U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

REGION III

Report No. 04002061/81-02

Docket No. 04002061 License No. STA-583

Licensee: Kerr McGee Chemical Corporation
Kerr McGee Center
Oklahoma City, OK 73125

Facility Name: Kerr McGee Factory

Inspection At: Kerr McGee Factory, West Chicago, Illinois

Inspection Conducted: October 29, 1980 to June 30, 1981

Inspectors: N. A. Nicholson
Radiation Specialist
July 28, 1981

C. J. Paperiello, Chief
Emergency Preparedness and
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Aug 4, 1981

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Independent Measurements &
Environmental Protection Section
August 4, 1981

Inspection Summary:

Inspection on October 29, 1980 to June 30, 1981 (Report No. 04002061/81-02)
Areas Inspected: Direct reading survey of residential areas surrounding the West Chicago, Illinois factory site to determine offsite exposure rates. Perimeter survey of the site also conducted. The inspection involved approximately 60 hours by three NRC representatives.
Results: A 20 micro R/hr isodose line was established to the east, west, and north of the factory. Based on data exhibited Appendix 1, it appears that both the tailings piles and offsite deposits contribute to offsite exposure rates.

DETAILS

1. Scope

Direct gamma measurements were taken at the licensee's fenceline boundary and residential sections of West Chicago to the east, north, and west of the factory site. This survey was conducted to:

a. estimate the current offsite external exposure rate from onsite material to determine the potential dose reduction upon site decommissioning,

b. construct a simulated isodose line throughout the residential section of West Chicago based on the 20 micro R/hr above background level inside private residences as recommended by the Environmental Protection Agency published in the Federal Register, Section 27370, April 22, 1980, and

c. supplement data published in the Argonne National Lab Report #ES-67 by N. Frigerio et al.

2. General

Readings were taken at the curbside in residential areas. Houses are situated approximately twenty-five feet from the curb. Most houses are frame structures; brick homes are identified in the survey notes (Appendix i).

A heavy frost covered the ground on November 26, 1980 when readings were taken north of Ann Street and east of Joliet Street. This may have yielded abnormally higher readings from the entrapment of radon daughters in the soil. All other survey days were clear and windy with temperature ranges of 30-50?F. The readings taken with NaI (Tl) Micro R meter, Eberline PRM-7, increased up to 5-7 micro R/hr as wind velocity increased.

According to the National Weather Service stations at O'Hare and Midway Airports, the prevailing winds for the Chicago metropolitan area range from south/southwest to west over a period of a year. Average wind direction for November when most measurements were taken is south/southwest with a velocity of 11.0 - 11.3 miles per hour. The higher readings east of the plant may have resulted from airborne contamination deposited during plant operations, use of tailings as fill by local residents, material falling from trucks during transport to or from the site, or a combination of the above.

3. Techniques

a. Residential Survey

Direct reading surveys around the factory site were taken with an Eberline PRM-7 Micro R meter by the curbside at one meter over the ground and, if the one meter reading were greater than 20 micro R/hr, on the surface. The meter was hand held by the surveyor at approximately one meter, or 2 - 3 centimeters above the ground for surface readings. Survey points generally corresponded to intersections, property boundaries, and alleys. Table 1 lists instruments used during this survey.

Selected, limited comparative readings were taken with a Reuter-Stokes presurized ion chamber (PIC) on November 25, 1980 to estimate compensation for the energy dependence of the crystal of the PRM-7. Simultaneous readings taken with the NaI (Tl) PRM-7 ran 20-30% higher than those of the PIC; both sets of data are given in Table 2. The isopleth data as shown on the map are corrected values for the PIC; observed and corrected values, and a corresponding map, are given in Appendix 1.

In an attempt to determine the primary source of offsite exposure, readings were taken with an Eberline PRM-6 equipped with a NaI (Tl) probe wrapped in a 1/8" lead sheet to discriminate between radiation fields from the tailings pile and deposits on the surface. The purpose of the lead was to attenuate extraneous photons from secondary sources as the unshielded end of the probe was pointed toward the primary source in question. Two sets of measurements were taken on March 20, 1981 at the southern terminus of Weyrauch Street, directly across from the piles in three instrument positions: facing the pile, opposite the pile, and upward. Data is attached in Table 3.

Results indicate the shield did not significantly affect readings in the various positions. From these readings, it is not possible to determine conclusively the contribution of either onsite or offsite deposits for dose assessment. Further data is necessary for this resolution.

b. Fenceline and Perimeter Survey

Readings were taken in the same manner as described above with the Micro R meter and an open window Geiger-Meuller meter on Kerr McGee property along the eastern, northern and western fenceline boundaries on October 29 - 30, 1980. Readings were also taken at approximately every fifth point with an Eberline PRM5-3 equipped with a SPA-3 NaI scintillation probe to provide a comparative base for the PRM-7 data. Perimeter survey data and a corresponding map are in Appendix 2.

4. Site and Environs

The abandoned factory site is located in a residential area of south-central West Chicago. The thorium piles are in the fenced South Acres, adjacent to the railroad tracks approximately 100 feet west of the southern boundary of Weyrauch Street. The South Acres are bounded by the railroad tracks, a field, and a park to the west; a field and parking lot to the south; and Weyrauch Street to the east. No houses immediately border Weyrauch Street on the southernmost section near the piles; however, large backyards and a sheet metal company extend to the eastern boundary of Weyrauch Street.

The western side of the factory is bounded by the Elgin, Joliet, and Eastern Railroad (EJ&E) tracks. The northern and eastern sides are bordered by residential streets. Vacant lots are located along the east side of Factory Street from Pomeroy Street north to Stimmel Street, from Stimmel Street north to the alley, and the southeast corner of Factory and Ann Streets.

5. Results

Background readings of 6-10 micro R/hr were located two blocks west of the site and three to four blocks east of the site. Curbside readings at one meter greater than 20 micro R/hr were found primarily east of the factory and disposal site. Highest readings were measured at south Weyrauch Street, the eastern side across from the fenceline, yielding two survey points of 172 micro R/hr, corrected data taken with the PRM-7 at the one meter level. Other areas greater than 20 micro R/hr are listed below; this data is diagrammed in Appendix 3.

East Side of Plant

a. Ann Street: north and south sides from EJ&E tracks to Wood Street.

b. Blair Street: north and south sides from Factory Street to Wood Street.

c. Stimmel Street: north side from Factory Street to Wood Street; south side from Factory Street to mid-point between Factory and Wood Streets.

d. Pomeroy Street: north and south sides from Factory Street to Wood Street.

e. Brown Street: north and south sides from Factory Street to Weyrauch Street.

f. Weyrauch Street: eastern and western sides between the southern terminus and Brown Street.

g. Lester Street: north and south sides from Weyrauch Street midway to Joliet Street.

West Side of Plant

j. Ann Street: southwest corner of Ann & EJ&E tracks.

k. Blair Street: south side from EJ&E tracks to Sherman Avenue.

l. Pioneer Park: two survey points

(1) Due west of northern pile, 600 feet west of the EJ&E tracks
(2) Due west of the southern pile, south edge of lake

6. Conclusion

The data collected indicate offsite doses result from material both onsite and offsite; however, we were unable to definitively break down and quantify the dose from each source, the tailings piles onsite and deposits on private property offsite. Further studies are necessary to provide this information. Based on occupancy factors and shielding from houses and building materials, it appears that doses to West Chicago residents do not exceed the 500 mrem/year level for an unrestricted area as specified by 10 CFR 20.105(a). To accurately quantify these doses, measurements should be taken inside homes as discussed in section 7.

This survey did not confirm the 20 micro R/hour above background recommendation in private residences as proposed by the EPA in Federal Register 27370 as measurements were restricted to the curbside. The isodose line shown in Appendix 1 is based on curbside readings, uncompensated for background.

Elevated readings on the eastern side of the plant were noted. Three explanations for these findings are proposed:

a. Prevailing winds from the west-southwest deposited material over the eastern section, primarily from airborne effluents during plant operation,

b. Contaminated material from the plant was used in the past as fill on private property in the older neighborhood of the eastern section (relative to the more recently developed western section), and,

c. Along some streets material from the factory was transported to the south tailings site and may have fallen on the streets.

7. Recommendations

Survey data did not provide a conclusive dose estimated for those residents living near the factory site. Further measurements taken inside the homes are necessary to accurately determine exposure levels. This can be accomplished by:

a. placing TLD chips in selected residences, and/or

b. taking direct readings inside several rooms of homes.

A followup survey such as the one implied above may be conducted most effectively by a contractor since the Office of Inspection and Enforcement does not have the staff necessary for an extensive and time-consuming study of this type.

The Region III staff recommends the West Chicago residential situation be referred to the Office of Executive Legal Director for consideration. Issues requiring legal guidance include:

a. what action is to be taken regarding the West Chicago residential areas should contamination above a pre-determined criterion be found, and

b authorization and/or coordination with residents to survey private homes.

Attachments:
Tables 1, 2, 3
Appendices 1, 2, 3

TABLE 1

Survey Instruments

Eberline PRM-6, Serial Number 488, NRC # 7305, Calibrated February 16, 1981

Eberline PRM-7, Serial 350, Calibrated September 24, 1980.

Eberline PRM-5-3, Serial 2885, NRC #007309, Calibrated September 29, 1980.

Eberline E520, Serial 1786, NRC #007982, Calibrated September 29, 1980.

Reuter Stokes Environmental Monitor, Pressurized Ion Chamber, RSSM-111

TABLE II

Reuter Stokes PIC Data vs. Eberline PRM-7 Data
November 25, 1980

Point	Reuter Stokes PIC (MicroR/hr)	Eberline PRM-7 (MicroR/hr)
#136[a] 244 & 240 Blair, boundary	22	28
#138[a] SW Corner, Wood & Blair	17	22
#149[a] 129 & 123 Blair, boundary	10	10
#38[b] Fenceline, western side of Weyrauch	112	138
#39[b] NW corner, Lester & Weyrauch	110	140
#51-52[b] TLD #2, fenceline, western Weyrauch	243	320
#55[b] TLD #3	168	245
#45[a] East side Weyrauch across from Disposal site gate.	176	250
#45-46[a] East Side of Weyrauch, North boundary	176	250
#44[a] 703 Weyrauch, south side of drive	24	30

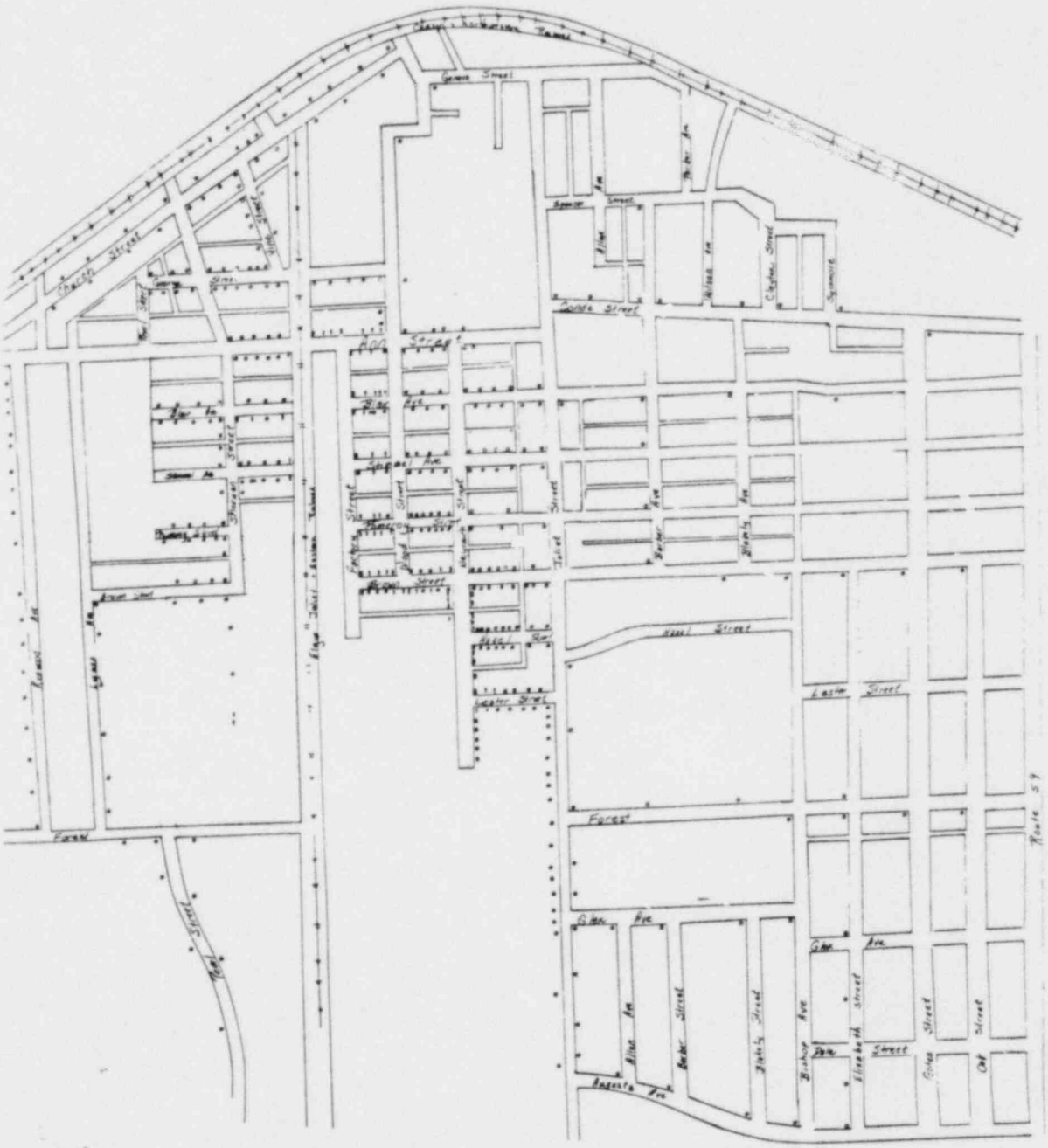
a. - Residential survey points, Appendix 1
b. - Perimeter survey points, Appendix 2

TABLE II

Shielded NaI Probe Data

1.	Kerr McGee fenceline, gate to disposal site	
	a. open probe toward pile	2000 cpm
	b. open probe opposite pile	1400 cpm
	c. open probe upward	1600 cpm
2.	TLD #3	
	a. open probe toward pile	1400 cpm
	b. open probe opposite pile	1200 cpm
	c. open probe upward	1000 cpm

Appendix 1
Residential Survey
West Chicago, Illinois



Appendix I
Residential Survey
West Chicago, Illinois

Point	Surface Readings (cpm/hr)		Gas Meter Readings (cpm/hr)		Location
	Measured	Corrected	Measured	Corrected	
1	100	78	100	78	Lester & Kingsland, fenceline
2	60	47	80	62	Lester & Kingsland, SW corner
3	34	27	34	27	126 Lester (south side)
4	34	27	30	23	122 Lester
5	22	17	24	19	118 Lester
6	20	16	20	16	114 Lester
7	18	14	18	14	114 Lester, eastern boundary
8	14	11	15	12	Lester, south side, ~150' from fence
9	14	11	13	10	Lester, south side, ~200' from fence
10	16	13	16	13	Lester, south side, ~150' from fence
11	22	17	20	16	121 Lester, east side of alley
12	22	17	22	17	121 Lester, east of drive
13	26	20	26	20	121 Lester, west of drive
14	38	30	38	30	133 Lester, west of drive
15	40	31	46	36	Lester, south side, ~66' from fence line
16	110	86	110	86	Kingsland, east side, ~5' south of
17	60	47	60	47	742 Kingsland
18	110	86	80	62	Kingsland, east side, ~25' south of
19	34	27	34	27	Hazel & Kingsland, SE corner
20	26	20	22	17	142 Hazel (south side)
21	18	14	18	14	138 Hazel, east side of house
22	16	12	16	12	134 Hazel, east side of drive
23	16	13	14	11	121 Hazel, west side of drive (south)
24	15	12	14	11	121 Hazel
25	15	12	14	13	Hazel, south side, east of alley
26	18	14	18	14	Hazel & Joliet, SW corner

Point	Surface Readings (mR/hr)		Bare Meter Readings (mR/hr)		Location
	Measured	Corrected	Measured	Corrected	
27	- 17	13	19	15	Hazel + Joliet, NW corner
28	15	12	17	13	105 Hazel (east side)
29	16	13	16	13	121 Hazel, west of alley
30	15	12	17	13	125 Hazel, east of drive
31	17	13	18	14	129 Hazel
32	18	14	19	15	129 Hazel, east of drive
33	20	16	22	17	133 Hazel, west of drive
34	24	19	25	20	139 Hazel, western boundary
35	16	13	23	18	139 Hazel, east of drive
36	23	18	28	22	Hazel + Hazel, NE corner
37	80	63	46	36	Hazel + Wayne Hayranch, east side, 25' north of
38	100	78	90	70	+ Hayranch Hayranch, east side, 5' north of Haz
39	80	62	46	36	702 Hayranch, (west side) south of dri
40	80	62	60	47	702 Hayranch, (west side) north of dr
41	44	34	39	30	702 Hayranch, (west side) front walk
42	60	47	38	30	702 Hayranch, south edge of house
43	80	62	60	47	702 Hayranch, (east side)
44	26	20	32	25	702 Hayranch, south of drive
45	260	203	220	172	Hayranch, (east side), ~150' south of Haste + Wayne
46	340	265	220	172	Hayranch, (east side), ~200 south of Haste + Wayne
47	90	70	40	31	250 Brook (south side)
48			21	16	246 Brook, west of drive
49			24	19	242 Brook, west of drive
50			24	19	236 Brook, west of drive
51	60	47	28	22	232 Brook, west of sidewalk
52	46	36	32	25	Wood + Brook, south tip mound of intersection

Point	Surface Readings (uR/hr)		Ion Meter Readings (uR/hr)		Location
	Measured	Corrected	Measured	Corrected	
53	110	86	60	47	224 Brook, west of drive
54	40	31	28	22	224 Brook, east of drive
55	32	25	18	14	220/218 Brook, between drives
56	60	47	32	25	204 Brook, west of house boundary
57	40	31	20	16	204 Brook, east of drive
58			24	19	Wayanch & Brook, SW corner
59			24	19	Wayanch & Brook, SE corner
60			12	9	138 Brook, east of drive
61			24	19	138 Brook, east of house boundary
62			16	13	124 Brook, east of drive
63			18	14	124 Brook at eastern property boundary
64			14	11	118 Brook, west edge of house
65			13	10	118 Brook, west of alley
66			8	6	Brook & Joliet, SW corner
67			11	9	Brook, (north side), east of alley
68			12	9	119/123 Brook, property boundary
69			13	10	127/123 Brook property boundary
70			12	9	127/131 Brook property boundary
71			14	11	131/139 Brook property boundary
72			14	11	139 Brook, west of drive
73			18	14	Brook & Wayanch, NE corner
74	100	78	60	47	Brook & Wayanch, NW corner
75	120	94	34	27	207 Brook, eastern boundary
76	70	55	26	20	213/207 Brook property boundary
77	100	78	26	20	219/213 Brook property boundary
78	60	47	28	22	Wood & Brook, NE corner

Point	Surface Readings (μR/h)		On Water Readings (μR/h)		Location
	Measured	Corrected	Measured	Corrected	
79	- 140	109	60	47	Wood & Brook, NW corner
80	120	94	50	39	237 Brook, (west side) east bounding
81	160	125	50	39	243/237 Brook bounding
82	120	94	38	30	243 Brook
83	180	140	60	47	Factory & Brook, NE corner
84	200	156	60	47	Pomeroy & Factory, SE corner
85	100	78	50	39	246/242 Pomeroy bounding
86	110	86	60	47	238/242 Pomeroy bounding
87	80	62	34	27	238 Pomeroy, eastern bound.
88	80	62	30	23	Wood & Pomeroy, SW corner
89	43	32	26	20	Wood & Pomeroy, SE corner
90	28	22	20	16	230/216 Pomeroy bounding
91			18	14	212/216 Pomeroy bounding
92			18	14	208/212 Pomeroy bounding
93			17	13	202/208 Pomeroy bounding
94			15	12	Pomeroy & Heyrauch, SW corner
95			15	12	Pomeroy & Heyrauch, SE corner
96			11	9	122 Pomeroy
97			7	5	Joliet & Pomeroy, SW corner
98			8	6	125 Pomeroy (north side), west bound
99			10	8	Pomeroy & Heyrauch, NE corner
100			11	9	Pomeroy & Heyrauch, NW corner
101			15	12	201/207 Pomeroy bounding
102			16	13	211/207 Pomeroy bounding
103			13	10	217/211 Pomeroy bounding
104			20	16	223/217 Pomeroy bounding

Point	Surface Reading (uR/hr)		Air Meter Reading (uR/hr)		Location
	Measured	Corrected	Measured	Corrected	
105	- 18	14	16	13	Wood × Pomeroy, NE corner
106	21	16	22	17	Wood × Pomeroy, NW corner
107	28	22	28	22	233 Pomeroy, western boundary
108	40	32	30	23	Pomeroy, midpoint between Wood × Factory
109	100	78	60	47	Pomeroy × Factory, NE corner
110	22	17	24	19	Factory × Stinnel, SE corner
111	60	47	35	30	Stinnel (south side), midpoint between Factory × Wood
112			18	14	Wood × Stinnel, SW corner
113	36	28	20	16	Wood × Stinnel, SE corner
114			18	14	216 Stinnel, western boundary
115			12	9	212 Stinnel, eastern boundary
116			10	8	Stinnel × Wagranch, SW corner
117			12	9	Stinnel × Wagranch, SE corner
118			10	7	138/132 Stinnel boundary
119			8	6	128/124 Stinnel boundary
120			8	6	108/120 Stinnel boundary, alley
121			8	6	Splat × Stinnel, SW corner
122			8	6	Splat × Stinnel, NW corner
123			7	5	Stinnel (north side), NW east of alley
124			11	9	125/119 Stinnel boundary
125			8	6	133 Stinnel, west of drive
126			12	9	139 Stinnel, western boundary
127			9	7	Stinnel × Wagranch, NE corner
128			13	10	Stinnel × Wagranch, NW corner
129			14	11	213/209 Stinnel boundary (north side)
130			15	12	219/233 Stinnel boundary

Point	Surface Readings (mR/hr)		Low Meter Readings (mR/hr)		Location
	Measured	Corrected	Measured	Corrected	
131	- 42	33	22	17	Wood + Stimmel, SE corner
132	60	47	34	27	Wood + Stimmel, NW corner
133	100	78	80	62	Stimmel, Wood + Factory north side, midpoint between
134	110	86	60	47	Factory + Stimmel NE corner
135	60	47	40	31	Factory + Blair, SE corner
136	110	86	48	37	244/240 Blair boundary (south side
137			18	14	236/240 Blair boundary
138	20	16	22	17	Wood + Blair, SW corner
139			16	13	213/222 Blair boundary
140			11	9	212/216 Blair boundary
141			8	6	Weyrauch + Blair, SW corner
142			11	9	138 Blair, west boundary
143			11	9	132 Blair, east boundary
144			8	6	124 Blair, east boundary
145			8	6	Blair (south side) east of alley, ~30' west of Joliet
146			6	5	Joliet + Blair, SW corner
147			6	6	Joliet + Blair NW corner
148			8	6	Blair (north side) west of alley
149			5	6	124/133 Blair boundary
150			8	6	131/133 Blair boundary
151			11	9	Weyrauch + Blair, NE corner
152			13	10	203 Blair (north side) west boun
153			14	11	225 Blair, east boundary
154			15	12	Wood + Blair, NE corner
155	30	23	28	22	231 Blair, east boundary
156	32	25	30	23	237/231 Blair boundary

Point	Surface Readings (μ mhos)		Cup Meter Readings (mhos)		Location
	Measured	Corrected	Measured	Corrected	
157	80	62	46	36	242/237 Blair boundary
158	38	30	40	31	249/243 Blair boundary
159	180	140	60	47	Blair + Factory, NE corner
160			11	9	Blair + Sherman, NW corner
161	60	47	38	30	322 Blair, western boundary
162			17	13	318/314 Blair boundary
163	32	17	28	22	306 Blair, eastern boundary
164			6	5	Stimmel + Sherman, NW corner
165			12	9	320 Stimmel, western boundary
166			14	11	316 Stimmel, eastern boundary
167	24	19	22	17	Stimmel (south side), eastern terminus
168			8	6	Pomeroy + Sherman, NW corner
169			13	10	Sherman, (west side) midpoint between Pomeroy + Brown
170			12	9	Brown + Sherman, NW corner
171			10	8	Blair + Sherman, NW corner
172			11	9	415/419 Blair boundary (north side)
173			8	6	419/423 Blair boundary
174			8	6	433/427 Blair boundary
175			8	6	427/423 Blair boundary (south side)
176			10	8	416 Blair
177			10	8	412/416 Blair boundary
178			9	7	406/412 Blair boundary
179			14	11	Sherman + Blair, SW corner
180			12	10	330 Sherman (west side)
181			11	9	324 Sherman
182			10	8	Sherman + Stimmel, NW corner

Point	Surface Readings (mg/hr)		One Meter Readings (mR/hr)		Location
	Measured	Corrected			
182	–		13	10	Sherman + Stimmel, NE corner
184			14	11	319/323 Stimmel (rear boundary, (east side)
185			16	13	315/317 Stimmel boundary,
186	22	17	19	15	311/313 Stimmel boundary
187	24	19	24	19	307/311 Stimmel
188	36	28	36	26	307 Stimmel, east boundary
189	32	25	32	25	Stimmel (south side), lot across from
190			17	13	316 Stimmel, east boundary
191			14	11	316/320 Stimmel
192			13	10	320 Stimmel, west boundary
193			11	9	Sherman + Stimmel, SE corner
194			13	10	603 Sherman (east side)
195			11	9	604 Sherman (west side)
196			15	12	Sherman + Pomeroy, NW corner
197			11	9	266/276 Pomeroy boundary (south)
198			9	7	296/306 Pomeroy boundary
199			9	7	306/320 Pomeroy
200			10	8	320 Pomeroy, western boundary
201			11	9	Pioneer School Playground
202			9	7	305 Pomeroy, western boundary
203			13	10	305 Pomeroy, eastern boundary
204			11	9	279/267 Pomeroy boundary
205			12	9	Pomeroy + Sherman, SW corner
206	20	16	17	13	Sherman + Brent (west side) between Pomeroy
207			16	12	Brent + Sherman, NW corner
208			13	10	264/250 Brent boundary

Point	Surg. Readings (ohms)		Ore Meter Readings (ohms)		Location
	Measured	Corrected	Measured	Corrected	
209	–		12	1	28/308 Brown boundary
210			10	8	308/390 Brown boundary
211			10	8	390 Brown, western boundary
212			13	10	418 Brown
213			14	11	418 Brown, eastern boundary
214			16	13	Brown + Sherman, SW corner
215	23	18	23	18	Field, 100' south of Brown + Sherman
216			20	16	Fence 400' south of Brown + Sherman
217	36	28	36	28	Field, ~600' south of Brown + Sherman
218	40	31	44	34	Fence west of pole, south of lake
219			14	11	315/323 Sherman boundary
220	38	30	28	22	318/322 Blair (south side) boundary
221	30	23	28	22	314/318 Blair boundary
222	28	22	24	19	310 Blair
223	80	62	60	47	Blair, eastern terminus
224	23	18	23	18	307/309 Blair (north side)
225	22	18	23	18	315 Blair
226	20	16	23	18	329 Blair
227			4	3	407 Kenwood (east side)
228			5	4	416 Kenwood (west side)
229			6	5	406 Kenwood
230			6	5	514 Kenwood
231			5	4	526 Kenwood
232			5	4	606 Kenwood
233			6	5	614 Kenwood
234			6	5	626 Kenwood

Point	Surface Readings (ug/l)		Soil Water Readings (ug/l)		Location
	Measured	Corrected	Measured	Corrected	
235	–		5	4	634 Kenwood
236			7	6	Kenwood + Grant, NW corner
237			8	6	706 Kenwood
238			5	4	718 Kenwood
239			6	5	730 Kenwood
240			6	5	738 Kenwood
241			6	5	748 Kenwood
242			6	5	810 Kenwood
243			6	5	822 Kenwood
244			6	5	Locust + Kenwood NW corner
245			8	6	Locust Ave, ~100' west of pile (across from tennis court)
246			10	8	Locust Ave, south side, ~90' west of pile
247			10	8	Locust + Peach
248			11	9	Peach St. (east side) ~100' South of Ave
249			8	6	554 Peach
250			9	7	121 Peach (east side)
251			14	11	571 Peach
252			15	12	Peach St. ~80' west of pile
253			8	6	826/830 Lyman boundary (west side)
254			6	5	814 Lyman
255			7	6	746/80 2 Lyman boundary
256			8	6	730/734 Lyman boundary
257			6	5	718 Lyman
258			6	5	Lyman + Bunn, SE corner
259	40	31	42	33	Academy + Ann, SE corner
260	50	39	32	25	242 Ann (south side)

Point	Surface Readings (mR/hr)		Ion Meter Readings (mR/hr)		Location
	Measured	Corrected	Measured	Corrected	
261	- 42	33	30	23	238/232 Axx boundary
262	34	27	18	14	Wood + Axx, SW corner
263	44	34	30	23	Wood + Axx, SE corner
264	32	25	26	20	218 Axx
265	28	22	22	17	212/208 Axx boundary
266	18	14	12	9	Axx + Wagnauch, SW corner
267	12	9	11	9	Axx + Wagnauch, SE corner
268	13	10	11	9	Axx, south side, ~60' east of Axx + Wagnauch
269			11	9	Axx + Wagnauch, NW corner
270			13	12	Axx, north side ~75' east of Axx + Axx
271	36	28	24	19	Wood + Axx, NE corner
272	50	39	38	30	241 Axx, eastern boundary
273	50	39	42	33	245 Axx
274	40	31	30	23	249/253 Axx boundary
275	90	70	60	47	253/257 Axx
276	38	30	34	27	254/263 boundary
277	70	55	50	39	254 Axx
278	40	31	42	33	Tracks + Axx, NE corner
279	18	14	18	14	303 Axx, eastern boundary
280	28	22	20	16	311 Axx, entrance sidewalk
281			15	12	323 Axx, east of drive
282			15	12	331 Axx, front sidewalk area
283			12	9	Axx + Sherman, NE corner
284			16	13	Axx + Sherman, SE corner
285	26	20	22	17	304 Axx
286	15	14	18	14	314/320 boundary

Point	Surface Readings (µR/hr)		One Meter Readings (µR/hr)		Location
	Measured	Corrected	Measured	Corrected	
287	~ 24	19	20	16	308/314 Ann boundary
288			16	13	304/308 Ann boundary
289	36	28	32	25	Tracks Ann, SW corner
290	180	140	220	172	Waynanch, east side, ~30' south of Slater + Waynanch
291	380	296	280	218	Waynanch, east side gate of yard, ~150' south of Slater + Way. Slater + Waynanch
292	200	156	180	140	Waynanch, east side 50' south of Advance Sheet Metal Co
293	220	172	200	156	Waynanch, east side, ~20' north of Co drive
294	140	109	140	109	Waynanch, east side, north of Advance
295			18	14	802 Joliet (west side)
296			15	12	806 Joliet
297			18	14	820 Joliet
298	18	14	22	17	828 Joliet
299	24	19	24	19	832 Joliet
300	18	14	22	17	836 Joliet
301	22	17	22	17	840 Joliet
302	24	19	24	17	844 Joliet
303	20	16	22	17	900 Joliet
304	18	14	18	14	906 Joliet
305			16	13	912 Joliet
306	24	19	17	13	322 Wood (west side)
307	20	16	14	11	Wood Street, south of alley
308	10	8	9	7	George + Wood, SW corner
309	12	9	11	9	212 George (south side)
310	10	8	10	8	220 George
311	19	15	12	9	234 George
312	13	10	12	9	59' E Tracks + George, SE Co

Point	Surface Readings (ohms)		Ore Motion Readings (ohms)		Location
	Measured	Corrected	Measured	Corrected	
313	- 15	12	13	10	258 George
314	14	11	11	9	304 George
315	11	9	9	7	312 George
316	10	8	8	6	318 George
317	12	9	9	7	324 George
318	10	8	7	6	Sherman + George, SE corner
319	12	9	8	6	Sherman + George, SW corner
320	10	8	7	6	Pearl + Sherman George, south side, midpoint between
321	8	6	7	6	424 George, SE corner
322	7	6	8	6	Pearl + George, SE corner
323	9	7	7	6	George St, north side, midpoint between Pearl + Sherman
324	10	8	9	7	George, north side, 25' west of Sherman + George
325	8	6	9	7	Sherman + George, NW corner
326	9	7	9	7	Sherman + George, NE corner
327	10	8	9	7	331 George (north side)
328	8	6	7	6	319 George
329	9	7	9	7	313 George
330	8	6	7	6	309 George
331	14	11	10	8	Vine + George, SE corner
332	10	8	7	6	312 Vine (east side)
333	12	9	9	7	336 Vine (west side)
334	17	13	9	7	330 Vine
335	10	8	9	7	322 Vine
336	16	13	10	8	318 Vine
337	10	8	9	7	Vine + Church, SW corner
338	9	7	9	7	332 Church

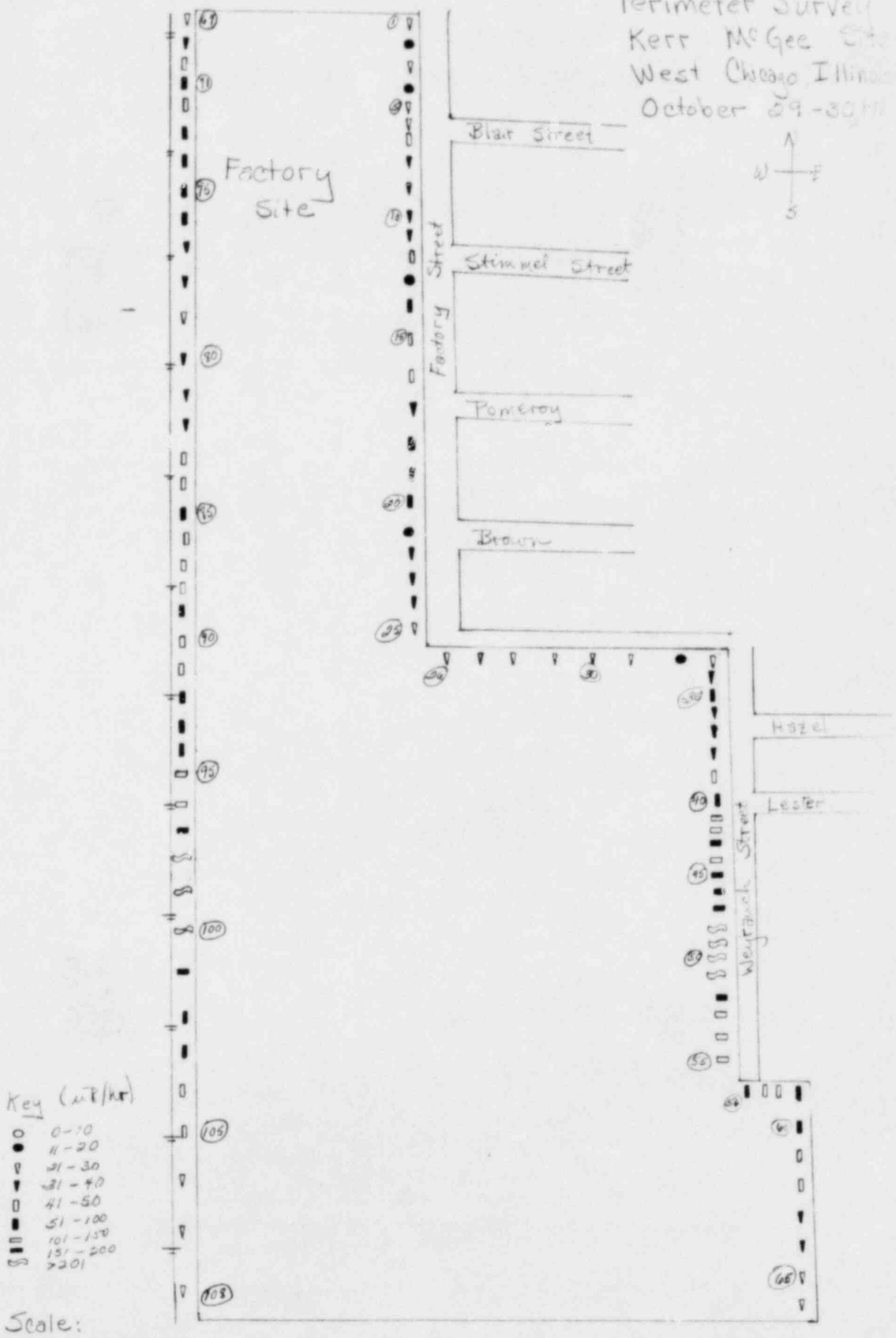
Point	Surface Readings (ul/hr)		Gel Meter Readings (ul/hr)		Location
	Measured	Corrected	Measured	Corrected	
339	- 9	7	8	6	344 Church
340	8	6	7	6	Sherman + Church, SE corner
341	9	7	8	6	416 Church
342	10	8	7	6	432 Church
343	8	6	7	6	450 Church
344	8	6	6	5	Lyman + Yorktown, SE corner
345	8	6	7	6	453 Church
346	11	9	7	6	439 Church
347	10	8	9	7	417 Church
348	10	8	7	6	Sherman + Church, NW corner
349	9	7	7	6	337 Church St
350	13	10	8	6	327 Vine
351	10	8	8	6	309 Church
352	12	9	7	6	Clara + Church, NW corner
353	10	8	10	8	Egret Rocks + Church, NW corner
354	14	11	10	8	243 Church (north side)
355	11	9	7	6	231 Church
356	10	8	9	7	225 Church
357	11	9	8	6	Wood + Church, NW corner
358	13	10	10	8	224 Church (south side)
359	11	9	9	7	242 Church
360	12	9	8	6	256 Church
361	13	10	9	7	284 Church
362	10	8	8	6	310 Church
363	10	8	9	7	317 Vine (east side)
364	8	6	8	6	331 Vine

Point	Surface Readings (μ/hr.)		One Meter Readings (μ/hr.)		Location
	Measured	Corrected	Measured	Corrected	
365	–		4	3	Tyler + Arbor, SW corner
366			12	9	Wood, (east side), 4/10' north of above
367			7	6	Wood (east side), 10' at high stake
368			6	5	Wood + Geneva, SE corner
369			7	6	Barber + Spencer, SW corner
370			6	5	Corde + Barber, NW corner
371			6	5	137 Corde (north side)
372			6	5	Blair + Joliet, SE corner
373			6	5	Blair + Barber, SW corner
374			5	4	Blair + Blakely, SW corner
375			4	3	452 Blair (east side)
376			4	3	Corde + Gates, SE corner
377			5	4	Corde + Sycamore, NE corner
378			6	5	Corde + Clayton, NE corner
379			5	4	Corde + Blakely, NE corner
380			6	5	Corde + Barber, NE corner
381			6	5	Corde + Joliet, NE corner
382			7	6	Barber + Stimmel, NW corner
383			8	6	Barber + Pomeroy, NW corner
384			8	6	Brown + Barber, NW corner
385			7	6	240 Brown (south side)
386			7	6	Brown + Bishop, SW corner
387	6	5	7	5	Brown + Elizabeth, SW corner
388			6	5	Gates + Brown, NW corner
389			6	5	Oak + Brown, SW corner
390			5	4	Lester + Oak, SW corner

Test	Surface Readings (mR/hr)		On Meter Reading (mR/hr)		Location
	Measured	Corrected	Measured	Corrected	
391			5	4	Lester + Gates, SW corner
392			5	4	Elizabeth + Lester, SW corner
393			6	5	Forest + Elizabeth, NW corner
394			6	5	Glen + Elizabeth, NW corner
395			4	3	1010 Elizabeth (west side)
396			5	4	1100 Elizabeth, north boundary
397			6	5	Augusta + Elizabeth, NW corner
398			6	5	Augusta + Bishop, NW corner
399			5	4	Blakely + Augusta, NW corner
400			6	5	Augusta + Barber NW corner
401			6	5	Augusta + Allen, SW corner
402			11	9	Glen + Joliet, SE corner
403			8	6	Glen + Allen, SW corner
404			7	6	Glen + Barber, SW corner
405			6	5	Glen + Blakely, SW corner
406			6	5	Glen + Bishop, SE corner
407			6	5	Bishop + Forest, SW corner
408			6	5	Forest + Elizabeth, SW corner
409			6	5	Gates + Forest, SW corner
410			6	5	Forest + Oak, SW corner
411			8	6	Forest, north side, across fr. Board of Education
412			8	6	139 Forest (north side)
413			19	15	Joliet + Forest, NE corner
414			80	62	Wingarch + Lester, NE corner
415			19	15	900 Joliet (west side)
416	20	16	21	16	928 Joliet, North boundary

Point	Surface Readings (μR/hr)		One Meter Readings (μR/hr)		Location
	Measured	Corrected	Measured	Corrected	
417	18	14	17	13	Joliet (west side) nursing home entrance.
418	14	10	13	10	923 Joliet, south boundary
419	10	8	10	8	1013 Joliet
420	10	8	9	7	1036 Joliet
421	9	7	9	7	1032 Joliet
422	9	7	8	6	1021 Joliet (east side)
423	10	8	12	9	1013 Joliet
424	12	9	11	9	1005 Joliet
425	15	12	16	1	Joliet (east side), southern bound of Gary Elementary School playg
426	18	14	17	13	Joliet (east side), midpoint of Gary Elementary School playgro
427	17	13	18	14	Joliet + Forest, SE corner
428	19	15	16	13	835 Joliet
429	14	11	13	10	Hazel + Joliet, SE corner

Appendix 2


Perimeter Survey
Kerr McGee Site
West Chicago, Illinois
October 29-30, 19
Blair Street
Stimmel Street
Pomeroy
Brown
Hazel
Lester
Factory Street
Factory Site
Key (μR/hr)
0-10
11-20
21-30
31-40
41-50
51-100
101-150
151-200
>201
Scale:
1" = 270' ≈ 1/20 (0.05) miles

Perimeter Survey
Kerr McGee Factory Site
W. Chicago, Illinois

Appendix 2

	PRM-M; Serial 350 (μR/hr)				E520; Serial 1786 (mR/hr)		PRM5-3	
	Surface		One Meter		Surface	One Meter	Surface	One Meter
	Measured	Corrected	Measured	Corrected				
1	46	36	28	22	0.03	0.03		
2	28	22	22	17	0.02	0.02		
3	36	28	28	22	0.03	0.03		
4	30	23	26	20	0.03	0.03		
5	34	27	30	23	0.03	0.03		
6	40	31	34	27	0.03	0.03		
7	280	218	60	47	0.02	0.02		
8	60	47	50	39	0.05	0.03		
9	90	90	50	39	0.09	0.04		
10	60	47	40	31	0.06	0.03		
11	60	47	40	31	0.05	0.02		
12	90	90	60	47	0.08	0.07		
13	28	22	19	15	0.02	0.05		
14	180	140	80	62	0.16	0.07		
15	110	86	60	47	0.09	0.08		
16	100	78	60	47	0.10	0.05	0.14 mR/hr 2.5K cpm;	0.11 mR/hr 2.0K cpm;
17	60	47	50	39	0.06	0.02		
18	100	78	80	62	0.10	0.08		
19	32	25	40	31	0.03	0.03		
20	60	47	80	62	0.06	0.04	0.09 mR/hr 1.5K cpm;	0.09 mR/hr 1.5K cpm;
21	20	16	20	16	0.02	0.02		
22	60	47	40	31	0.04	0.03		
23	46	36	44	34	0.04	0.03		
24	40	31	42	33	0.03	0.02		
25	35	27	38	30	0.02	0.03	100 cpm	200 cpm

	PRM-7, Serial 350 (μR/hr)				E520, Serial 1786 (mR/hr)		PRM-5-3	
	Surface		One Meter		Surface	One Meter	Surface	One Meter
	Measured	Corrected	Measured	Corrected				
26	38	30	38	30	0.03	0.03		
27	36	28	38	30	0.01	0.02		
28	32	25	32	25	0.02	0.01	300 cpm / 0.024 mR/hr	250 cpm / 0.02 mR/hr
29	28	22	34	27	0.02	0.02		
30	28	22	30	23	0.02	0.02		
31	30	23	30	23	0.02	0.02		
32	28	22	26	20	0.02	0.02		
33	30	23	34	27	0.03	0.03	400 cpm / 0.032 mR/hr	450 cpm / 0.036 mR/hr
34	28	22	40	31	0.02	0.03		
35	200	156	100	78	0.15	0.08		
36	42	33	44	34	0.02	0.03		
37	48	37	50	39	0.04	0.03		
38	48	37	40	31	0.04	0.03	400 cpm / 0.032 mR/hr	500 cpm / 0.04 mR/hr
39	60	47	60	47	0.04	0.04		
40	60	47	80	62	0.03	0.06		
41	180	140	140	109	0.09	0.09		
42	160	125	140	109	0.10	0.10		
43	280	218	220	172	0.20	0.10		3.0 K cpm / 0.17 mR/hr
44	180	140	170	133	0.11	0.10		
45	240	187	220	172	0.14	0.12		3.5 K cpm / 0.2 mR/hr
46	240	187	220	172	0.16	0.11		
47	240	187	240	187	0.13	0.13		
48	1000	780	380	296	0.60	0.30		
49	600	468	320	250	0.50	0.30		
50	360	281	340	265	0.30	0.30	10 K cpm / 0.8 mR/hr	10 K cpm / 0.8 mR/hr

	PRM-7, Serial 350 (μR/hr)				E-520, Serial 1984		PRM-5-3	
	Surface		One Meter		Surface	One Meter	Surface	One Meter
	Measured	Corrected	Measured	Corrected	(mR/hr)	(mR/hr)		
51	280	218	260	203	0.20	0.20	5.0 K cpm / 0.4 mR/hr	5.0 K cpm / 0.4 mR/hr
52	220	172	220	172	0.11	0.11	3.5 K cpm / 0.28 mR/hr	3.0 K cpm / 0.24 mR/hr
53	120	94	160	125	0.06	0.08		
54	180	140	180	140	0.08	0.09		
55	120	94	130	101	0.04	0.06		
56	100	78	100	78	0.04	0.03		
57	40	31	60	47	0.03	0.02		
58	40	31	60	47	0.02	0.02	150 cpm / 0.012 mR/hr	150 cpm / 0.012 mR/hr
59	80	62	80	62	0.02	0.03		
60	80	62	80	62	0.02	0.02		
61	60	47	60	47	0.02	0.02		
62	60	47	60	47	0.02	0.02		
63	40	31	40	31	0.03	0.01	200 cpm / 0.016 mR/hr	200 cpm / 0.016 mR/hr
64	40	31	40	31	0.02	0.01		
65	32	25	34	27	0.01	0.02		
66	30	23	30	23	0.01	0.02		
67	18	14	28	22	0.02	0.02		
68	32	25	40	31	0.04	0.04		
69	42	33	60	47	0.06	0.07		
70	110	86	—	—	0.07	—		
71	38	30	80	62	0.02	0.07	1.0 K cpm / 0.08 mR/hr	2.5 K cpm / 0.14 mR/hr
72	38	30	60	47	0.03	0.04		
73	40	31	80	62	0.04	0.05		
74	100	78	80	62	0.14	0.7		
75	80	62	120	94	0.10	0.13		

	PRM-7, Serial 350 (μR/hr)				E-520, Serial 1786 (mR/hr)		PRM-5-3	
	Surface		One Meter		Surface	One Meter	Surface	One Meter
	Measured	Corrected	Measured	Corrected				
76	40	31	80	62	0.05	0.07	2.0K cpm / 0.16 mR/hr	2.0K cpm / 0.16 mR/hr
77	40	31	40	31	0.03	0.07		
78	30	23	46	36	0.02	0.04		
79	22	17	38	30	0.02	0.04		
80	28	22	42	33	0.04	0.04		
81	30	23	40	31	0.03	0.02	250 cpm / 0.02 mR/hr	300 cpm / 0.024 mR/h
82	32	25	42	33	0.03	0.02		
83	42	33	60	47	0.03	0.04		
84	38	25	60	47	0.03	0.07		
85	44	34	80	62	0.04	0.07		
86	38	25	60	47	0.02	0.02	350 cpm / 0.028 mR/hr	500 cpm / 0.04 mR/h
87	36	28	60	47	0.03	0.07		
88	38	25	60	47	0.05	0.06		
89	42	33	80	62	0.03	0.05		
90	38	25	60	47	0.03	0.04		
91	40	31	60	47	0.04	0.04	200 cpm / 0.016 mR/hr	1.5K cpm / 0.12 mR/h
92	60	47	80	62	0.03	0.06		
93	80	62	80	62	0.02	0.04		
94	80	62	100	78	0.03	0.05		
95	100	78	160	125	0.03	0.07		
96	120	94	140	109	0.07	0.07	1.5K cpm / 0.12 mR/hr	1.5K cpm / 0.12 mR/h
97	160	125	220	172	0.07	0.12		
98	220	172	280	218	0.12	0.14		
99	240	187	360	281	0.15	0.20		
100	280	218	380	296	0.20	0.30		

	PRM-7, Serial 350 (μR/hr)				E520, Serial 1786		PRM-5-3	
	Surface		One Meter		Surface	One Meter	Surface	One Meter
	Measured	Corrected	Measured	Corrected	(mR/hr)	(mR/hr)		
101	180	140	220	172	0.13	0.14	2.0 K cpm / 0.16 mR/hr	2.0 K cpm / 0.16 mR/hr
102	100	78	120	94	0.04	0.06		
103	80	62	80	62	0.04	0.04		
104	50	39	60	47	0.04	0.04		
105	40	31	60	47	0.03	0.03		
106	34	27	38	30	0.03	0.03	200 cpm / 0.016 mR/hr	250 cpm / 0.02 mR/hr
107	26	20	30	23	0.02	0.02		
108	26	20	28	22	0.01	0.02		

Appendix 3