70E+04
1.40E-04	3.40E-03	0	3	2.70E+04	2.70E+04
3.40E-07	1.20E-07	0	3	2.70E+04	2.70E+04
2.10E-07	6.40E-08	0	3	2.70E+04	2.70E+04
8.70E-08	3.00E-08	0	3	2.70E+04	2.70E+04

4.20E-07	1.50E-07	0	3	2.70E+04	2.70E+04
4.90E-06	5.40E-06	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
5.30E-06	2.30E-05	0	2	2.70E+03	2.70E+03
1.57E-06	3.85E-04	0	2	2.70E+03	2.70E+03
-	-	0	3	2.70E+04	2.70E+04
5.10E-06	2.70E-06	0	3	2.70E+04	2.70E+04
8.10E-06	5.30E-05	0	3	2.70E+04	2.70E+04
1.90E-05	1.20E-05	0	3	2.70E+04	2.70E+04
1.10E-06	1.10E-06	0	3	2.70E+04	2.70E+04
7.80E-07	5.60E-07	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
6.90E-05	2.10E-08	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
1.37E-03	5.88E-06	0	3	2.70E+04	2.70E+04
7.70E-06	4.40E-06	0	3	2.70E+04	2.70E+04
1.40E-06	5.40E-07	0	3	2.70E+04	2.70E+04
6.30E-07	2.20E-07	0	3	2.70E+04	2.70E+04
7.33E-06	6.62E-04	0	3	2.70E+04	2.70E+04
2.00E-06	2.30E-06	0	3	2.70E+04	2.70E+04
6.80E-06	6.20E-05	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
7.50E-06	4.00E-06	0	3	2.70E+04	2.70E+04
6.90E-06	5.60E-06	0	3	2.70E+04	2.70E+04
1.50E-07	5.50E-08	0	3	2.70E+04	2.70E+04
9.90E-08	4.30E-07	0	3	2.70E+04	2.70E+04
2.70E-06	6.40E-06	0	2	2.70E+03	2.70E+03
9.50E-07	3.30E-07	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
9.20E-08	3.60E-08	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
1.30E-06	2.80E-05	0	3	2.70E+04	2.70E+04
4.40E-07	3.60E-06	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
1.20E-05	8.00E-06	0	2	2.70E+03	2.70E+03
1.40E-06	9.50E-07	0	3	2.70E+04	2.70E+04
4.90E-06	2.10E-06	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
5.30E-07	2.80E-05	0	3	2.70E+04	2.70E+04
5.10E-06	3.30E-04	0	2	2.70E+03	2.70E+03
-	-	0	3	2.70E+04	2.70E+04

2.20E-06	4.50E-06	0	3	2.70E+04	2.70E+04
2.00E-06	2.20E-06	0	3	2.70E+04	2.70E+04
4.40E-06	2.00E-06	0	3	2.70E+04	2.70E+04
2.30E-07	7.10E-08	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
3.90E-06	6.20E-06	0	3	2.70E+04	2.70E+04
4.60E-07	2.00E-07	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
2.00E-07	1.30E-06	0	3	2.70E+04	2.70E+04
5.40E-07	3.00E-06	0	4	2.70E+05	2.70E+05
-	-	0	4	2.70E+05	2.70E+05
6.10E-07	2.10E-07	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
2.10E-07	3.80E-06	0	1	2.70E+02	2.70E+02
-	-	0	1	2.70E+02	2.70E+02
-	-	0	1	2.70E+02	2.70E+02
3.90E-03	4.90E-01	0	1	2.70E+02	2.70E+02
3.40E-06	3.10E-05	0	1	2.70E+02	2.70E+02
2.90E-06	2.20E-06	0	1	2.70E+02	2.70E+02
2.00E-07	6.30E-08	0	1	2.70E+02	2.70E+02
-	-	0	1	2.70E+02	2.70E+02
-	-	0	3	2.70E+04	2.70E+04
2.10E-06	1.00E-05	0	3	2.70E+04	2.70E+04
-	-	1	2	2.70E+03	2.70E+03
-	-	0	3	2.70E+04	2.70E+04
2.00E-06	3.70E-06	0	3	2.70E+04	2.70E+04
3.60E-07	2.80E-07	0	3	2.70E+04	2.70E+04
3.10E-06	1.90E-06	0	3	2.70E+04	2.70E+04
1.09E-05	6.70E-04	0	3	2.70E+04	2.70E+04
7.70E-06	1.30E-05	0	4	2.70E+05	2.70E+05
8.80E-07	1.90E-06	0	3	2.70E+04	2.70E+04
5.60E-06	1.50E-03	0	3	2.70E+04	2.70E+04
1.10E-02	1.30E+00	1.089698	2	2.70E+03	2.70E+03
3.30E-06	8.60E-06	0	3	2.70E+04	2.70E+04
2.10E-06	7.40E-07	0	3	2.70E+04	2.70E+04
0.00E+00	0.00E+00	0	3	2.70E+04	2.70E+04
9.60E-07	5.20E-07	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
1.50E-06	3.70E-06	0	3	2.70E+04	2.70E+04
2.10E-07	9.00E-08	0	3	2.70E+04	2.70E+04
5.10E-03	1.30E-02	0	1	2.70E+02	2.70E+02
4.40E-07	8.00E-06	0	3	2.70E+04	2.70E+04
4.10E-05	1.60E-04	0	3	2.70E+04	2.70E+04
5.80E-07	6.70E-06	0	3	2.70E+04	2.70E+04
6.90E-07	1.40E-06	0	3	2.70E+04	2.70E+04
1.40E-07	1.30E-05	0	3	2.70E+04	2.70E+04
2.10E-06	1.10E-06	0	3	2.70E+04	2.70E+04
9.50E-07	8.30E-06	0	3	2.70E+04	2.70E+04
3.90E-06	4.40E-05	0	3	2.70E+04	2.70E+04
4.60E-07	2.70E-05	0	3	2.70E+04	2.70E+04
3.20E-06	1.10E-04	0	3	2.70E+04	2.70E+04

9.50E-07	3.40E-05	0	4	2.70E+05	2.70E+05
9.50E-06	1.00E-05	0	3	2.70E+04	2.70E+04
7.00E-06	1.70E-05	0	3	2.70E+04	2.70E+04
3.60E-06	2.80E-06	0	3	2.70E+04	2.70E+04
2.80E-06	1.60E-06	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
1.60E-03	8.10E-03	1.000001	1	2.70E+02	2.70E+02
-	-	0	3	2.70E+04	2.70E+04
-	-	1	2	2.70E+03	2.70E+03
-	-	1	2	2.70E+03	2.70E+03
-	-	0.999996	2	2.70E+03	2.70E+03
-	-	1	2	2.70E+03	2.70E+03
-	-	0.999998	2	2.70E+03	2.70E+03
-	-	0.999801	2	2.70E+03	2.70E+03
5.10E-06	2.70E-06	0	3	2.70E+04	2.70E+04
4.50E-06	7.30E-06	0	3	2.70E+04	2.70E+04
1.10E-07	4.20E-08	0	3	2.70E+04	2.70E+04
0.00E+00	0.00E+00	0	3	2.70E+04	2.70E+04
1.30E-06	6.00E-07	0	3	2.70E+04	2.70E+04
1.10E-07	2.10E-07	0	3	2.70E+04	2.70E+04
1.70E-06	8.30E-07	0	3	2.70E+04	2.70E+04
2.20E-06	1.20E-06	0	3	2.70E+04	2.70E+04
1.50E-06	5.20E-07	0	3	2.70E+04	2.70E+04
3.10E-07	1.20E-07	0	3	2.70E+04	2.70E+04
1.30E-03	1.60E-01	1.000826	1	2.70E+02	2.70E+02
1.00E-06	1.60E-06	0	1	2.70E+02	2.70E+02
3.80E-03	4.60E-01	1.000031	1	2.70E+02	2.70E+02
4.30E-03	5.10E-01	1.000094	1	2.70E+02	2.70E+02
4.30E-03	5.10E-01	0.99963	1	2.70E+02	2.70E+02
8.60E-05	1.00E-02	0	3	2.70E+04	2.70E+04
4.10E-03	4.80E-01	1.004983	1	2.70E+02	2.70E+02
3.30E-07	1.50E-07	0	1	2.70E+02	2.70E+02
4.00E-03	4.80E-01	1.00235	1	2.70E+02	2.70E+02
2.40E-06	1.20E-06	0	1	2.70E+02	2.70E+02
-	-	0	1	2.70E+02	2.70E+02
-	-	0.999623	1	2.70E+02	2.70E+02
5.50E-04	7.50E-03	1.005147	1	2.70E+02	2.70E+02
3.30E-04	2.90E-03	1.000176	1	2.70E+02	2.70E+02
3.10E-04	7.50E-03	0	1	2.70E+02	2.70E+02
1.10E-03	7.90E-03	1.001078	1	2.70E+02	2.70E+02
1.20E-03	4.20E-03	0	1	2.70E+02	2.70E+02
1.30E-07	1.00E-07	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
7.70E-06	4.90E-06	0	3	2.70E+04	2.70E+04
1.00E-05	6.50E-06	0	3	2.70E+04	2.70E+04
9.40E-06	6.60E-06	0	3	2.70E+04	2.70E+04
4.80E-06	3.30E-06	0	3	2.70E+04	2.70E+04
1.60E-07	8.00E-08	0	3	2.70E+04	2.70E+04
8.00E-08	3.70E-08	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04

-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
2.20E-06	3.60E-06	0	3	2.70E+04	2.70E+04
2.40E-06	1.20E-05	0	3	2.70E+04	2.70E+04
2.60E-06	3.00E-06	0	3	2.70E+04	2.70E+04
8.30E-09	4.90E-08	0	3	2.70E+04	2.70E+04
2.80E-06	1.80E-06	0	3	2.70E+04	2.70E+04
1.10E-08	4.60E-09	0	3	2.70E+04	2.70E+04
1.40E-06	8.90E-07	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
0.00E+00	0.00E+00	0	3	2.70E+04	2.70E+04
-	-	1	2	2.70E+03	2.70E+03
-	-	1.002087	2	2.70E+03	2.70E+03
-	2.90E-07	1	2	2.70E+03	2.70E+03
-	2.54E-04	1	2	2.70E+03	2.70E+03
-	5.08E-07	0	3	2.70E+04	2.70E+04
-	6.77E-05	0	3	2.70E+04	2.70E+04
2.70E-06	7.80E-06	0	3	2.70E+04	2.70E+04
1.00E-06	4.10E-07	0	3	2.70E+04	2.70E+04
2.10E-05	4.40E-04	0	2	2.70E+03	2.70E+03
6.40E-07	4.20E-07	0	3	2.70E+04	2.70E+04
6.50E-07	2.30E-06	0	4	2.70E+05	2.70E+05
-	-	0	3	2.70E+04	2.70E+04
7.40E-08	2.30E-08	0	3	2.70E+04	2.70E+04
6.30E-06	4.70E-06	0	3	2.70E+04	2.70E+04
9.30E-06	2.10E-05	0	2	2.70E+03	2.70E+03
2.60E-06	9.80E-06	0	3	2.70E+04	2.70E+04
9.60E-06	1.00E-05	0	3	2.70E+04	2.70E+04
7.30E-08	2.80E-08	0	3	2.70E+04	2.70E+04
6.60E-06	5.40E-06	0	3	2.70E+04	2.70E+04
1.70E-06	5.70E-07	0	3	2.70E+04	2.70E+04
1.40E-06	4.20E-07	0	3	2.70E+04	2.70E+04
5.60E-06	2.00E-05	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
1.90E-06	1.70E-06	0	3	2.70E+04	2.70E+04
6.40E-06	3.60E-06	0	3	2.70E+04	2.70E+04
2.40E-07	9.30E-08	0	3	2.70E+04	2.70E+04
1.50E-06	3.80E-07	0	3	2.70E+04	2.70E+04
8.80E-06	8.20E-06	0	3	2.70E+04	2.70E+04
8.30E-06	8.90E-06	0	3	2.70E+04	2.70E+04
5.40E-07	2.00E-07	0	3	2.70E+04	2.70E+04
1.70E-06	1.00E-03	0	3	2.70E+04	2.70E+04
9.10E-07	1.10E-05	0	3	2.70E+04	2.70E+04
1.80E-04	7.10E-02	1	2	2.70E+03	2.70E+03
3.40E-07	2.90E-05	0	3	2.70E+04	2.70E+04
2.60E-06	1.70E-06	0	3	2.70E+04	2.70E+04
2.70E-06	8.90E-06	0	3	2.70E+04	2.70E+04
2.60E-06	3.40E-06	0	3	2.70E+04	2.70E+04
1.20E-06	5.30E-06	0	3	2.70E+04	2.70E+04
8.90E-07	4.70E-07	0	3	2.70E+04	2.70E+04
1.30E-06	8.90E-06	0	3	2.70E+04	2.70E+04
7.70E-06	3.00E-05	0	3	2.70E+04	2.70E+04

1.00E-07	4.20E-08	0	3	2.70E+04	2.70E+04
1.10E-05	1.40E-05	0	3	2.70E+04	2.70E+04
1.70E-05	8.60E-05	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
1.90E-06	3.20E-06	0	3	2.70E+04	2.70E+04
2.40E-08	8.20E-09	0	3	2.70E+04	2.70E+04
1.20E-07	3.80E-08	0	3	2.70E+04	2.70E+04
8.70E-06	3.70E-05	0	4	2.70E+05	2.70E+05
1.30E-04	1.30E-03	0	2	2.70E+03	2.70E+03
3.00E-06	1.40E-06	0	3	2.70E+04	2.70E+04
1.90E-06	7.70E-07	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
6.00E-06	3.70E-05	0	3	2.70E+04	2.70E+04
1.00E-07	9.00E-06	0	3	2.70E+04	2.70E+04
6.40E-06	2.20E-05	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
3.80E-08	1.60E-08	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
2.70E-06	2.40E-06	0	3	2.70E+04	2.70E+04
3.10E-08	2.10E-08	0	3	2.70E+04	2.70E+04
1.50E-07	8.90E-07	0	3	2.70E+04	2.70E+04
1.10E-06	4.20E-06	0	3	2.70E+04	2.70E+04
4.80E-06	1.70E-05	0	3	2.70E+04	2.70E+04
1.30E-06	7.50E-06	0	4	2.70E+05	2.70E+05
6.00E-08	3.20E-08	0	3	2.70E+04	2.70E+04
1.50E-06	1.60E-06	0	3	2.70E+04	2.70E+04
6.70E-06	1.30E-05	0	3	2.70E+04	2.70E+04
4.10E-06	1.10E-05	0	3	2.70E+04	2.70E+04
5.10E-06	9.50E-06	0	3	2.70E+04	2.70E+04
3.40E-06	6.70E-06	0	3	2.70E+04	2.70E+04
6.90E-07	2.90E-07	0	3	2.70E+04	2.70E+04
7.90E-06	1.90E-05	0	3	2.70E+04	2.70E+04
1.90E-07	7.70E-08	0	3	2.70E+04	2.70E+04
9.90E-06	2.00E-05	0	3	2.70E+04	2.70E+04
8.50E-07	4.30E-07	0	3	2.70E+04	2.70E+04
8.30E-06	5.50E-06	0	3	2.70E+04	2.70E+04
7.40E-06	7.70E-06	0	3	2.70E+04	2.70E+04
1.60E-07	8.60E-08	0	3	2.70E+04	2.70E+04
7.60E-07	3.80E-07	0	3	2.70E+04	2.70E+04
2.10E-07	1.00E-07	0	3	2.70E+04	2.70E+04
9.20E-07	3.50E-05	0.999627	1	2.70E+02	2.70E+02
3.60E-05	1.60E-02	1.003211	1	2.70E+02	2.70E+02
3.80E-04	3.10E-01	0.9999	1	2.70E+02	2.70E+02
3.50E-03	2.00E+00	0.99797	1	2.70E+02	2.70E+02
5.30E-04	3.20E-01	1.0013	1	2.70E+02	2.70E+02
1.30E-06	8.10E-07	0	1	2.70E+02	2.70E+02
2.80E-03	1.60E+00	1.002	1	2.70E+02	2.70E+02
-	-	0	1	2.70E+02	2.70E+02
1.30E-05	3.30E-05	0	1	2.70E+02	2.70E+02
1.90E-05	8.90E-04	0	3	2.70E+04	2.70E+04
5.70E-07	2.00E-07	0	3	2.70E+04	2.70E+04

-	-	0	3	2.70E+04	2.70E+04
6.70E-07	4.60E-07	0	3	2.70E+04	2.70E+04
2.90E-07	2.30E-07	0	3	2.70E+04	2.70E+04
1.50E-06	9.80E-07	0	3	2.70E+04	2.70E+04
3.20E-06	2.30E-06	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
5.00E-06	2.30E-05	0	3	2.70E+04	2.70E+04
3.90E-07	8.60E-06	0	3	2.70E+04	2.70E+04
8.40E-04	2.00E-02	1.000521	2	2.70E+03	2.70E+03
1.10E-06	1.10E-06	0	2	2.70E+03	2.70E+03
1.30E-03	6.70E-01	1.000834	2	2.70E+03	2.70E+03
2.70E-04	1.30E-01	0.999327	2	2.70E+03	2.70E+03
2.60E-04	1.30E-01	1.000401	2	2.70E+03	2.70E+03
2.50E-04	1.20E-01	0.997	2	2.70E+03	2.70E+03
2.50E-04	1.20E-01	1.0026	2	2.70E+03	2.70E+03
2.70E-06	3.30E-06	0	2	2.70E+03	2.70E+03
2.30E-04	1.20E-01	1.0023	2	2.70E+03	2.70E+03
7.60E-08	3.30E-08	0	2	2.70E+03	2.70E+03
4.10E-06	2.10E-06	0	2	2.70E+03	2.70E+03
7.50E-06	8.00E-06	0	3	2.70E+04	2.70E+04
5.40E-08	2.80E-07	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
3.10E-07	1.50E-07	0	3	2.70E+04	2.70E+04
1.90E-06	7.50E-07	0	3	2.70E+04	2.70E+04
2.60E-06	5.30E-07	0	3	2.70E+04	2.70E+04
9.00E-06	4.10E-06	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
-	-	0	3	2.70E+04	2.70E+04
4.10E-06	1.60E-06	0	3	2.70E+04	2.70E+04
2.20E-06	1.60E-06	0	3	2.70E+04	2.70E+04
5.20E-06	2.10E-05	0	3	2.70E+04	2.70E+04
6.35E-08	5.05E-08	0	3	2.70E+04	2.70E+04
1.00E-05	8.20E-06	0	3	2.70E+04	2.70E+04
6.60E-07	4.40E-07	0	3	2.70E+04	2.70E+04
8.90E-06	4.40E-05	0	3	2.70E+04	2.70E+04
3.90E-08	3.10E-08	0	3	2.70E+04	2.70E+04
1.90E-06	6.20E-07	0	3	2.70E+04	2.70E+04
4.50E-06	2.10E-06	0	3	2.70E+04	2.70E+04
2.80E-06	7.00E-06	0	3	2.70E+04	2.70E+04

1.60E-06	1.50E-06	0	3	2.70E+04	2.70E+04
3.40E-06	1.80E-06	0	3	2.70E+04	2.70E+04
1.40E-05	1.80E-05	0	2	2.70E+03	2.70E+03
8.50E-08	3.60E-08	0	3	2.70E+04	2.70E+04
1.20E-06	6.90E-07	0	3	2.70E+04	2.70E+04
3.50E-06	2.10E-06	0	3	2.70E+04	2.70E+04
1.30E-06	2.20E-05	0	3	2.70E+04	2.70E+04
3.10E-06	2.10E-06	0	3	2.70E+04	2.70E+04
1.60E-06	3.20E-04	0	3	2.70E+04	2.70E+04
3.40E-06	1.90E-05	0	3	2.70E+04	2.70E+04
8.00E-06	4.00E-06	0	3	2.70E+04	2.70E+04

HPS N13.12-1999 Volume Screening Level pCi/g	RG 1.86 Group Number	RG 1.86 Maximum Surface Contamination pCi/100cm^2	RG 1.86 Average Surface Contamination pCi/100cm^2	RG 1.86 Removable Surface Contamination pCi/100cm^2	10CFR835 Appendix D Group Number
30	1	2252.25	6756.76	450.45	1
300	2	45.05	135.14	9.01	2
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
30	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
30	1	2252.25	6756.76	450.45	1
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
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300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4

300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
30	1	2252.25	6756.76	450.45	1
30	1	2252.25	6756.76	450.45	1
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
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3000	4	2252.25	6756.76	450.45	4
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300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2

3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
30	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
30	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
3000	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
30	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
30	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
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300	4	2252.25	6756.76	450.45	4
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300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
30	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
30	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
3000	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
3	2	45.05	135.14	9.01	2
30	1	2252.25	6756.76	450.45	1

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300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4
300	4	2252.25	6756.76	450.45	4

10CFR835 Appendix D Removable Surface Contamination pCi/100cm^2	10CFR835 Appendix D Total Surface Contamination pCi/100cm^3	FGR 11 Ingestion		FGR 11 Inhalation	
		F1	DCF	Class	DCF
450.45	2252.25	0.001	1.11E-04	D	6.70E+00
9.01	225.23	0.001	1.41E-02	D	7.14E-06
450.45	2252.25	0.001	2.16E-06	Y	2.83E-04
450.45	2252.25	0.05	6.48E-06	W	6.33E-08
450.45	2252.25	-	0.00E+00	-	0.00E+00
450.45	2252.25	0.05	7.62E-06	W	1.27E-07
450.45	2252.25	-	0.00E+00	W	1.27E-06
450.45	2252.25	-	0.00E+00	W	4.07E-06
450.45	2252.25	0.05	1.08E-05	W	7.96E-06
450.45	2252.25	0.05	5.07E-06	W	2.42E-06
450.45	2252.25	0.01	1.46E-05	Y	1.30E-05
450.45	2252.25	-	0.00E+00	-	0.00E+00
9.01	225.23	0.001	3.64E-03	Y	2.19E-06
9.01	225.23	0.001	1.41E-06	D	2.68E-08
9.01	225.23	0.001	3.51E-03	D	3.67E-07
9.01	225.23	0.001	3.62E-03	D	3.03E-06
9.01	225.23	0.001	1.99E-06	D	6.70E-07
9.01	225.23	0.001	1.81E-07	D	7.81E-06
9.01	225.23	0.001	1.68E-07	D	6.22E-07
450.45	2252.25	-	0.00E+00	-	0.00E+00
450.45	2252.25	-	0.00E+00	D	1.72E-07
450.45	2252.25	-	0.00E+00	D	3.74E-06
450.45	2252.25	0.5	6.07E-06	Y	3.21E-07
450.45	2252.25	0.5	7.07E-07	D	6.59E-08
450.45	2252.25	0.5	3.96E-06	D	1.91E-07
450.45	2252.25	0.5	5.22E-06	D	1.27E-07
450.45	2252.25	0.5	1.27E-06	W	8.29E-07
450.45	2252.25	1	3.96E-05	W	1.96E-04
450.45	2252.25	-	0.00E+00	D	2.16E-05
450.45	2252.25	0.1	1.88E-06	W	5.73E-01
450.45	2252.25	0.1	1.06E-06	D	1.64E-07
450.45	2252.25	-	0.00E+00	W	1.60E-06
450.45	2252.25	-	-	-	-
450.45	2252.25	0.1	4.22E-06	W	3.92E-07
450.45	2252.25	0.1	5.33E-06	W	1.53E-06
450.45	2252.25	0.1	1.78E-06	ORGANIC	2.09E-06
450.45	2252.25	0.1	1.84E-06	D	4.37E-07
450.45	2252.25	0.1	3.40E-06	Y	1.59E-06
450.45	2252.25	0.1	2.09E-06	Y	4.18E-08
450.45	2252.25	0.1	1.70E-06	Y	1.41E-06
450.45	2252.25	-	0.00E+00	Y	9.07E-06
450.45	2252.25	0.1	4.00E-07	Y	8.95E-06
450.45	2252.25	0.1	9.47E-06	Y	3.39E-06
450.45	2252.25	0.1	2.09E-07	Y	3.74E-04
450.45	2252.25	0.1	1.11E-07	W	9.92E-06
450.45	2252.25	0.005	4.66E-06	Y	5.07E-02

450.45	2252.25	0.005	1.28E-07	W	5.77E-01
450.45	2252.25	0.05	8.40E-06	W	3.07E-01
450.45	2252.25	0.05	5.48E-06	W	4.55E-01
450.45	2252.25	-	-	-	-
450.45	2252.25	0.05	6.40E-06	W	1.65E+00
450.45	2252.25	-	0.00E+00	Y	2.09E-06
450.45	2252.25	0.05	1.06E-06	Y	3.96E-05
450.45	2252.25	0.05	7.21E-07	Y	1.09E-05
450.45	2252.25	0.05	2.83E-07	Y	2.19E-04
9.01	225.23	0.001	1.20E-05	D	7.25E-08
9.01	225.23	0.001	5.81E-07	Y	3.34E-07
9.01	225.23	-	-	-	-
450.45	2252.25	1	3.05E-07	D	4.62E-05
450.45	2252.25	1	5.85E-08	D	4.55E-06
450.45	2252.25	1	2.76E-07	D	3.19E-05
450.45	2252.25	1	1.71E-06	D	1.01E-07
450.45	2252.25	1	9.14E-08	Y	1.87E-07
450.45	2252.25	1	1.82E-07	Y	2.77E-07
450.45	2252.25	-	-	-	-
450.45	2252.25	1	1.22E-08	Y	1.23E-06
450.45	2252.25	1	2.09E-06	W	2.43E-06
450.45	2252.25	1	2.09E-06	W	2.43E-06
450.45	2252.25	1	2.09E-06	W	2.43E-06
450.45	2252.25	1	2.09E-06	W	2.43E-06
450.45	2252.25	0.3	1.27E-06	W	7.47E-06
450.45	2252.25	0.3	3.16E-06	W	9.06E-08
450.45	2252.25	0.3	6.51E-06	W	2.99E-08
450.45	2252.25	-	0.00E+00	-	0.00E+00
450.45	2252.25	0.05	1.31E-05	W	4.11E-02
450.45	2252.25	-	-	-	-
450.45	2252.25	0.05	1.74E-04	W	1.43E-05
450.45	2252.25	0.05	1.61E-04	W	2.68E-04
450.45	2252.25	0.05	5.70E-06	W	2.86E-04
450.45	2252.25	0.05	1.62E-05	W	4.14E-05
450.45	2252.25	0.05	1.12E-06	W	2.19E-06
450.45	2252.25	0.05	1.19E-06	D	7.47E-04
450.45	2252.25	0.0003	1.14E-06	D	1.23E-05
450.45	2252.25	0.0003	2.90E-06	W	1.86E-06
450.45	2252.25	0.0003	4.55E-06	W	5.59E-07
450.45	2252.25	0.0003	2.10E-05	W	1.86E-06
9.01	225.23	0.001	3.34E-04	D	3.30E-01
9.01	225.23	0.001	4.74E-03	D	2.43E-01
9.01	225.23	0.001	2.13E-03	D	2.38E-05
9.01	225.23	0.001	4.85E-03	W	3.17E-07
9.01	225.23	0.001	1.08E-03	W	5.18E-05
9.01	225.23	0.001	1.40E-05	W	1.22E-07
9.01	225.23	0.001	2.42E-03	W	1.05E-06
450.45	2252.25	1	3.03E-06	W	1.20E-06
450.45	2252.25	1	2.35E-07	D	3.18E-04
9.01	225.23	0.001	1.15E-04	D	1.54E-05
9.01	225.23	0.001	2.51E-03	D	3.32E-03
9.01	225.23	0.001	2.02E-03	D	6.22E-08

9.01	225.23	0.001	3.74E-03	D	1.17E-07
9.01	225.23	0.001	3.70E-03	W	8.55E-07
9.01	225.23	0.001	3.42E-03	VAPOR	1.85E-07
9.01	225.23	0.001	1.36E-02	VAPOR	7.70E-07
9.01	225.23	0.001	9.99E-08	D ORGANIC	1.81E-04
9.01	225.23	0.001	7.77E-02	VAPOR	2.06E-07
450.45	2252.25	0.3	1.26E-05	VAPOR	1.20E-06
450.45	2252.25	0.3	1.18E-06	D ORGANIC	7.33E-06
450.45	2252.25	0.3	3.58E-06	W	4.48E-08
450.45	2252.25	0.05	9.10E-08	W	1.55E-08
450.45	2252.25	0.3	2.69E-05	W	2.52E-08
450.45	2252.25	0.3	3.63E-09	W	1.90E-08
450.45	2252.25	0.05	2.63E-07	W	7.73E-04
450.45	2252.25	0.01	1.84E-07	D	2.42E-05
450.45	2252.25	0.1	1.47E-07	D	1.74E-04
450.45	2252.25	-	0.00E+00	D	3.29E-05
450.45	2252.25	1	2.18E-07	D	5.85E-06
450.45	2252.25	1	2.47E-07	D	1.23E-06
450.45	2252.25	1	1.89E-06	D	1.19E-07
450.45	2252.25	1	7.33E-05	D	3.08E-07
450.45	2252.25	1	4.92E-08	D	1.35E-07
450.45	2252.25	1	7.07E-06	W	8.40E-07
450.45	2252.25	1	1.12E-05	D	9.03E-09
450.45	2252.25	1	5.00E-05	D	4.11E-08
450.45	2252.25	1	1.94E-07	-	0.00E+00
450.45	2252.25	-	-	-	-
450.45	2252.25	0.5	4.37E-07	D	1.77E-07
450.45	2252.25	-	0.00E+00	D	4.44E-08
450.45	2252.25	0.5	4.66E-07	Y	5.48E-07
450.45	2252.25	0.5	1.31E-06	Y	1.54E-06
450.45	2252.25	0.0003	2.81E-07	Y	6.40E-06
450.45	2252.25	0.0003	3.63E-07	-	0.00E+00
450.45	2252.25	0.0003	6.62E-06	-	0.00E+00
450.45	2252.25	0.0003	1.50E-06	Y	6.84E-05
450.45	2252.25	0.0003	1.45E-06	Y	1.39E-07
9.01	225.23	0.001	3.37E-05	D	1.36E-06
9.01	225.23	0.001	3.13E-04	D	6.92E-07
9.01	225.23	0.001	1.79E-05	D	8.29E-08
9.01	225.23	-	-	-	-
450.45	2252.25	0.001	6.48E-06	-	0.00E+00
450.45	2252.25	0.001	2.00E-06	-	0.00E+00
450.45	2252.25	0.001	9.55E-06	-	0.00E+00
450.45	2252.25	0.001	1.53E-06	-	0.00E+00
450.45	2252.25	0.001	9.18E-06	-	0.00E+00
450.45	2252.25	1	1.22E-07	D	8.77E-05
450.45	2252.25	0.1	5.59E-06	D	1.37E-03
450.45	2252.25	0.1	6.07E-07	D	5.81E-07
450.45	2252.25	0.1	6.70E-06	Y	1.35E-06
9.01	225.23	0.001	1.74E-06	Y	3.96E-05
9.01	225.23	0.001	1.04E-05	Y	2.54E-05
9.01	225.23	-	-	-	-
450.45	2252.25		0.00E+00	Y	7.33E-05

450.45	2252.25	1	8.62E-06	Y	3.27E-08
450.45	2252.25	0.001	4.81E-06	W	1.65E-02
450.45	2252.25	0.001	7.84E-07	W	5.70E-06
450.45	2252.25	0.001	3.42E-07	W	5.00E-07
450.45	2252.25	0.001	4.62E-06	Y	1.24E-06
450.45	2252.25	0.0003	2.18E-04	Y	2.29E-06
450.45	2252.25	0.0003	1.61E-04	Y	2.29E-06
450.45	2252.25	0.0003	1.17E-06	Y	1.22E-07
450.45	2252.25	0.0003	1.98E-06	Y	1.03E-06
450.45	2252.25	No Data	No Data	-	-
450.45	2252.25	1	1.07E-06	Y	6.85E-06
450.45	2252.25	1	9.62E-09	VAPOR	4.14E-06
450.45	2252.25	1	5.74E-07	W	8.32E-06
4504.50		1	6.40E-08	W	2.03E-06
4504.50		1	6.40E-08	W	2.03E-06
450.45	2252.25	0.002	1.82E-06	W	8.14E-08
450.45	2252.25	-	-	-	-
450.45	2252.25	-	-	-	-
450.45	2252.25	0.002	2.10E-05	D	1.74E-08
450.45	2252.25	0.002	5.40E-06	Y	1.38E-06
450.45	2252.25	0.002	7.33E-07	D	1.04E-05
450.45	2252.25	0.002	4.70E-06	Y	4.18E-06
450.45	2252.25	-	-	-	-
450.45	2252.25	0.02	9.58E-07	D	7.81E-06
450.45	2252.25	0.02	1.90E-06	Y	1.28E-05
450.45	2252.25	1	1.14E-05	Y	3.92E-05
450.45	2252.25	1	1.14E-05	Y	3.92E-05
450.45	2252.25	1	1.14E-05	Y	3.92E-05
450.45	2252.25	0.0003	5.59E-06	-	0.00E+00
450.45	2252.25	0.0003	8.07E-06	Radon pathway	0.00E+00
450.45	2252.25	-	0.00E+00	Y	4.77E-08
450.45	2252.25	1	5.29E-07	-	0.00E+00
450.45	2252.25	1	3.18E-05	Y	1.35E-07
9.01	225.23	1	3.85E-05	Y	5.77E-08
90.09	450.45	1	7.10E-05	Y	2.88E-06
450.45	2252.25	1	8.99E-08	Y	3.69E-08
9.01	225.23	1	2.76E-04	Y	8.10E-06
450.45	2252.25	1	4.74E-06	Y	4.33E-08
90.09	450.45	1	5.33E-05	-	0.00E+00
450.45	2252.25	1	6.73E-07	Y	6.73E-07
90.09	450.45	1	1.04E-05	D	1.32E-07
450.45	2252.25	1	2.46E-07	D	3.14E-06
450.45	2252.25	1	2.25E-06	D	1.79E-07
450.45	2252.25	-	-	-	-
450.45	2252.25	0.02	1.33E-06	D	1.67E-06
450.45	2252.25	0.02	1.05E-07	W	3.92E-01
450.45	2252.25	-	0.00E+00	W	4.29E-01
450.45	2252.25	0.02	1.71E-05	W	4.29E-01
450.45	2252.25	0.02	1.58E-04	W	4.11E-01
450.45	2252.25	0.02	3.45E-07	W	4.03E-01
450.45	2252.25	0.02	2.19E-07	W	2.19E-05
450.45	2252.25	0.02	9.58E-08	W	7.84E-03

450.45	2252.25	0.02	4.26E-07	W	8.58E-03
450.45	2252.25	0.01	5.44E-06	W	2.01E-06
450.45	2252.25	-	-	-	-
450.45	2252.25	-	-	-	-
450.45	2252.25	0.01	5.74E-06	Y	4.77E-05
450.45	2252.25	-	-	-	-
450.45	2252.25	-	-	-	-
450.45	2252.25	0.01	5.29E-06	Y	3.09E-06
450.45	2252.25	0.01	9.10E-06	Radon pathway	0.00E+00
450.45	2252.25	1	1.86E-05	D	2.32E-08
450.45	2252.25	1	1.13E-06	D	7.66E-08
450.45	2252.25	1	7.70E-07	D	2.51E-08
450.45	2252.25	-	0.00E+00	W	5.14E-06
450.45	2252.25	-	0.00E+00	W	2.52E-05
450.45	2252.25	-	0.00E+00	W	1.04E-08
450.45	2252.25	-	0.00E+00	W	1.22E-05
450.45	2252.25	-	0.00E+00	W	1.17E-05
450.45	2252.25	-	0.00E+00	D	3.39E-08
450.45	2252.25	-	0.00E+00	W	6.03E-06
450.45	2252.25	-	-	-	-
450.45	2252.25	-	-	-	-
450.45	2252.25	-	-	-	-
450.45	2252.25	0.001	8.44E-06	D	1.76E-07
450.45	2252.25	0.001	1.38E-06	W	4.59E-07
450.45	2252.25	0.001	6.62E-07	W	8.47E-06
450.45	2252.25	-	-	-	-
450.45	2252.25	0.0003	2.15E-06	W	6.25E-06
450.45	2252.25	0.0003	7.36E-06	W	1.15E-05
450.45	2252.25	-	-	-	-
450.45	2252.25	0.5	8.07E-06	Y	6.14E-05
450.45	2252.25	0.1	7.58E-06	Y	4.14E-05
450.45	2252.25	0.1	1.81E-07	Y	1.30E-03
450.45	2252.25	0.1	1.08E-07	Y	8.07E-07
450.45	2252.25	0.1	2.77E-06	Y	3.20E-07
450.45	2252.25	0.1	9.77E-07	Y	4.66E-07
450.45	2252.25	-	-	-	-
450.45	2252.25	0.05	1.10E-07	Y	3.07E-07
450.45	2252.25	-	-	-	-
450.45	2252.25	0.8	1.35E-06	Y	2.45E-04
450.45	2252.25	0.05	5.03E-06	Y	5.22E-06
450.45	2252.25	-	0.00E+00	Y	8.40E-08
450.45	2252.25	-	-	-	-
450.45	2252.25	1	1.15E-05	Y	2.43E-08
450.45	2252.25	1	1.42E-06	W	2.08E-07
450.45	2252.25	0.01	5.40E-06	W	4.00E-06
450.45	2252.25	-	-	-	-
450.45	2252.25	-	-	-	-
450.45	2252.25	-	-	-	-
450.45	2252.25	-	-	-	-
450.45	2252.25	0.01	5.22E-07	W	9.21E-06
450.45	2252.25	0.01	7.14E-06	W	2.56E-04
450.45	2252.25	-	-	-	-

450.45	2252.25	0.01	2.57E-06	W	3.40E-06
450.45	2252.25	0.01	2.30E-06	D	8.21E-08
450.45	2252.25	0.01	4.70E-06	D	2.69E-07
450.45	2252.25	0.01	2.33E-07	W	2.50E-07
450.45	2252.25	-	0.00E+00	W	3.88E-06
450.45	2252.25	0.0003	4.37E-06	W	2.15E-05
450.45	2252.25	0.0003	4.66E-07	W	2.39E-05
450.45	2252.25	0.05	3.88E-06	D	4.33E-07
450.45	2252.25	0.05	3.77E-06	Y	3.42E-01
450.45	2252.25	0.05	2.10E-07	W	2.15E+00
450.45	2252.25	0.05	5.77E-07	W	1.64E+00
450.45	2252.25	0.05	5.77E-07	W	1.64E+00
450.45	2252.25	0.05	6.22E-07	D	2.15E-07
450.45	2252.25	0.05	6.22E-07	D	2.15E-07
9.01	225.23	0.001	2.43E-07	D	2.35E-07
9.01	225.23	-	-	-	-
9.01	225.23	-	-	-	-
9.01	225.23	0.001	4.44E-03	-	0.00E+00
9.01	225.23	0.001	4.00E-06	Radon pathway	0.00E+00
9.01	225.23	0.001	3.26E-06	Radon pathway	0.00E+00
9.01	225.23	0.001	2.37E-07	-	0.00E+00
9.01	225.23	-	0.00E+00	Radon pathway	0.00E+00
450.45	2252.25	-	0.00E+00	W	3.77E-07
450.45	2252.25	0.01	2.26E-06	Y	1.32E-01
450.45	2252.25	-	-	-	-
450.45	2252.25	-	0.00E+00	Y	2.27E-06
450.45	2252.25	0.01	2.31E-06	W	1.02E-05
450.45	2252.25	0.01	3.85E-07	D	2.71E-07
450.45	2252.25	0.01	3.24E-06	D	7.51E-07
450.45	2252.25	-	-	-	-
450.45	2252.25	0.8	8.77E-06	-	0.00E+00
450.45	2252.25	0.8	9.18E-07	-	0.00E+00
450.45	2252.25	0.001	6.22E-06	-	0.00E+00
9.01	225.23	0.001	1.06E-02	Y	1.72E-06
450.45	2252.25	0.001	3.63E-06	Y	2.81E-05
450.45	2252.25	0.001	2.16E-06	Y	4.88E-05
450.45	2252.25	-	0.00E+00	Y	3.63E-08
450.45	2252.25	0.2	1.08E-06	Y	8.07E-06
450.45	2252.25	-	0.00E+00	Y	1.62E-06
450.45	2252.25	0.2	1.63E-06	Y	1.45E-07
450.45	2252.25	0.2	2.13E-07	Y	1.62E-07
450.45	2252.25	0.2	5.37E-03	Y	2.06E-06
450.45	2252.25	0.2	5.25E-07	Y	8.14E-08
450.45	2252.25	0.2	4.55E-05	Y	2.04E-05
450.45	2252.25	0.2	6.25E-07	Y	3.92E-08
450.45	2252.25	0.005	7.88E-07	D	3.21E-04
450.45	2252.25	0.005	1.49E-07	W	8.58E-03
450.45	2252.25	0.005	2.17E-06	Y	8.10E-03
450.45	2252.25	0.0003	1.03E-06	Y	1.25E-04
450.45	2252.25	0.0003	4.33E-06	W	4.77E-08
450.45	2252.25	0.0003	4.74E-07	Y	5.14E-08
450.45	2252.25	0.0003	3.67E-06	Y	5.03E-08

450.45	2252.25	0.0003	1.05E-06	W	3.77E-06
450.45	2252.25	0.0003	1.09E-05	Y	4.48E-06
450.45	2252.25	0.0003	7.66E-06	W	5.74E-06
450.45	2252.25	0.0003	3.96E-06	D	3.01E-05
450.45	2252.25	0.0003	2.99E-06	W	3.09E-05
450.45	2252.25	-	0.00E+00	D	2.26E-06
450.45	2252.25	0.1	1.90E-03	D	8.21E-05
450.45	2252.25	-	0.00E+00	W	2.64E-07
450.45	2252.25	-	0.00E+00	D	6.36E-07
450.45	2252.25	-	0.00E+00	W	9.43E-07
450.45	2252.25	-	0.00E+00	D	4.33E-07
450.45	2252.25	-	0.00E+00	W	4.18E-06
450.45	2252.25	-	0.00E+00	D	1.43E-06
450.45	2252.25	-	0.00E+00	W	3.03E-06
450.45	2252.25	0.0003	5.25E-06	W	3.61E-05
450.45	2252.25	0.0003	4.70E-06	W	1.58E-07
450.45	2252.25	0.0003	1.17E-07	D	2.01E-06
450.45	2252.25	-	0.00E+00	D	3.85E-06
450.45	2252.25	0.01	1.46E-06	W	1.41E-07
450.45	2252.25	0.01	1.19E-07	W	1.23E-07
450.45	2252.25	0.01	1.81E-06	D	1.24E-06
450.45	2252.25	0.01	2.56E-06	D	2.13E-07
450.45	2252.25	0.01	1.61E-06	W	2.49E-08
450.45	2252.25	0.01	3.13E-07	D	3.41E-07
9.01	225.23	0.001	1.17E-03	W	5.18E-08
9.01	225.23	0.001	4.44E-07	D	1.03E-07
9.01	225.23	0.001	3.20E-03	W	3.96E-05
9.01	225.23	0.001	3.54E-03	W	5.11E-04
9.01	225.23	0.001	3.54E-03	W	4.70E-04
9.01	225.23	0.001	6.84E-05	Y	4.00E-04
9.01	225.23	0.001	3.36E-03	W	4.11E-05
9.01	225.23	0.00001	3.34E-07	Y	4.29E-05
9.01	225.23	0.001	3.32E-03	Y	4.22E-07
9.01	225.23	0.00001	2.72E-06	W	7.88E-06
9.01	225.23	0.00001	1.35E-05	W	1.47E-06
450.45	2252.25	-	0.00E+00	W	1.32E-06
90.09	450.45	0.2	6.59E-04	W	7.21E-06
90.09	450.45	0.2	3.66E-04	W	8.32E-06
450.45	2252.25	0.2	3.85E-04	W	3.20E-06
9.01	225.23	0.2	1.32E-03	W	2.16E-04
9.01	225.23	0.2	1.44E-03	W	5.96E-04
450.45	2252.25	1	1.45E-07	Y	3.89E-01
450.45	2252.25	-	0.00E+00	W	2.84E-03
450.45	2252.25	1	7.70E-06	D	2.24E-06
450.45	2252.25	1	9.99E-06	W	1.18E-07
450.45	2252.25	1	9.36E-06	W	1.02E-07
450.45	2252.25	1	4.92E-06	W	1.89E-06
450.45	2252.25	1	1.74E-07	W	2.23E-05
450.45	2252.25	1	9.81E-08	W	2.63E-06
450.45	2252.25	-	-	-	-
450.45	2252.25	-	-	-	-
450.45	2252.25	-	-	-	-

450.45	2252.25	-	-	-	-
450.45	2252.25	-	-	-	-
450.45	2252.25	0.8	2.19E-06	W	2.62E-07
450.45	2252.25	0.8	2.95E-06	D	1.85E-07
450.45	2252.25	0.8	2.94E-06	D	1.96E-07
450.45	2252.25	0.8	9.51E-09	W	1.17E-06
450.45	2252.25	0.8	3.07E-06	D	1.90E-06
450.45	2252.25	0.05	1.16E-08	D	1.66E-06
450.45	2252.25	0.05	1.48E-06	D	4.26E-07
450.45	2252.25	-	-	-	-
450.45	2252.25	-	0.00E+00	D	6.99E-07
450.45	2252.25	-	0.00E+00	W	1.12E-07
450.45	2252.25	-	0.00E+00	D	7.29E-07
450.45	2252.25	-	0.00E+00	D INORGANIC	1.23E-07
450.45	2252.25	-	0.00E+00	D INORGANIC	1.23E-07
450.45	2252.25	-	0.00E+00	D ORGANIC	9.25E-08
450.45	2252.25	-	0.00E+00	D ORGANIC	9.25E-08
450.45	2252.25	0.05	3.05E-06	D INORGANIC	5.70E-07
450.45	2252.25	0.05	1.06E-06	VAPOR	1.74E-04
450.45	2252.25	0.05	2.74E-05	W	4.22E-05
450.45	2252.25	0.05	6.96E-07	W	1.50E-06
450.45	2252.25	0.1	7.33E-07	D INORGANIC	7.36E-07
450.45	2252.25	0.1	7.33E-07	D INORGANIC	7.36E-07
450.45	2252.25	0.01	7.70E-08	W	5.74E-06
450.45	2252.25	0.01	7.29E-06	W	1.51E-07
450.45	2252.25	0.01	1.01E-05	D	4.63E-08
450.45	2252.25	0.1	2.81E-06	W	4.81E-07
450.45	2252.25	0.01	1.07E-05	W	8.25E-07
450.45	2252.25	0.01	9.40E-08	W	1.91E-07
450.45	2252.25	0.01	7.21E-06	W	1.44E-06
450.45	2252.25	0.01	1.79E-06	W	2.87E-08
450.45	2252.25	0.0001	1.43E-06	W	2.64E-06
450.45	2252.25	0.0001	6.40E-06	W	3.40E-05
450.45	2252.25	-	-	-	-
450.45	2252.25	0.0001	2.23E-06	D	1.38E-07
450.45	2252.25	0.0001	7.25E-06	W	1.27E-07
450.45	2252.25	0.0001	2.52E-07	D	2.36E-07
450.45	2252.25	0.05	1.61E-06	W	2.32E-05
450.45	2252.25	0.8	9.62E-06	W	5.62E-07
450.45	2252.25	0.8	8.69E-06	W	2.38E-06
450.45	2252.25	0.01	5.40E-07	W	4.55E-05
450.45	2252.25	0.01	2.18E-06	W	3.04E-07
450.45	2252.25	-	-	-	-
450.45	2252.25	0.0003	1.85E-04	D	5.25E-06
450.45	2252.25	0.0003	3.89E-07	W	3.30E-07
450.45	2252.25	0.0003	2.99E-06	Y	3.65E-08
450.45	2252.25	0.02	3.08E-06	W	2.09E-06
450.45	2252.25	0.02	2.95E-06	W	3.61E-05
450.45	2252.25	0.02	1.39E-06	W	4.77E-06
450.45	2252.25	0.02	9.03E-07	W	2.10E-06
450.45	2252.25	0.02	1.55E-06	W	1.15E-07
450.45	2252.25	0.02	8.40E-06	W	9.29E-07

450.45	2252.25	0.02	1.08E-07	W	3.33E-07
450.45	2252.25	0.02	1.23E-05	W	6.36E-06
450.45	2252.25	0.02	1.95E-05	D	2.63E-06
450.45	2252.25	0.01	2.45E-05	D	3.51E-06
450.45	2252.25	0.3	1.98E-06	D	1.16E-07
450.45	2252.25	0.01	2.39E-08	D	8.58E-07
450.45	2252.25	0.01	1.32E-07	W	6.51E-06
450.45	2252.25	0.01	9.25E-06	Y	9.92E-06
90.09	450.45	0.3	1.42E-04	D	2.44E-06
450.45	2252.25	0.01	3.10E-06	W	3.74E-06
450.45	2252.25	0.01	2.01E-06	D	1.15E-06
450.45	2252.25	-	-	-	-
450.45	2252.25	0.001	6.51E-06	W	1.01E-06
450.45	2252.25	0.0003	1.24E-07	W	7.55E-06
450.45	2252.25	0.0003	6.73E-06	W	6.11E-07
450.45	2252.25	-	-	-	-
450.45	2252.25	0.8	4.22E-08	W	2.74E-05
450.45	2252.25	0.8	4.66E-07	Y	2.14E-05
450.45	2252.25	0.8	1.45E-06	D	5.99E-07
450.45	2252.25	0.8	2.76E-06	D	2.05E-06
450.45	2252.25	0.8	3.19E-08	D	2.02E-06
450.45	2252.25	0.8	1.71E-07	D	2.90E-06
450.45	2252.25	0.8	1.24E-06	D	1.94E-06
450.45	2252.25	0.8	4.88E-06	D	1.10E-06
450.45	2252.25	0.8	1.46E-06	W	1.27E-06
450.45	2252.25	0.8	6.22E-08	D	1.02E-05
450.45	2252.25	0.2	1.68E-06	D	5.29E-05
450.45	2252.25	0.2	7.70E-06	W	1.64E-05
450.45	2252.25	0.2	4.18E-06	Y	4.70E-09
450.45	2252.25	0.2	5.66E-06	W	8.77E-07
450.45	2252.25	0.2	3.67E-06	Y	1.79E-07
450.45	2252.25	0.2	6.92E-07	Y	2.13E-08
450.45	2252.25	0.2	8.25E-06	W	2.79E-06
450.45	2252.25	0.2	2.02E-07	Y	8.33E-08
450.45	2252.25	0.2	1.07E-05	W	6.48E-06
450.45	2252.25	0.2	9.03E-07	W	4.18E-07
450.45	2252.25	0.2	9.10E-06	W	1.18E-04
450.45	2252.25	0.2	9.40E-06	Y	1.15E-07
450.45	2252.25	0.2	1.75E-07	W	4.26E-07
450.45	2252.25	0.2	8.36E-07	VAPOR	3.53E-07
450.45	2252.25	0.2	2.45E-07	W	2.03E-08
450.45	2252.25	0.0002	9.25E-07	W	5.33E-08
450.45	2252.25	0.0002	3.81E-05	W	2.35E-07
9.01	225.23	0.0002	3.96E-04	D	2.27E-06
450.45	2252.25	0.0002	3.53E-03	D	5.55E-06
9.01	225.23	0.0002	5.48E-04	D	2.13E-06
450.45	2252.25	0.0002	1.35E-06	D	4.70E-06
90.09	450.45	0.0002	2.73E-03	D	2.42E-06
450.45	2252.25	-	-	-	-
450.45	2252.25	0.0002	1.37E-05	D	1.38E-06
450.45	2252.25	0.01	2.31E-05	W	1.47E-07
450.45	2252.25	0.01	5.99E-07	D	7.21E-06

450.45	2252.25	-	-	-	-
450.45	2252.25	1	6.73E-07	W	5.22E-05
450.45	2252.25	1	3.00E-07	D	4.96E-07
450.45	2252.25	1	1.47E-06	W	2.55E-08
450.45	2252.25	1	3.36E-06	D	4.00E-06
450.45	2252.25	-	0.00E+00	D	2.26E-06
450.45	2252.25	-	0.00E+00	D	3.35E-07
450.45	2252.25	-	0.00E+00	D	6.51E-06
450.45	2252.25	-	0.00E+00	D	8.62E-06
450.45	2252.25	0.0003	5.29E-06	D	2.80E-07
450.45	2252.25	0.0003	4.29E-07	W	1.72E-07
450.45	2252.25	0.05	9.03E-04	D	1.92E-06
450.45	2252.25	0.002	1.18E-06	D	2.39E-04
90.09	450.45	0.05	1.31E-03	D	9.32E-07
450.45	2252.25	0.05	2.89E-04	W	3.34E-07
450.45	2252.25	0.05	2.83E-04	W	4.29E-07
450.45	2252.25	0.05	2.66E-04	W	1.79E-05
450.45	2252.25	0.05	2.69E-04	W	2.18E-05
450.45	2252.25	0.002	3.17E-06	W	1.04E-06
450.45	2252.25	0.05	2.55E-04	W	6.51E-08
450.45	2252.25	0.002	7.73E-08	W	2.10E-07
450.45	2252.25	0.002	4.44E-06	D	1.59E-06
450.45	2252.25	0.01	8.58E-06	D	3.26E-06
450.45	2252.25	0.01	6.14E-08	D	1.02E-06
450.45	2252.25	-	-	-	-
450.45	2252.25	0.01	3.44E-07	D	1.06E-05
450.45	2252.25	0.01	1.99E-06	D	5.62E-06
450.45	2252.25	0.01	2.76E-06	D	2.49E-07
450.45	2252.25	0.01	9.40E-06	D	1.35E-05
450.45	2252.25	-	0.00E+00	W	4.59E-07
450.45	2252.25	-	0.00E+00	D	5.11E-06
450.45	2252.25	-	0.00E+00	D	8.36E-06
450.45	2252.25	-	0.00E+00	W	8.84E-08
450.45	2252.25	-	0.00E+00	W	4.07E-07
450.45	2252.25	-	0.00E+00	W	1.20E-07
450.45	2252.25	-	0.00E+00	W	3.32E-05
450.45	2252.25	-	0.00E+00	W	1.52E-02
450.45	2252.25	-	0.00E+00	W	2.50E-01
450.45	2252.25	-	0.00E+00	Y	1.73E+00
450.45	2252.25	-	-	-	-
450.45	2252.25	-	0.00E+00	Y	2.62E-01
450.45	2252.25	0.0001	4.22E-06	Y	1.15E+00
450.45	2252.25	0.0001	2.43E-06	W	1.79E-04
450.45	2252.25	0.0001	5.99E-06	D	8.58E-03
450.45	2252.25	-	-	-	-
450.45	2252.25	0.0001	1.08E-05	W	1.61E-02
450.45	2252.25	0.0001	7.07E-07	D	1.27E-02
450.45	2252.25	0.0001	9.51E-06	W	1.49E-02
450.45	2252.25	0.0001	4.14E-08	W	7.99E-03
450.45	2252.25	0.0001	1.91E-06	W	7.88E-03
450.45	2252.25	0.0001	4.55E-06	W	7.29E-03
450.45	2252.25	0.0003	3.00E-06	D	4.66E-06

450.45	2252.25	0.0003	1.76E-06	W	1.56E-06
450.45	2252.25	0.5	3.64E-06	W	3.23E-05
450.45	2252.25	0.5	1.44E-05	W	7.14E-07
450.45	2252.25	0.5	8.88E-08	W	1.96E-06
450.45	2252.25	0.5	1.31E-06	W	6.59E-08
450.45	2252.25	0.002	3.85E-06	W	6.99E-06
450.45	2252.25	0.002	1.49E-06	W	1.59E-06
450.45	2252.25	0.002	3.42E-06	D	2.12E-05
450.45	2252.25	0.002	1.66E-06	W	1.09E-05
450.45	2252.25	0.002	3.77E-06	W	8.33E-05
450.45	2252.25	0.002	8.44E-06	Y	2.33E-05

RESRAD v.6.3	RESRAD v6.3	FGR 12	FGR 12			
Res. Farmer	RECYCLE	Air Sub.	Water Sub.			HEAST Mort
Results		Dose	Dose			
		Coefficient	Coefficient	ICRP Lung	GI	Water
G(i,tmin)		mrem per	mrem per	Retention	Absorption	Ingestion
(pCi/g)		µCi y cm^-3	µCi y cm^-3	Type	(f1)	(risk/pCi)
-		8.42E+07	1.88E+05	S	5.00E-04	1.89E-10
4.89E+00		6.80E+05	1.52E+03	S	5.00E-04	2.01E-10
-		5.58E+09	1.21E+07	S	5.00E-04	1.99E-12
-		1.61E+10	3.50E+07	M	5.00E-02	4.81E-12
-		1.08E+08	2.34E+05	-	-	-
2.73E+00		9.11E+09	1.97E+07	M	5.00E-02	8.14E-12
-		2.24E+07	5.12E+04	-	-	-
-		2.08E+08	4.43E+05	-	-	-
5.41E+00		1.59E+10	3.43E+07	M	5.00E-02	9.88E-12
-		1.51E+08	3.28E+05	M	5.00E-02	8.21E-12
2.10E+00		1.59E+10	3.43E+07	M	1.00E-02	1.73E-11
-		1.08E+10	2.35E+07	-	-	-
1.37E+00		9.55E+07	2.20E+05	M	5.00E-04	1.04E-10
-		7.18E+07	1.61E+05	M	5.00E-04	1.79E-12
3.17E+00		3.70E+06	8.50E+03	M	5.00E-04	7.07E-11
7.50E-01		2.55E+08	5.77E+05	M	5.00E-04	1.03E-10
-		4.50E+09	9.78E+06	M	5.00E-04	2.52E-12
-		1.71E+08	3.77E+05	M	5.00E-04	2.22E-13
-		3.83E+09	8.34E+06	M	5.00E-04	1.23E-13
-		1.48E+04	0.00E+00	-	-	-
-		1.06E+06	2.06E+03	-	-	-
-		7.59E+09	1.65E+07	-	-	-
-		1.03E+10	2.23E+07	M	5.00E-01	1.02E-11
-		2.22E+07	5.10E+04	M	5.00E-01	1.56E-12
-		4.26E+09	9.26E+06	M	5.00E-01	6.70E-12
-		2.49E+09	5.40E+06	M	5.00E-01	9.66E-12
-		5.03E+07	1.10E+05	M	5.00E-01	2.50E-12
-		1.86E+08	4.19E+05	M	1.00E+00	3.37E-11
-		1.73E+06	3.76E+03	-	-	-
-		6.18E+09	1.34E+07	S	1.00E-01	1.66E-12
4.67E+02		3.75E+08	8.53E+05	S	1.00E-01	1.50E-12
-		1.09E+09	2.41E+06	-	-	-
-		-	-	-	-	-
-		2.27E+09	4.93E+06	S	1.00E-01	6.29E-12
-		3.11E+09	6.87E+06	S	1.00E-01	7.44E-12
-		4.77E+08	1.06E+06	S	1.00E-01	2.78E-12
-		2.45E+09	5.35E+06	M	2.00E-01	2.00E-12
2.30E+01		2.08E+09	4.57E+06	M	2.00E-01	6.81E-12
-		3.06E+08	6.75E+05	M	2.00E-01	3.19E-12
-		2.71E+08	5.98E+05	M	2.00E-01	2.56E-12
-		3.36E+09	7.31E+06	-	-	-
-		2.53E+08	5.52E+05	M	2.00E-01	3.70E-13
-		1.00E+09	2.18E+06	M	2.00E-01	1.49E-11
-		4.86E+09	1.06E+07	M	2.00E-01	2.14E-13
-		6.02E+09	1.31E+07	M	2.00E-01	9.29E-14
1.00E+04		1.31E+06	2.53E+03	S	5.00E-03	7.03E-12

-		2.76E+08	6.02E+05	S	5.00E-03	8.66E-14
-		1.88E+10	4.10E+07	M	5.00E-02	7.73E-12
6.09E+00		8.81E+09	1.92E+07	M	5.00E-02	5.66E-12
-		-	-	-	-	-
-		3.84E+06	7.39E+03	M	5.00E-02	8.92E-12
-		2.59E+08	5.66E+05	M	-	-
-		1.08E+09	2.34E+06	M	5.00E-02	7.10E-13
-		7.46E+08	1.62E+06	M	5.00E-02	5.11E-13
-		8.94E+09	1.94E+07	M	5.00E-02	1.92E-13
6.23E+03		9.59E+03	1.89E+01	M	5.00E-04	1.11E-12
-		5.12E+09	1.11E+07	M	5.00E-04	5.66E-13
-		-	-	-	-	-
-		1.76E+09	3.85E+06	M	1.00E+00	3.01E-13
-		4.50E+08	9.76E+05	M	1.00E+00	4.70E-14
-		3.63E+07	8.49E+04	M	1.00E+00	2.82E-13
-		1.52E+10	3.29E+07	M	1.00E+00	1.71E-12
-		4.46E+07	9.64E+04	M	1.00E+00	8.44E-14
-		1.10E+10	2.38E+07	M	1.00E+00	1.48E-13
-		-	-	-	-	-
-		5.71E+09	1.24E+07	M	1.00E+00	4.07E-14
-		2.84E+17	5.13E+01	M	1.00E+00	1.55E-12
-		2.84E+17	5.13E+01	M	1.00E+00	1.55E-12
-		2.84E+17	5.13E+01	M	1.00E+00	1.55E-12
-		-	-	-	-	-
4.01E+02		0.00E+00	0.00E+00	M	3.00E-01	3.53E-13
-		1.01E+05	1.96E+02	M	3.00E-01	2.47E-12
-		6.26E+09	1.35E+07	M	3.00E-01	7.55E-12
-		2.02E+10	4.39E+07	M	-	-
1.43E+01		3.43E+07	7.91E+04	S	5.00E-02	5.00E-12
-		-	-	-	-	-
1.77E-01		1.69E+05	3.29E+02	F	5.00E-02	2.28E-11
2.44E-01		8.11E+05	1.57E+03	F	5.00E-02	2.87E-11
-		1.31E+09	2.84E+06	S	5.00E-02	8.66E-12
-		1.37E+08	2.94E+05	S	5.00E-02	1.70E-11
-		6.37E+09	1.38E+07	S	5.00E-02	1.37E-12
-		1.23E+10	2.65E+07	S	5.00E-02	1.22E-12
-		7.86E+08	1.74E+06	M	5.00E-04	1.35E-12
-		4.01E+08	8.90E+05	M	5.00E-04	4.63E-12
-		1.51E+09	3.31E+06	M	5.00E-04	7.10E-12
2.01E+02		9.96E+07	2.23E+05	M	5.00E-04	3.52E-11
7.56E+02		5.52E+05	1.30E+03	M	5.00E-04	4.44E-11
1.53E+01		1.85E+09	4.03E+06	M	5.00E-04	1.27E-10
9.76E+01		5.26E+05	1.24E+03	M	5.00E-04	8.62E-11
2.78E+01		6.52E+08	1.45E+06	M	5.00E-04	1.32E-10
2.11E+02		5.91E+05	1.38E+03	-	-	-
-		1.26E+05	2.50E+02	M	5.00E-04	4.26E-12
-		1.72E+03	4.03E+00	M	-	-
1.89E+00		2.60E+06	5.23E+03	M	1.00E+00	3.30E-12
-		9.19E+09	1.99E+07	M	1.00E+00	1.93E-13
-		6.65E+05	1.55E+03	M	5.00E-04	3.85E-11
3.95E+01		6.87E+08	1.52E+06	M	5.00E-04	9.47E-11
1.03E+02		5.73E+05	1.34E+03	M	5.00E-04	8.36E-11

2.88E+00		4.63E+08	1.03E+06	M	5.00E-04	1.04E-10
5.51E+01		5.21E+05	1.23E+03	M	5.00E-04	1.02E-10
1.12E+01		1.75E+09	3.82E+06	M	5.00E-04	9.95E-11
1.50E+01		3.96E+05	9.30E+02	-	-	-
-		1.09E+08	2.37E+05	M	5.00E-04	8.40E-14
-		0.00E+00	0.00E+00	-	-	-
-		2.14E+10	4.64E+07	M	1.00E-01	1.01E-11
1.28E+02		6.55E+08	1.46E+06	M	1.00E-01	1.04E-12
-		5.56E+09	1.20E+07	M	1.00E-01	2.95E-12
-		1.02E+04	2.42E+01	M	1.00E-01	1.26E-13
2.82E+00		1.47E+10	3.20E+07	M	1.00E-01	1.57E-11
-		2.53E+07	5.55E+04	M	1.00E-01	2.66E-15
-		4.60E+08	1.02E+06	M	1.00E-01	2.43E-13
-		5.88E+09	1.28E+07	S	1.00E-01	1.35E-13
-		1.76E+08	3.85E+05	S	1.00E-01	1.85E-13
-		6.12E+09	1.33E+07	-	-	-
-		1.45E+09	3.15E+06	F	1.00E+00	1.85E-13
-		3.83E+07	8.99E+04	F	1.00E+00	1.86E-13
-		3.90E+09	8.48E+06	F	1.00E+00	1.46E-12
5.01E+00		8.84E+09	1.92E+07	F	1.00E+00	4.22E-11
-		1.06E+08	2.37E+05	F	1.00E+00	4.14E-14
4.69E+02		6.60E+04	1.28E+02	F	1.00E+00	4.74E-12
-		1.24E+10	2.70E+07	F	1.00E+00	8.66E-12
1.10E+01		9.04E+05	1.74E+03	F	1.00E+00	3.04E-11
-		1.41E+10	3.06E+07	F	1.00E+00	1.58E-13
-		-	-	-	-	-
-		4.66E+09	1.01E+07	S	5.00E-01	4.63E-13
-		5.68E+09	1.24E+07	-	-	-
-		1.06E+09	2.31E+06	S	5.00E-01	6.40E-13
-		6.32E+08	1.40E+06	S	5.00E-01	1.94E-12
-		1.90E+09	4.17E+06	M	5.00E-04	2.26E-13
-		1.40E+08	3.07E+05	M	5.00E-04	4.14E-13
-		1.64E+08	3.73E+05	M	5.00E-04	1.11E-11
-		2.03E+05	3.95E+02	M	5.00E-04	2.53E-12
-		2.08E+09	4.58E+06	M	5.00E-04	2.02E-12
-		2.14E+06	4.74E+03	M	5.00E-04	3.49E-11
1.20E+01		2.25E+07	5.12E+04	M	5.00E-04	5.51E-11
-		2.63E+09	5.71E+06	M	5.00E-04	2.73E-11
-		-	-		-	-
6.47E+00		6.60E+09	1.44E+07	M	5.00E-04	6.07E-12
-		1.66E+09	3.61E+06	M	5.00E-04	2.98E-12
5.99E+00		7.17E+09	1.55E+07	M	5.00E-04	1.03E-11
2.54E+02		2.91E+08	6.55E+05	M	5.00E-04	1.90E-12
-		7.88E+09	1.71E+07	M	5.00E-04	1.27E-11
-		5.72E+09	1.25E+07	M	1.00E+00	9.73E-14
-		4.13E+09	9.03E+06	M	1.00E-01	7.07E-12
9.72E+04		0.00E+00	0.00E+00	M	1.00E-01	8.62E-13
-		6.97E+09	1.51E+07	M	1.00E-01	7.88E-12
-		7.67E+05	1.79E+03	M	5.00E-04	2.15E-12
-		1.28E+07	2.93E+04	M	5.00E-04	1.65E-11
-		-	-	-	-	-
-		1.71E+08	3.76E+05	-	-	-

-		2.67E+08	5.97E+05	F	1.00E+00	7.29E-12
-		1.51E+10	3.27E+07	M	1.00E-03	6.40E-12
-		8.41E+08	1.86E+06	M	1.00E-03	1.04E-12
-		5.35E+09	1.16E+07	M	1.00E-03	2.83E-13
-		1.62E+10	3.50E+07	M	1.00E-03	5.59E-12
2.99E+02		0.00E+00	0.00E+00	F	5.00E-04	4.22E-11
2.18E+01		0.00E+00	0.00E+00	F	5.00E-04	2.97E-11
2.84E+02		4.33E+08	9.83E+05	M	5.00E-04	1.52E-12
-		2.58E+08	5.68E+05	M	5.00E-04	3.19E-12
-		-	-	-	-	-
1.46E+01		8.61E+03	1.99E+01	M	1.00E+00	6.96E-12
-		8.72E+03	2.01E+01	M	1.00E+00	6.48E-14
-		6.21E+09	1.35E+07	M	1.00E+00	1.22E-12
-		3.87E+04	0.00E+00	M	1.00E+00	1.12E-13
-		-	-	M	1.00E+00	1.12E-13
-		1.97E+09	4.33E+06	M	2.00E-03	1.96E-12
-		-	-	-	-	-
-		-	-	-	-	-
3.43E+00		1.31E+10	2.85E+07	F	2.00E-03	1.51E-11
-		4.92E+09	1.08E+07	M	2.00E-03	6.55E-12
-		5.54E+09	1.21E+07	M	2.00E-03	7.18E-13
-		3.06E+09	6.70E+06	M	2.00E-03	6.36E-12
-		-	-	-	-	-
-		3.11E+08	7.05E+05	M	2.00E-02	1.43E-12
-		4.73E+08	1.05E+06	M	2.00E-02	3.00E-12
-		1.32E+09	2.90E+06	M	1.00E+00	5.70E-12
-		1.32E+09	2.90E+06	M	1.00E+00	5.70E-12
-		1.32E+09	2.90E+06	M	1.00E+00	5.70E-12
-		1.66E+08	3.61E+05	M	5.00E-04	9.21E-12
4.32E+00		9.87E+09	2.15E+07	M	5.00E-04	8.03E-12
-		5.33E+09	1.16E+07	-	-	-
-		8.50E+08	1.88E+06	F	1.00E+00	6.96E-13
-		6.28E+09	1.37E+07	F	1.00E+00	4.14E-11
-		6.10E+07	1.44E+05	F	1.00E+00	2.54E-11
-		2.51E+09	5.48E+06	F	1.00E+00	8.73E-11
-		4.86E+08	1.05E+06	F	1.00E+00	8.14E-14
1.26E-01		4.44E+07	1.04E+05	F	1.00E+00	1.48E-10
-		1.21E+10	2.63E+07	F	1.00E+00	6.36E-12
-		2.13E+09	4.65E+06	F	1.00E+00	4.55E-11
-		1.31E+10	2.84E+07	F	1.00E+00	8.44E-13
-		3.43E+09	7.46E+06	F	1.00E+00	1.44E-11
-		1.52E+10	3.29E+07	F	1.00E+00	2.50E-13
-		9.32E+09	2.02E+07	F	1.00E+00	3.05E-12
-		-	-	-	-	-
-		2.17E+09	4.78E+06	M	2.00E-02	1.29E-12
-		1.41E+09	3.08E+06	M	2.00E-02	9.47E-14
-		1.62E+07	3.52E+04	-	-	-
-		4.88E+08	1.07E+06	M	2.00E-02	2.48E-11
6.10E-01		5.26E+05	1.02E+03	F	2.00E-02	3.38E-11
-		8.63E+08	1.89E+06	M	2.00E-02	4.40E-13
-		1.46E+10	3.17E+07	M	2.00E-02	1.62E-13
-		3.87E+09	8.43E+06	M	2.00E-02	7.03E-14

-		4.89E+08	1.07E+06	M	2.00E-02	4.44E-13
-		8.01E+09	1.75E+07	S	1.00E-02	5.66E-12
-		-	-	-	-	-
-		-	-	-	-	-
-		4.57E+09	9.97E+06	S	1.00E-02	7.36E-12
-		-	-	-	-	-
-		-	-	-	-	-
-		5.30E+08	1.15E+06	S	1.00E-02	8.62E-12
-		1.31E+10	2.85E+07	S	1.00E-02	8.88E-12
1.78E+01		9.40E+08	2.03E+06	F	1.00E+00	2.47E-11
-		1.71E+09	3.68E+06	F	1.00E+00	1.26E-12
-		5.45E+09	1.19E+07	F	1.00E+00	7.88E-13
-		1.41E+09	3.08E+06	-	-	-
-		3.12E+07	6.84E+04	-	-	-
-		1.75E+05	4.08E+02	-	-	-
-		1.39E+07	2.98E+04	-	-	-
-		8.74E+08	1.93E+06	-	-	-
-		4.81E+09	1.04E+07	-	-	-
-		1.19E+10	2.58E+07	-	-	-
-		-	-	-	-	-
-		-	-	-	-	-
-		-	-	-	-	-
-		1.37E+10	2.97E+07	M	5.00E-04	1.10E-11
-		2.79E+08	5.98E+05	M	5.00E-04	1.88E-12
-		1.68E+10	3.64E+07	M	5.00E-04	5.77E-13
-		-	-	-	-	-
-		1.89E+08	4.18E+05	S	5.00E-04	3.53E-12
-		5.45E+09	1.20E+07	S	5.00E-04	9.36E-12
-		-	-	-	-	-
-		7.93E+09	1.72E+07	M	5.00E-01	1.14E-11
-		2.01E+10	4.37E+07	M	1.00E-01	6.44E-12
-		1.40E+10	3.04E+07	M	1.00E-01	1.27E-13
8.68E+03		0.00E+00	0.00E+00	M	1.00E-01	1.56E-13
1.23E+01		4.78E+09	1.04E+07	M	1.00E-01	2.28E-12
-		1.01E+10	2.17E+07	M	1.00E-01	1.03E-12
-		-	-	-	-	-
-		8.02E+09	1.74E+07	M	1.00E+00	6.88E-14
-		-	-	-	-	-
2.87E+02		2.94E+06	6.91E+03	M	1.00E+00	3.35E-12
-		8.50E+08	1.85E+06	M	1.00E+00	1.60E-12
-		5.72E+09	1.25E+07	-	-	-
-		-	-	-	-	-
3.62E+00		1.26E+10	2.74E+07	F	1.00E+00	9.62E-12
-		2.55E+10	5.52E+07	F	1.00E+00	1.23E-12
-		2.53E+10	5.49E+07	M	1.00E-02	5.70E-12
-		-	-	-	-	-
-		-	-	-	-	-
-		-	-	-	-	-
-		-	-	-	-	-
7.84E+01		5.19E+05	1.21E+03	M	1.00E-02	8.03E-13
4.38E+00		8.99E+09	1.95E+07	-	-	-
-		No Data	No Data	-	-	-

-		4.37E+09	9.47E+06	M	1.00E-02	2.45E-12
-		3.42E+08	7.51E+05	M	1.00E-02	3.66E-12
-		1.41E+10	3.08E+07	M	1.00E-02	5.03E-12
-		3.71E+09	8.07E+06	M	1.00E-02	1.96E-13
-		4.15E+09	8.99E+06	-	-	-
-		7.23E+08	1.59E+06	S	5.00E-04	6.96E-12
-		2.11E+09	4.63E+06	S	5.00E-04	5.44E-13
-		9.82E+09	2.14E+07	M	5.00E-02	2.83E-12
-		1.13E+10	2.45E+07	M	5.00E-02	3.89E-12
1.49E+04		0.00E+00	0.00E+00	M	5.00E-02	2.74E-13
-		0.00E+00	0.00E+00	M	5.00E-02	6.70E-13
-		0.00E+00	0.00E+00	M	5.00E-02	6.70E-13
-		3.26E+09	7.05E+06	M	5.00E-02	6.96E-13
-		3.26E+09	7.05E+06	M	5.00E-02	6.96E-13
1.47E+04		5.96E+06	1.35E+04	M	5.00E-04	3.46E-13
-		-	-	-	-	-
-		-	-	-	-	-
2.85E+00		1.20E+08	2.71E+05	M	5.00E-04	6.18E-11
-		3.18E+09	6.88E+06	M	5.00E-04	5.40E-12
-		8.98E+08	1.99E+06	M	5.00E-04	5.14E-12
-		7.37E+09	1.60E+07	M	5.00E-04	2.23E-13
-		1.89E+09	4.10E+06	-	-	-
-		5.73E+09	1.25E+07	-	-	-
-		4.01E+09	8.72E+06	M	1.00E-02	1.92E-12
-		-	-	-	-	-
-		8.88E+09	1.94E+07	M	-	-
-		3.75E+08	8.44E+05	M	1.00E-02	3.64E-12
-		3.21E+07	7.34E+04	M	1.00E-02	6.11E-13
-		3.97E+08	8.71E+05	M	1.00E-02	5.29E-12
-		-	-	-	-	-
-		1.16E+07	2.22E+04	M	8.00E-01	8.95E-12
-		9.61E+04	1.87E+02	M	8.00E-01	9.81E-13
-		3.66E+09	7.97E+06	S	5.00E-04	3.77E-12
1.54E-01		2.01E+08	4.42E+05	S	5.00E-04	1.73E-10
-		1.09E+09	2.39E+06	S	5.00E-04	5.55E-12
-		1.09E+10	2.37E+07	S	5.00E-04	2.56E-12
-		8.40E+07	1.78E+05	-	-	-
-		1.68E+09	3.69E+06	M	2.00E-01	1.02E-12
-		-	-	-	-	-
9.66E+03		5.91E+04	1.37E+02	M	2.00E-01	6.33E-13
-		9.48E+05	1.83E+03	M	2.00E-01	2.41E-13
3.71E+00		6.59E+06	1.53E+04	M	2.00E-01	8.81E-10
-		2.91E+08	6.32E+05	M	2.00E-01	4.11E-13
-		8.02E+08	1.78E+06	M	2.00E-01	2.50E-11
-		1.38E+09	3.03E+06	M	2.00E-01	3.44E-13
-		8.97E+06	2.10E+04	S	5.00E-03	1.25E-12
1.62E+04		0.00E+00	0.00E+00	S	5.00E-03	2.50E-13
-		2.93E+07	6.53E+04	S	5.00E-03	3.50E-12
3.90E+01		1.71E+09	3.70E+06	S	5.00E-04	8.73E-13
6.69E+00		8.74E+09	1.90E+07	S	5.00E-04	3.34E-12
1.46E+03		8.28E+07	1.93E+05	S	5.00E-04	5.59E-13
1.07E+01		4.19E+09	9.13E+06	S	5.00E-04	4.18E-12

8.53E+04		8.09E+04	1.64E+02	S	5.00E-04	1.69E-12
-		3.38E+09	7.31E+06	S	5.00E-04	1.72E-11
-		1.13E+10	2.45E+07	S	5.00E-04	7.99E-12
-		6.32E+07	1.37E+05	S	5.00E-04	6.66E-12
-		1.76E+09	3.85E+06	S	5.00E-04	4.51E-12
-		-	-	-	-	-
-		4.86E+04	1.05E+02	M	-	0.00E+00
-		4.45E+07	9.66E+04	-	-	-
-		0.00E+00	0.00E+00	-	-	-
-		0.00E+00	0.00E+00	-	-	-
-		4.77E+05	1.03E+03	-	-	-
-		9.85E+05	2.15E+03	-	-	-
-		9.68E+04	2.10E+02	-	-	-
-		5.23E+04	1.13E+02	-	-	-
-		3.68E+08	7.93E+05	S	5.00E-04	8.58E-12
-		2.45E+06	4.72E+03	S	5.00E-04	7.92E-12
-		2.28E+08	4.85E+05	S	5.00E-04	8.10E-14
-		3.26E+07	7.53E+04	-	-	-
-		1.57E+09	3.47E+06	F	1.00E-02	1.76E-12
2.40E+04		4.65E+04	1.08E+02	F	1.00E-02	2.11E-13
-		4.85E+07	1.10E+05	F	1.00E-02	3.03E-12
-		3.32E+08	7.51E+05	F	1.00E-02	4.11E-12
-		1.18E+08	2.64E+05	F	1.00E-02	2.62E-12
-		4.08E+08	9.05E+05	F	1.00E-02	4.00E-13
1.14E+02		7.42E+05	1.73E+03	M	5.00E-04	7.47E-11
-		2.36E+08	5.29E+05	M	5.00E-04	5.77E-13
6.32E+01		5.70E+05	1.33E+03	M	5.00E-04	1.31E-10
5.69E+01		4.95E+05	1.12E+03	M	5.00E-04	1.35E-10
5.69E+01		5.55E+05	1.30E+03	M	5.00E-04	1.35E-10
4.17E+01		8.47E+03	1.89E+01	M	5.00E-04	1.76E-12
5.99E+01		4.68E+05	1.09E+03	M	5.00E-04	1.28E-10
-		1.20E+08	2.70E+05	M	5.00E-04	4.74E-13
1.62E+01		3.47E+05	8.13E+02	M	5.00E-04	1.37E-10
-		2.32E+09	5.07E+06	M	5.00E-04	4.48E-12
-		7.02E+08	1.55E+06	M	5.00E-04	1.73E-11
-		5.13E+07	1.12E+05	-	-	-
-		7.11E+08	1.58E+06	M	2.00E-01	2.38E-10
-		5.50E+07	1.20E+05	M	2.00E-01	1.67E-10
-		3.26E+07	7.58E+04	M	2.00E-01	1.14E-10
3.73E-01		3.68E+07	8.12E+04	M	2.00E-01	3.85E-10
2.59E+00		0.00E+00	0.00E+00	M	2.00E-01	1.04E-09
-		3.46E+09	7.53E+06	F	1.00E+00	1.28E-13
-		6.19E+09	1.34E+07	-	-	-
-		2.79E+09	6.06E+06	F	1.00E+00	5.70E-12
-		5.22E+09	1.13E+07	F	1.00E+00	8.81E-12
-		5.62E+08	1.21E+06	F	1.00E+00	9.88E-12
2.64E+02		2.13E+05	4.13E+02	F	1.00E+00	5.22E-12
-		3.92E+09	8.48E+06	F	1.00E+00	1.40E-13
-		1.24E+10	2.69E+07	F	1.00E+00	7.88E-14
-		-	-	-	-	-
-		-	-	-	-	-
-		-	-	M	8.00E-01	4.96E-12

-		-	-	-	-	-
-		-	-	-	-	-
-		5.01E+09	1.09E+07	M	8.00E-01	3.16E-12
-		2.13E+09	4.65E+06	M	8.00E-01	4.88E-12
-		1.07E+08	2.39E+05	M	8.00E-01	5.59E-12
3.82E+04		0.00E+00	0.00E+00	M	8.00E-01	1.79E-14
-		3.35E+08	7.31E+05	M	8.00E-01	4.88E-12
-		1.03E+06	2.42E+03	S	5.00E-02	9.40E-15
-		4.34E+08	9.51E+05	S	5.00E-02	2.34E-12
-		-	-	-	-	-
-		1.21E+09	2.62E+06	-	-	-
-		4.26E+06	9.27E+03	-	-	-
-		3.13E+08	6.83E+05	-	-	-
-		2.16E+06	4.71E+03	-	-	-
-		2.16E+06	4.71E+03	-	-	-
-		2.23E+06	4.86E+03	-	-	-
-		2.23E+06	4.86E+03	-	-	-
-		2.63E+09	5.71E+06	M	5.00E-02	3.85E-12
-		4.45E+09	9.66E+06	M	5.00E-02	1.35E-12
9.96E+00		0.00E+00	0.00E+00	M	5.00E-02	4.22E-11
-		-	-	M	5.00E-02	6.36E-13
-		2.84E+04	5.54E+01	M	1.00E+00	5.14E-13
-		2.84E+04	5.54E+01	M	1.00E+00	5.14E-13
-		9.31E+08	2.06E+06	M	1.00E-01	6.59E-14
-		2.49E+09	5.42E+06	M	1.00E-01	1.06E-11
-		-	-	M	1.00E-01	1.29E-11
2.24E+01		-	-	M	1.00E-01	4.37E-12
-		1.60E+10	3.49E+07	M	1.00E-01	1.11E-11
-		8.76E+09	1.90E+07	M	1.00E-01	6.66E-14
-		3.89E+09	8.46E+06	M	1.00E-01	1.01E-11
-		8.34E+09	1.81E+07	M	1.00E-01	2.19E-12
-		1.23E+10	2.66E+07	S	1.00E-04	1.56E-12
-		1.17E+10	2.52E+07	S	1.00E-04	6.22E-12
-		-	-	-	-	-
-		6.00E+08	1.33E+06	S	1.00E-04	3.49E-12
-		1.96E+10	4.24E+07	S	1.00E-04	7.33E-12
-		2.25E+07	4.47E+04	S	1.00E-04	2.05E-13
-		6.03E+09	1.32E+07	F	8.00E-01	7.96E-13
-		2.16E+09	4.75E+06	F	8.00E-01	8.14E-12
1.68E+00		3.54E+04	6.93E+01	F	8.00E-01	7.29E-12
-		1.37E+07	2.76E+04	S	1.00E-02	6.48E-13
9.53E+02		6.12E+04	1.19E+02	S	1.00E-02	3.44E-12
-		-	-	-	-	-
4.31E+02		0.00E+00	0.00E+00	M	5.00E-04	3.74E-11
2.19E+05		4.22E+03	9.93E+00	M	5.00E-04	5.55E-13
-		2.66E+08	6.02E+05	M	5.00E-04	4.85E-12
-		4.46E+07	1.01E+05	M	2.00E-02	4.33E-12
-		7.97E+08	1.76E+06	M	2.00E-02	4.37E-12
2.40E+02		1.18E+07	2.79E+04	M	2.00E-02	2.21E-12
-		2.77E+05	5.37E+02	M	2.00E-02	1.50E-12
1.20E+01		7.03E+06	1.65E+04	M	2.00E-02	2.34E-12
-		4.71E+07	1.00E+05	M	2.00E-02	1.40E-11

-		7.65E+08	1.69E+06	M	2.00E-02	7.96E-14
-		1.85E+09	4.01E+06	M	2.00E-02	2.01E-11
1.20E+00		2.46E+08	5.56E+05	M	2.00E-02	2.56E-11
-		7.51E+05	1.75E+03	M	3.00E-01	3.13E-11
-		2.83E+09	6.14E+06	M	3.00E-01	2.26E-12
-		1.23E+09	2.69E+06	M	3.00E-01	1.67E-14
-		1.78E+09	3.89E+06	M	3.00E-01	1.07E-13
-		9.03E+06	1.74E+04	M	3.00E-01	1.28E-11
5.02E+00		8.80E+05	1.71E+03	M	3.00E-01	5.59E-11
-		4.03E+09	8.74E+06	M	3.00E-01	3.22E-12
-		7.93E+09	1.72E+07	M	3.00E-01	2.25E-12
-		-	-	-	-	-
-		7.48E+09	1.62E+07	S	1.00E-03	7.96E-12
1.44E+04		7.92E+06	1.83E+04	M	5.00E-04	1.86E-13
-		6.47E+09	1.40E+07	M	5.00E-04	8.70E-12
-		-	-	-	-	-
-		1.88E+09	4.10E+06	M	5.00E-01	3.06E-14
-		4.49E+09	9.73E+06	M	5.00E-01	5.77E-13
-		3.77E+09	8.20E+06	M	5.00E-01	1.80E-12
-		1.42E+10	3.10E+07	M	5.00E-01	3.42E-12
-		2.62E+08	5.66E+05	M	5.00E-01	3.59E-14
1.69E+02		3.89E+06	9.13E+03	M	5.00E-01	2.70E-13
-		5.42E+06	1.26E+04	M	5.00E-01	2.38E-12
5.09E+00		8.01E+09	1.74E+07	M	5.00E-01	7.10E-12
1.98E+01		1.89E+05	3.67E+02	M	5.00E-01	2.75E-12
-		6.88E+08	1.53E+06	M	5.00E-01	7.96E-14
-		3.15E+09	6.87E+06	M	3.00E-01	1.46E-12
-		1.16E+09	2.53E+06	M	3.00E-01	6.40E-12
6.99E+00		2.51E+07	5.90E+04	M	3.00E-01	4.11E-12
-		7.60E+08	1.68E+06	M	3.00E-01	4.14E-12
-		5.29E+07	1.24E+05	M	3.00E-01	3.33E-12
-		2.83E+07	6.14E+04	M	3.00E-01	1.00E-12
-		1.72E+07	4.02E+04	M	3.00E-01	8.62E-12
-		3.21E+08	7.00E+05	M	3.00E-01	1.71E-13
-		1.81E+08	3.96E+05	M	3.00E-01	1.53E-11
-		2.38E+09	5.19E+06	M	3.00E-01	2.17E-13
-		8.19E+09	1.78E+07	M	3.00E-01	8.25E-12
-		1.20E+09	2.66E+06	M	3.00E-01	1.70E-11
-		5.37E+09	1.17E+07	M	3.00E-01	1.92E-13
-		1.33E+10	2.90E+07	M	3.00E-01	8.73E-13
-		4.95E+09	1.08E+07	M	3.00E-01	3.01E-13
-		4.19E+07	9.33E+04	S	5.00E-04	6.66E-13
-		5.70E+08	1.25E+06	S	5.00E-04	4.74E-11
4.83E+00		1.07E+07	2.39E+04	S	5.00E-04	1.07E-10
1.65E+01		4.47E+08	1.00E+06	S	5.00E-04	2.24E-10
2.16E+00		2.03E+06	4.60E+03	S	5.00E-04	9.10E-11
-		6.10E+07	1.38E+05	S	5.00E-04	2.21E-12
1.66E+00		1.02E+06	2.32E+03	S	5.00E-04	1.01E-10
-		-	-	-	-	-
-		3.95E+07	8.92E+04	S	5.00E-04	2.31E-11
3.29E+00		6.46E+08	1.46E+06	S	1.00E-02	2.56E-11
-		4.88E+09	1.06E+07	-	-	-

-		-	-	-	-	-
-		7.50E+09	1.64E+07	F	1.00E+00	6.14E-13
-		4.42E+08	9.94E+05	F	1.00E+00	3.61E-13
-		2.55E+09	5.58E+06	F	1.00E+00	1.49E-12
1.12E+01		6.53E+06	1.42E+04	F	1.00E+00	5.85E-12
-		1.89E+07	3.95E+04	-	-	-
-		2.07E+10	4.49E+07	-	-	-
-		1.19E+10	2.59E+07	-	-	-
-		-	-	-	-	-
-		2.60E+07	5.84E+04	M	5.00E-04	8.92E-12
3.95E+04		2.51E+06	5.78E+03	M	5.00E-04	6.99E-13
-		6.11E+06	1.37E+04	M	2.00E-02	2.09E-10
-		3.45E+08	7.72E+05	M	2.00E-02	1.75E-12
4.30E+00		1.66E+06	3.76E+03	M	2.00E-02	2.92E-10
2.32E+01		1.90E+06	4.25E+03	M	2.00E-02	7.18E-11
2.35E+01		8.91E+05	2.04E+03	M	2.00E-02	7.07E-11
5.42E+00		8.41E+08	1.86E+06	M	2.00E-02	6.96E-11
2.57E+01		5.85E+05	1.35E+03	M	2.00E-02	6.70E-11
-		6.97E+08	1.55E+06	M	2.00E-02	4.88E-12
2.56E+01		3.98E+05	9.29E+02	M	2.00E-02	6.40E-11
-		2.53E+08	5.69E+05	M	2.00E-02	7.40E-14
-		4.59E+06	1.06E+04	M	2.00E-02	7.03E-12
-		1.69E+10	3.68E+07	M	1.00E-02	8.21E-12
1.40E+06		0.00E+00	0.00E+00	M	1.00E-02	1.22E-13
-		-	-	-	-	-
-		1.64E+08	3.76E+05	F	3.00E-01	3.96E-13
-		6.27E+05	1.30E+03	F	3.00E-01	2.93E-12
-		2.66E+09	5.80E+06	F	3.00E-01	3.67E-12
-		1.06E+07	2.31E+04	F	3.00E-01	1.40E-11
-		2.87E+08	6.35E+05	-	-	-
-		3.54E+09	7.72E+06	-	-	-
-		1.39E+09	3.06E+06	-	-	-
-		1.46E+09	3.20E+06	-	-	-
-		1.24E+08	2.84E+05	-	-	-
-		4.54E+07	1.04E+05	-	-	-
-		1.82E+08	4.13E+05	-	-	-
-		1.60E+08	3.55E+05	-	-	-
-		1.39E+09	3.05E+06	-	-	-
-		2.38E+09	5.20E+06	-	-	-
-		-	-	-	-	-
-		6.74E+09	1.46E+07	-	-	-
-		2.09E+10	4.54E+07	S	1.00E-04	4.07E-12
-		2.51E+09	5.47E+06	S	1.00E-04	2.58E-12
-		1.60E+10	3.48E+07	S	1.00E-04	4.18E-12
-	-	-	-	-	-	-
-		2.22E+07	4.24E+04	S	1.00E-04	1.81E-11
-		3.52E+09	7.66E+06	S	1.00E-04	1.04E-12
-		3.04E+07	6.35E+04	S	1.00E-04	1.60E-11
-		2.98E+09	6.47E+06	S	1.00E-04	3.52E-14
-		1.52E+09	3.28E+06	S	1.00E-04	2.48E-12
-		5.61E+08	1.20E+06	S	1.00E-04	7.18E-12
-		1.51E+09	3.36E+06	S	5.00E-04	4.00E-12

-		2.18E+08	4.78E+05	S	5.00E-04	2.87E-12
-		2.42E+09	5.27E+06	M	5.00E-01	4.96E-12
1.31E+01		3.39E+09	7.35E+06	M	5.00E-01	1.17E-11
-		2.52E+06	4.86E+03	M	5.00E-01	7.22E-14
-		2.32E+09	5.07E+06	M	5.00E-01	1.86E-12
-		1.50E+09	3.28E+06	M	1.00E-02	3.85E-12
-		2.20E+09	4.79E+06	M	1.00E-02	1.58E-12
-		6.63E+09	1.44E+07	M	1.00E-02	3.60E-12
3.54E+02		0.00E+00	0.00E+00	M	1.00E-02	1.11E-12
-		4.20E+09	9.13E+06	M	1.00E-02	4.59E-12
-		1.05E+09	2.29E+06	M	1.00E-02	1.25E-11

›idity Risk Coefficients				
			External	10 CFR 30
Food	Soil		Exposure	Schedule B
Ingestion	Ingestion	Inhalation	(risk/y per	
(risk/pCi)	(risk/pCi)	(risk/pCi)	pCi/g)	(pCi)
2.71E-10	5.18E-10	2.86E-08	4.50E-08	0.1
2.45E-10	3.81E-10	1.49E-07	3.48E-10	0.1
2.89E-12	5.55E-12	4.92E-11	4.53E-06	0.1
6.73E-12	1.14E-11	3.54E-12	1.31E-05	0.1
-	-	-	8.56E-08	0.1
1.12E-11	1.92E-11	2.67E-11	7.18E-06	0.1
-	-	-	7.66E-09	0.1
-	-	-	1.69E-07	0.1
1.37E-11	2.37E-11	2.83E-11	1.30E-05	1
1.21E-11	2.37E-11	6.66E-12	1.09E-07	100
2.49E-11	4.70E-11	6.92E-11	1.33E-05	0.1
-	-	-	9.32E-06	0.1
1.34E-10	2.17E-10	2.81E-08	2.76E-08	0.1
2.62E-12	5.14E-12	5.03E-11	3.48E-08	0.1
8.77E-11	1.29E-10	1.56E-08	1.05E-09	0.1
1.34E-10	2.17E-10	2.70E-08	9.47E-08	0.1
3.66E-12	7.03E-12	3.09E-12	3.58E-06	0.1
3.22E-13	6.11E-13	1.56E-13	1.04E-07	0.1
1.73E-13	2.93E-13	1.31E-13	2.93E-06	0.1
-	-	-	0.00E+00	0.1
-	-	-	5.94E-10	0.1
-	-	-	6.39E-06	0.1
1.48E-11	2.79E-11	4.29E-12	8.21E-06	0.1
2.28E-12	4.40E-12	3.88E-12	5.78E-09	100
9.69E-12	1.82E-11	8.44E-12	3.35E-06	10
1.42E-11	2.70E-11	4.14E-12	2.01E-06	10
3.67E-12	7.03E-12	1.76E-12	3.58E-08	100
4.63E-11	8.21E-11	3.58E-10	7.94E-08	0.1
-	-	-	1.32E-09	0.1
2.36E-12	4.22E-12	7.92E-13	4.93E-06	0.1
2.19E-12	4.22E-12	6.48E-12	1.38E-07	0.1
-	-	-	7.37E-07	0.1
-	-	-	-	0.1
9.18E-12	1.78E-11	4.00E-12	1.70E-06	100
1.08E-11	2.09E-11	7.77E-12	1.89E-06	0.1
4.07E-12	7.92E-12	3.12E-12	2.79E-07	100
2.87E-12	5.25E-12	2.91E-12	1.77E-06	10
9.44E-12	1.39E-11	1.16E-11	1.44E-06	10
4.66E-12	9.07E-12	2.04E-12	1.96E-07	0.1
3.74E-12	7.29E-12	1.61E-12	1.70E-07	0.1
-	-	-	2.69E-06	0.1
5.33E-13	9.73E-13	1.79E-13	1.65E-07	0.1
2.17E-11	4.18E-11	2.03E-11	7.61E-07	10
3.07E-13	5.59E-13	9.69E-14	3.79E-06	0.1
1.31E-13	2.27E-13	4.55E-14	4.85E-06	0.1
1.02E-11	2.02E-11	9.40E-11	7.43E-10	0.1

1.20E-13	2.02E-13	2.13E-13	2.13E-07	0.1
1.10E-11	1.98E-11	5.85E-12	1.52E-05	0.1
8.14E-12	1.49E-11	2.10E-11	7.08E-06	0.1
-	-	-	-	0.1
1.30E-11	2.55E-11	3.17E-10	2.76E-09	1
-	-	-	1.88E-07	0.1
9.99E-13	1.78E-12	7.77E-11	8.87E-07	0.1
7.18E-13	1.28E-12	6.85E-11	5.65E-07	0.1
2.65E-13	4.33E-13	2.90E-11	7.48E-06	0.1
1.57E-12	2.95E-12	5.14E-11	2.63E-12	0.1
8.18E-13	1.54E-12	1.03E-12	4.23E-06	0.1
-	-	-	-	0.1
4.03E-13	6.51E-13	2.06E-13	1.34E-06	0.1
6.48E-14	1.03E-13	1.80E-14	3.55E-07	0.1
3.89E-13	6.70E-13	2.43E-13	5.95E-09	0.1
2.30E-12	3.70E-12	1.66E-12	1.24E-05	10
1.16E-13	1.94E-13	1.21E-13	3.46E-08	0.1
2.02E-13	3.21E-13	7.18E-14	9.35E-06	0.1
-	-	-	-	0.1
5.59E-14	8.70E-14	2.78E-14	4.45E-06	0.1
2.00E-12	2.79E-12	7.07E-12	7.83E-12	100
2.00E-12	2.79E-12	7.07E-12	7.83E-12	100
2.00E-12	2.79E-12	7.07E-12	7.83E-12	100
-	-	-	-	0.1
4.37E-13	5.74E-13	2.09E-13	0.00E+00	0.1
3.37E-12	6.07E-12	9.40E-12	3.96E-11	10
1.08E-11	2.02E-11	7.88E-12	5.24E-06	10
-	-	-	1.75E-05	0.1
6.70E-12	1.14E-11	2.19E-11	8.73E-09	10
-	-	-	-	0.1
2.90E-11	3.85E-11	1.12E-10	7.36E-11	0.1
3.64E-11	5.11E-11	1.30E-10	4.45E-10	0.1
1.27E-11	2.47E-11	5.14E-12	1.01E-06	100
2.46E-11	4.74E-11	2.92E-11	1.13E-07	10
1.99E-12	3.81E-12	6.51E-13	5.23E-06	0.1
1.76E-12	3.26E-12	6.55E-13	1.03E-05	0.1
1.95E-12	3.70E-12	5.66E-12	4.54E-07	0.1
6.77E-12	1.34E-11	1.14E-11	2.27E-07	100
1.04E-11	2.04E-11	3.74E-12	1.09E-06	100
5.18E-11	1.02E-10	1.10E-10	5.02E-08	1
6.22E-11	1.18E-10	1.81E-08	4.73E-11	0.1
1.63E-10	2.54E-10	3.40E-08	1.37E-06	0.1
1.12E-10	1.85E-10	2.66E-08	4.48E-11	0.1
1.70E-10	2.67E-10	3.40E-08	3.76E-07	0.1
-	-	-	8.66E-11	0.1
6.11E-12	1.20E-11	4.22E-09	4.86E-11	0.1
-	-	-	1.46E-13	0.1
4.44E-12	7.66E-12	2.50E-11	1.74E-09	0.1
2.64E-13	4.22E-13	9.40E-14	7.93E-06	10
5.48E-11	1.05E-10	1.51E-08	7.73E-11	0.1
1.23E-10	2.05E-10	2.69E-08	4.19E-07	0.1
1.08E-10	1.81E-10	2.53E-08	4.85E-11	0.1

1.35E-10	2.18E-10	2.77E-08	2.38E-07	0.1
1.31E-10	2.12E-10	2.77E-08	4.57E-11	0.1
1.30E-10	2.11E-10	2.50E-08	1.31E-06	0.1
-	-	-	0.00E+00	0.1
1.20E-13	2.18E-13	7.25E-14	0.00E+00	0.1
-	-	-	-	0.1
1.43E-11	2.56E-11	1.85E-11	1.80E-05	0.1
1.49E-12	2.78E-12	2.09E-12	3.55E-07	0.1
4.18E-12	7.44E-12	5.99E-12	4.48E-06	10
1.83E-13	3.47E-13	6.88E-14	1.00E-12	10
2.23E-11	4.03E-11	3.58E-11	1.24E-05	1
3.66E-15	5.88E-15	3.96E-15	1.86E-08	0.1
3.49E-13	6.40E-13	1.43E-13	2.48E-07	0.1
1.89E-13	3.20E-13	7.36E-14	4.43E-06	0.1
2.66E-13	4.96E-13	1.67E-13	1.27E-07	1000
-	-	-	4.74E-06	0.1
2.48E-13	4.00E-13	7.44E-14	1.05E-06	0.1
2.49E-13	4.11E-13	7.51E-14	4.90E-09	1000
1.91E-12	2.89E-12	5.92E-13	3.11E-06	0.1
5.14E-11	5.81E-11	1.65E-11	7.10E-06	1
5.55E-14	8.84E-14	1.99E-14	5.02E-08	100
5.88E-12	7.18E-12	1.86E-12	2.36E-11	10
1.12E-11	1.65E-11	3.49E-12	1.00E-05	10
3.74E-11	4.33E-11	1.19E-11	5.32E-10	10
2.16E-13	3.40E-13	4.00E-14	1.19E-05	0.1
-	-	-	-	0.1
6.70E-13	1.20E-12	2.41E-13	3.63E-06	0.1
-	-	-	4.43E-06	0.1
9.32E-13	1.72E-12	4.33E-13	8.30E-07	100
2.83E-12	5.29E-12	2.35E-12	3.83E-07	0.1
3.20E-13	5.62E-13	8.33E-14	1.32E-06	0.1
6.03E-13	1.15E-12	2.10E-13	9.49E-08	10
1.63E-11	3.22E-11	8.36E-12	6.02E-08	100
3.70E-12	7.36E-12	3.85E-12	9.10E-11	100
2.96E-12	5.74E-12	9.40E-13	1.42E-06	100
5.11E-11	1.01E-10	8.84E-09	1.25E-09	0.1
7.81E-11	1.50E-10	1.85E-08	8.55E-09	0.1
4.00E-11	7.88E-11	1.53E-09	2.10E-06	0.1
-	-	-	-	0.1
8.70E-12	1.62E-11	9.10E-11	5.30E-06	1
4.37E-12	8.51E-12	1.12E-12	1.33E-06	1
1.49E-11	2.85E-11	1.15E-10	5.83E-06	1
2.77E-12	5.40E-12	1.48E-11	1.24E-07	10
1.84E-11	3.56E-11	1.37E-11	6.62E-06	0.1
1.30E-13	2.00E-13	1.21E-13	4.45E-06	1000
1.03E-11	1.94E-11	2.73E-12	3.07E-06	0.1
1.16E-12	2.09E-12	7.99E-13	0.00E+00	100
1.11E-11	2.07E-11	1.33E-11	5.83E-06	10
3.13E-12	6.07E-12	1.98E-10	1.23E-10	0.1
2.42E-11	4.77E-11	8.84E-10	3.85E-09	0.1
-	-	-	-	0.1
-	-	-	1.11E-07	0.1

1.00E-11	1.78E-11	3.06E-12	1.40E-07	0.1
9.32E-12	1.80E-11	2.18E-12	1.26E-05	0.1
1.51E-12	2.89E-12	9.55E-13	5.36E-07	0.1
4.03E-13	7.18E-13	1.28E-13	4.17E-06	0.1
8.07E-12	1.53E-11	2.17E-12	1.37E-05	10
5.51E-11	9.07E-11	1.26E-08	0.00E+00	0.1
3.85E-11	6.29E-11	9.10E-09	0.00E+00	0.1
2.22E-12	4.26E-12	6.55E-12	1.62E-07	10
4.66E-12	9.21E-12	1.46E-12	1.74E-07	100
-	-	-	-	0.1
9.88E-12	1.85E-11	4.88E-11	4.69E-13	0.1
9.18E-14	1.73E-13	5.18E-14	4.74E-13	100
1.65E-12	2.81E-12	1.15E-12	4.82E-06	0.1
1.44E-13	2.20E-13	1.99E-13	-	1000
1.44E-13	2.20E-13	1.99E-13	-	1000
2.83E-12	5.29E-12	4.29E-12	1.35E-06	0.1
-	-	-	-	0.1
-	-	-	-	0.1
2.13E-11	3.89E-11	3.70E-10	9.57E-06	0.1
9.51E-12	1.81E-11	1.38E-11	3.42E-06	0.1
1.03E-12	1.89E-12	4.14E-13	3.93E-06	0.1
9.25E-12	1.79E-11	1.76E-11	2.24E-06	10
-	-	-	-	0.1
2.09E-12	4.07E-12	1.25E-12	1.14E-07	100
4.40E-12	8.62E-12	2.28E-12	2.50E-07	100
7.62E-12	1.27E-11	8.95E-12	9.21E-07	10
7.62E-12	1.27E-11	8.95E-12	9.21E-07	10
7.62E-12	1.27E-11	8.95E-12	9.21E-07	10
1.35E-11	2.67E-11	3.85E-12	1.18E-07	100
1.14E-11	2.10E-11	3.09E-10	7.69E-06	0.1
-	-	-	4.17E-06	0.1
2.05E-12	1.96E-12	3.03E-13	5.10E-07	0.1
1.22E-10	1.16E-10	1.76E-11	5.10E-06	0.1
6.29E-11	5.55E-11	1.06E-11	7.24E-09	1
2.48E-10	2.31E-10	3.70E-11	1.96E-06	1
2.06E-13	1.89E-13	3.04E-14	3.74E-07	0.1
3.22E-10	2.71E-10	6.07E-11	6.10E-09	0.1
1.88E-11	1.80E-11	2.76E-12	9.67E-06	0.1
1.34E-10	1.26E-10	1.95E-11	1.59E-06	1
2.34E-12	2.22E-12	3.74E-13	1.06E-05	10
4.40E-11	4.26E-11	6.25E-12	2.72E-06	1
6.44E-13	5.96E-13	1.02E-13	1.24E-05	10
8.99E-12	8.62E-12	1.34E-12	7.83E-06	10
-	-	-	-	0.1
1.85E-12	3.40E-12	8.03E-13	1.42E-06	0.1
1.35E-13	2.47E-13	5.18E-14	1.05E-06	100
-	-	-	0.00E+00	0.1
3.60E-11	7.03E-11	3.00E-11	3.57E-07	10
4.33E-11	5.85E-11	4.03E-10	2.70E-10	10
6.40E-13	1.24E-12	2.15E-13	6.27E-07	100
2.26E-13	3.77E-13	8.77E-14	1.23E-05	0.1
9.84E-14	1.67E-13	5.59E-14	2.90E-06	0.1

6.44E-13	1.22E-12	2.33E-13	3.35E-07	0.1
8.10E-12	1.50E-11	8.81E-12	5.99E-06	0.1
-	-	-	-	0.1
-	-	-	-	0.1
1.07E-11	2.04E-11	2.41E-11	3.40E-06	10
-	-	-	-	0.1
-	-	-	-	0.1
1.26E-11	2.49E-11	3.40E-12	4.09E-07	0.1
1.26E-11	2.29E-11	4.59E-11	1.01E-05	0.1
3.43E-11	6.18E-11	1.03E-11	7.97E-07	0.1
1.74E-12	3.06E-12	4.33E-13	1.46E-06	10
1.07E-12	1.81E-12	3.09E-13	4.23E-06	0.1
-	-	-	1.08E-06	0.1
-	-	-	2.18E-08	0.1
-	-	-	1.34E-11	0.1
-	-	-	1.05E-08	100
-	-	-	5.46E-07	0.1
-	-	-	4.00E-06	10
-	-	-	1.02E-05	0.1
-	-	-	-	0.1
-	-	-	-	0.1
-	-	-	-	0.1
1.59E-11	3.05E-11	4.77E-12	1.15E-05	10
2.74E-12	5.37E-12	7.44E-13	2.37E-07	0.1
8.21E-13	1.48E-12	2.42E-13	1.44E-05	0.1
-	-	-	-	0.1
5.18E-12	1.02E-11	4.66E-12	1.14E-07	100
1.36E-11	2.60E-11	5.70E-11	3.63E-06	0.1
-	-	-	-	0.1
1.65E-11	3.06E-11	5.14E-12	6.56E-06	0.1
9.07E-12	1.58E-11	4.40E-12	1.67E-05	10
1.75E-13	2.82E-13	5.07E-14	1.15E-05	0.1
2.25E-13	4.37E-13	2.17E-13	0.00E+00	0.1
3.11E-12	5.14E-12	5.88E-12	3.89E-06	10
1.48E-12	2.78E-12	4.14E-13	8.44E-06	10
-	-	-	-	0.1
9.44E-14	1.48E-13	4.33E-14	6.62E-06	0.1
-	-	-	-	0.1
4.18E-12	5.29E-12	1.27E-12	2.17E-10	0.1
2.11E-12	3.50E-12	4.29E-12	6.64E-07	100
-	-	-	4.45E-06	0.1
-	-	-	-	0.1
1.26E-11	1.97E-11	3.89E-12	1.03E-05	0.1
1.65E-12	2.64E-12	4.74E-13	2.20E-05	10
8.21E-12	1.52E-11	2.27E-12	2.13E-05	0.1
-	-	-	-	0.1
-	-	-	-	0.1
-	-	-	-	0.1
-	-	-	-	0.1
1.17E-12	2.31E-12	1.90E-12	3.83E-11	10
-	-	-	-	0.1
-	-	-	-	0.1

3.50E-12	6.36E-12	5.44E-12	3.53E-06	10
5.37E-12	1.05E-11	3.27E-12	2.32E-07	0.1
7.25E-12	1.35E-11	2.28E-12	1.15E-05	0.1
2.79E-13	5.00E-13	1.07E-13	2.97E-06	10
-	-	-	3.34E-06	0.1
1.02E-11	2.01E-11	9.36E-12	4.87E-07	100
7.92E-13	1.51E-12	3.19E-13	1.49E-06	100
3.96E-12	6.70E-12	2.88E-12	7.74E-06	0.1
5.55E-12	1.02E-11	1.78E-12	9.43E-06	0.1
3.89E-13	7.33E-13	4.66E-13	0.00E+00	100
9.51E-13	1.79E-12	1.64E-12	0	10
9.51E-13	1.79E-12	1.64E-12	0	10
1.01E-12	1.92E-12	3.03E-13	2.74E-06	100
1.01E-12	1.92E-12	3.03E-13	2.74E-06	100
5.07E-13	9.99E-13	1.15E-12	2.13E-09	0.1
-	-	-	-	0.1
-	-	-	-	0.1
8.29E-11	1.46E-10	1.77E-08	5.36E-08	0.1
7.88E-12	1.52E-11	4.18E-12	2.62E-06	0.1
7.51E-12	1.47E-11	4.00E-12	5.41E-07	0.1
3.16E-13	5.55E-13	1.95E-13	5.80E-06	0.1
-	-	-	1.51E-06	0.1
-	-	-	4.46E-06	0.1
2.70E-12	4.77E-12	6.14E-12	3.11E-06	10
-	-	-	-	0.1
-	-	-	6.76E-06	0.1
5.33E-12	1.05E-11	7.10E-12	1.66E-07	100
8.95E-13	1.76E-12	6.36E-13	1.05E-08	100
7.77E-12	1.53E-11	2.71E-12	2.69E-07	100
-	-	-	-	
1.23E-11	2.21E-11	1.22E-11	9.41E-09	10
1.36E-12	2.47E-12	5.11E-12	3.72E-11	0.1
5.40E-12	1.02E-11	2.58E-09	2.86E-06	0.1
2.26E-10	3.74E-10	4.55E-08	1.39E-07	0.1
8.14E-12	1.59E-11	1.42E-11	7.43E-07	0.1
3.70E-12	7.03E-12	1.46E-12	8.71E-06	0.1
-	-	-	6.87E-08	0.1
1.46E-12	2.65E-12	7.55E-13	1.09E-06	0.1
-	-	-	-	0.1
8.25E-13	1.26E-12	6.44E-13	3.50E-12	0.1
3.49E-13	6.55E-13	1.90E-13	5.37E-10	0.1
1.18E-09	1.84E-09	2.77E-09	1.41E-09	0.1
5.81E-13	1.04E-12	3.70E-11	2.29E-07	0.1
3.54E-11	6.70E-11	5.77E-10	5.09E-07	0.1
4.85E-13	8.51E-13	3.63E-11	9.82E-07	0.1
1.84E-12	3.61E-12	1.77E-12	1.15E-09	100
3.67E-13	7.25E-13	1.69E-12	0.00E+00	0.1
5.14E-12	1.01E-11	1.85E-12	1.27E-08	100
1.24E-12	2.20E-12	5.37E-12	1.33E-06	0.1
4.66E-12	8.10E-12	2.76E-11	6.90E-06	0.1
8.07E-13	1.54E-12	6.59E-12	1.61E-08	0.1
5.99E-12	1.12E-11	5.40E-11	3.29E-06	0.1

2.48E-12	4.88E-12	1.61E-11	3.21E-11	10
2.52E-11	4.96E-11	1.05E-11	2.80E-06	0.1
1.15E-11	2.13E-11	2.12E-11	8.98E-06	0.1
9.77E-12	1.93E-11	3.66E-12	4.60E-08	10
6.59E-12	1.28E-11	2.36E-12	1.27E-06	0.1
-	-	-	-	0.1
0.00E+00	0.00E+00	1.08E-08	3.95E-11	0.1
-	-	-	0.00E+00	0.1
-	-	-	0.00E+00	0.1
-	-	-	0.00E+00	0.1
-	-	-	3.86E-10	0.1
-	-	-	7.48E-10	0.1
-	-	-	7.87E-11	0.1
-	-	-	4.26E-11	0.1
1.26E-11	2.49E-11	3.38E-12	3.14E-07	100
1.16E-11	2.29E-11	9.73E-12	1.63E-09	100
1.12E-13	1.82E-13	3.58E-14	1.94E-07	0.1
-	-	-	8.73E-09	0.1
2.55E-12	4.85E-12	4.63E-13	9.78E-07	100
3.09E-13	6.14E-13	1.11E-13	2.78E-12	100
4.44E-12	8.81E-12	7.73E-13	1.68E-08	100
6.03E-12	1.19E-11	1.05E-12	1.26E-07	0.1
3.85E-12	7.59E-12	5.22E-13	5.63E-08	100
5.81E-13	1.12E-12	8.66E-14	2.38E-07	100
9.92E-11	1.74E-10	2.28E-08	1.19E-10	0.1
8.40E-13	1.62E-12	1.27E-12	1.12E-07	0.1
1.69E-10	2.72E-10	3.36E-08	7.22E-11	0.1
1.74E-10	2.76E-10	3.33E-08	2.00E-10	0.1
1.74E-10	2.77E-10	3.33E-08	6.98E-11	0.1
2.28E-12	3.29E-12	3.34E-10	4.11E-12	0.1
1.65E-10	2.63E-10	3.13E-08	6.25E-11	0.1
6.92E-13	1.34E-12	2.94E-13	5.50E-08	0.1
1.80E-10	2.94E-10	2.93E-08	3.01E-11	0.1
6.55E-12	1.28E-11	2.07E-12	1.77E-06	0.1
2.53E-11	4.92E-11	1.73E-11	4.04E-07	0.1
-	-	-	3.71E-08	0.1
3.39E-10	6.44E-10	2.50E-08	4.34E-07	0.1
2.38E-10	4.51E-10	9.99E-09	3.72E-08	0.1
1.54E-10	2.72E-10	2.10E-08	5.91E-09	0.1
5.14E-10	7.29E-10	1.15E-08	2.29E-08	0.1
1.43E-09	2.28E-09	5.18E-09	0.00E+00	0.1
1.74E-13	2.83E-13	4.63E-14	2.59E-06	0.1
-	-	-	4.85E-06	0.1
7.51E-12	1.18E-11	2.32E-12	2.18E-06	0.1
1.17E-11	1.91E-11	3.59E-12	4.22E-06	0.1
1.34E-11	2.37E-11	4.00E-12	4.67E-07	10
7.07E-12	1.25E-11	2.14E-12	9.11E-11	10
1.92E-13	3.06E-13	3.17E-14	3.36E-06	0.1
1.08E-13	1.70E-13	2.09E-14	1.05E-05	0.1
-	-	-	-	0.1
-	-	-	-	0.1
6.99E-12	1.26E-11	4.44E-12	8.22E-06	0.1

-	-	-	-	0.1
-	-	-	-	0.1
4.40E-12	7.66E-12	6.73E-12	3.93E-06	0.1
6.96E-12	1.27E-11	2.26E-11	1.52E-06	0.1
8.03E-12	1.53E-11	4.26E-12	5.49E-08	100
2.56E-14	4.81E-14	2.51E-14	0.00E+00	0.1
7.07E-12	1.35E-11	2.22E-12	2.38E-07	100
1.34E-14	2.40E-14	9.14E-15	9.31E-11	100
3.43E-12	6.73E-12	1.59E-12	3.15E-07	100
-	-	-	-	0.1
-	-	-	9.66E-07	0.1
-	-	-	3.39E-09	0.1
-	-	-	2.25E-07	0.1
-	-	-	1.70E-09	0.1
-	-	-	1.70E-09	0.1
-	-	-	1.74E-09	0.1
-	-	-	1.74E-09	0.1
5.55E-12	1.05E-11	8.92E-12	2.04E-06	10
1.96E-12	3.77E-12	6.48E-13	3.51E-06	10
6.11E-11	1.19E-10	1.02E-10	0.00E+00	1
9.07E-13	1.65E-12	3.36E-13	8.63E-07	100
3.70E-12	1.24E-12	5.03E-12	8.77E-12	100
3.70E-12	1.24E-12	5.03E-12	8.77E-12	100
9.44E-14	1.70E-13	4.07E-14	5.78E-07	0.1
1.55E-11	3.03E-11	5.48E-12	1.97E-06	100
1.85E-11	3.50E-11	2.43E-11	8.89E-06	10
6.14E-12	1.12E-11	1.66E-11	1.81E-06	10
1.59E-11	2.93E-11	1.15E-11	1.28E-05	0.1
9.21E-14	1.48E-13	3.16E-14	6.94E-06	0.1
1.47E-11	2.85E-11	7.51E-12	3.07E-06	0.1
3.19E-12	6.11E-12	9.62E-13	6.85E-06	0.1
2.25E-12	4.22E-12	6.44E-13	9.95E-06	0.1
8.88E-12	1.62E-11	2.47E-11	9.63E-06	10
-	-	-	-	0.1
5.11E-12	1.00E-11	3.05E-12	3.62E-07	100
1.05E-11	1.93E-11	3.96E-12	1.62E-05	10
2.92E-13	5.25E-13	1.07E-13	1.90E-08	0.1
1.13E-12	1.99E-12	1.99E-13	4.52E-06	0.1
1.08E-11	1.67E-11	3.77E-12	1.45E-06	10
9.69E-12	1.60E-11	3.33E-12	1.10E-11	0.1
9.40E-13	1.81E-12	3.05E-13	1.11E-08	100
5.00E-12	9.81E-12	2.93E-10	2.18E-11	0.1
-	-	-	-	0.1
4.77E-11	7.59E-11	6.88E-09	0.00E+00	0.1
8.07E-13	1.59E-12	4.88E-12	3.60E-13	10
7.10E-12	1.40E-11	2.95E-12	1.06E-07	100
6.33E-12	1.22E-11	1.00E-11	2.02E-08	10
6.40E-12	1.25E-11	8.84E-12	4.69E-07	0.1
3.24E-12	6.36E-12	7.81E-12	1.20E-09	0.1
2.20E-12	4.33E-12	1.02E-12	1.30E-10	0.1
3.41E-12	6.66E-12	1.54E-11	8.85E-10	0.1
2.05E-11	4.03E-11	3.03E-11	3.88E-08	0.1

1.12E-13	1.94E-13	5.62E-14	4.62E-07	0.1
2.95E-11	5.81E-11	1.41E-11	1.53E-06	10
3.69E-11	7.07E-11	9.95E-11	9.96E-08	0.1
4.48E-11	8.47E-11	3.69E-11	5.00E-11	0.1
3.11E-12	5.03E-12	2.56E-12	2.20E-06	10
2.31E-14	3.74E-14	8.32E-15	8.21E-07	0.1
1.51E-13	2.69E-13	5.62E-14	1.33E-06	0.1
1.84E-11	3.47E-11	2.34E-11	7.19E-09	1
6.88E-11	9.18E-11	1.05E-10	4.82E-10	0.1
4.66E-12	8.81E-12	1.70E-12	3.30E-06	10
3.26E-12	6.18E-12	1.03E-12	6.69E-06	10
-	-	-	-	0.1
1.15E-11	2.19E-11	3.74E-11	6.04E-06	10
2.70E-13	5.29E-13	1.46E-12	1.63E-09	0.1
1.27E-11	2.42E-11	2.45E-11	5.23E-06	10
-	-	-	-	0.1
4.22E-14	6.81E-14	1.85E-14	1.37E-06	0.1
8.03E-13	1.35E-12	2.63E-13	3.63E-06	0.1
2.51E-12	4.29E-12	3.40E-12	2.93E-06	0.1
4.74E-12	7.81E-12	2.00E-12	1.16E-05	10
5.00E-14	8.36E-14	2.05E-14	2.13E-07	0.1
3.89E-13	7.40E-13	8.51E-13	2.94E-10	100
3.44E-12	6.62E-12	1.12E-11	1.04E-09	100
1.01E-11	1.83E-11	3.01E-11	6.45E-06	0.1
4.00E-12	7.66E-12	1.41E-11	8.14E-11	10
1.14E-13	2.03E-13	5.70E-14	3.93E-07	100
2.01E-12	3.40E-12	1.30E-12	2.00E-06	0.1
8.51E-12	1.42E-11	1.44E-11	7.83E-07	0.1
5.11E-12	6.77E-12	2.50E-12	2.73E-09	0.1
5.66E-12	1.02E-11	1.36E-11	4.48E-07	0.1
4.70E-12	8.92E-12	1.17E-11	6.95E-09	10
1.48E-12	2.87E-12	6.11E-13	2.10E-08	100
1.20E-11	2.25E-11	2.58E-11	2.73E-09	10
2.44E-13	4.40E-13	9.95E-14	2.45E-07	100
2.20E-11	4.26E-11	2.49E-11	1.38E-07	10
3.05E-13	5.62E-13	6.40E-14	1.79E-06	0.1
1.19E-11	2.28E-11	4.22E-12	6.61E-06	10
2.44E-11	4.77E-11	9.32E-12	7.83E-07	10
2.73E-13	5.29E-13	4.92E-14	4.29E-06	0.1
1.24E-12	2.42E-12	2.64E-13	1.09E-05	0.1
4.18E-13	7.51E-13	1.60E-13	3.78E-06	0.1
9.32E-13	1.58E-12	1.56E-10	2.36E-08	0.1
6.92E-11	1.37E-10	3.51E-08	3.78E-07	0.1
1.48E-10	2.89E-10	1.32E-07	5.59E-09	0.1
2.90E-10	4.96E-10	1.75E-07	2.25E-07	0.1
1.19E-10	2.02E-10	2.85E-08	8.19E-10	0.1
3.24E-12	6.36E-12	1.52E-12	2.45E-08	0.1
1.33E-10	2.31E-10	4.33E-08	3.42E-10	0.1
-	-	-	-	0.1
3.40E-11	6.70E-11	3.07E-11	1.63E-08	0.1
3.64E-11	6.73E-11	3.41E-10	2.39E-07	0.1
-	-	-	-	0.1

-	-	-	-	0.1
8.21E-13	1.31E-12	2.52E-13	5.93E-06	100
5.00E-13	8.81E-13	1.49E-13	1.88E-07	100
2.01E-12	3.28E-12	6.14E-13	1.83E-06	100
8.25E-12	1.54E-11	2.45E-12	2.76E-09	10
-	-	-	1.52E-08	0.1
-	-	-	1.76E-05	0.1
-	-	-	1.00E-05	0.1
-	-	-	-	0.1
1.31E-11	2.59E-11	2.43E-11	1.01E-08	10
1.02E-12	2.02E-12	3.33E-12	6.97E-10	10
2.98E-10	5.66E-10	4.55E-08	3.07E-09	0.1
2.56E-12	5.00E-12	1.80E-12	1.60E-07	0.1
3.85E-10	5.74E-10	1.95E-08	5.98E-10	0.1
9.69E-11	1.60E-10	1.16E-08	9.82E-10	0.1
9.55E-11	1.58E-10	1.14E-08	2.52E-10	0.1
9.44E-11	1.57E-10	1.01E-08	5.18E-07	0.1
9.03E-11	1.49E-10	1.05E-08	1.25E-10	0.1
7.14E-12	1.39E-11	6.44E-12	3.76E-07	0.1
8.66E-11	1.43E-10	9.32E-09	4.99E-11	0.1
1.06E-13	1.90E-13	5.70E-14	1.21E-07	0.1
1.03E-11	2.02E-11	2.96E-12	7.33E-10	0.1
1.17E-11	2.13E-11	9.29E-12	1.40E-05	10
1.79E-13	3.53E-13	1.47E-13	0.00E+00	0.1
-	-	-	-	0.1
5.70E-13	1.07E-12	1.35E-13	4.86E-08	10
4.29E-12	8.36E-12	9.36E-13	2.92E-10	10
5.37E-12	1.03E-11	1.11E-12	2.04E-06	100
2.05E-11	4.00E-11	4.63E-12	7.02E-09	0.1
-	-	-	1.83E-07	0.1
-	-	-	2.72E-06	0.1
-	-	-	9.38E-07	0.1
-	-	-	9.52E-07	0.1
-	-	-	4.25E-08	0.1
-	-	-	1.41E-08	1000
-	-	-	6.62E-08	100
-	-	-	9.25E-08	0.1
-	-	-	9.70E-07	100
-	-	-	1.86E-06	0.1
-	-	-	-	0.1
-	-	-	5.62E-06	0.1
5.81E-12	1.05E-11	1.58E-12	1.73E-05	0.1
3.70E-12	6.92E-12	1.49E-12	1.94E-06	0.1
5.85E-12	9.92E-12	1.70E-11	1.37E-05	0.1
-	-	-	-	0.1
2.65E-11	5.25E-11	8.40E-12	1.91E-08	10
1.51E-12	2.95E-12	4.81E-13	2.58E-06	0.1
2.35E-11	4.66E-11	3.36E-11	2.51E-08	10
4.96E-14	8.51E-14	3.01E-14	2.34E-06	0.1
3.61E-12	7.03E-12	9.32E-13	1.26E-06	100
1.05E-11	2.08E-11	2.64E-12	4.60E-07	100
5.85E-12	1.12E-11	1.08E-11	7.75E-07	0.1

4.22E-12	8.29E-12	2.95E-12	1.54E-07	100
7.25E-12	1.34E-11	2.65E-12	1.87E-06	0.1
1.54E-11	2.45E-11	5.81E-12	2.81E-06	10
1.03E-13	1.79E-13	6.11E-14	1.67E-09	1000
2.73E-12	5.07E-12	1.28E-12	1.77E-06	100
5.55E-12	1.02E-11	1.56E-12	1.04E-06	0.1
2.18E-12	3.74E-12	8.95E-12	1.65E-06	0.1
5.18E-12	9.58E-12	1.92E-12	5.38E-06	0.1
1.44E-12	2.12E-12	7.29E-12	0.00E+00	10
6.59E-12	1.23E-11	1.65E-11	3.40E-06	10
1.83E-11	3.57E-11	4.81E-12	0.00E+00	10