AX TANK FARM DRYWELL SPECTRAL GAMMA LOGGING PLOTS

Figure E-45. Plan Map of the Hanford Site AX Tank Farm Showing the Tank Monitoring Boreholes from DOE-GJO 2000a.

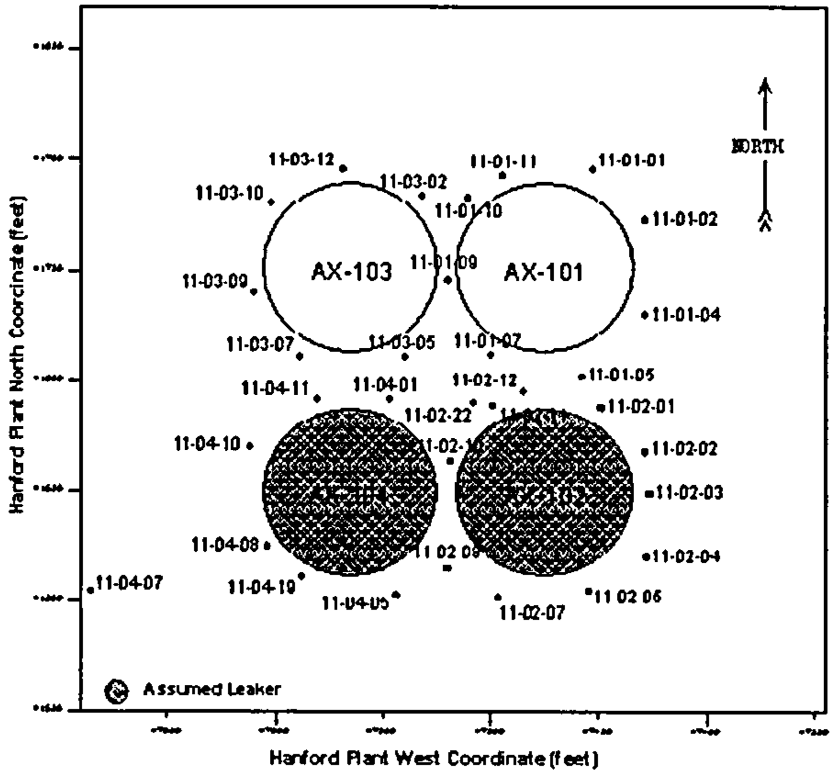


Figure 15-8. Plan Map of the Hanford Site AX Tank Farm Showing the Tank Monitoring Boreholes

Figure E-46. 11-01-10 Man-Made Radionuclide Concentrations from DOE-GJO 1997a.

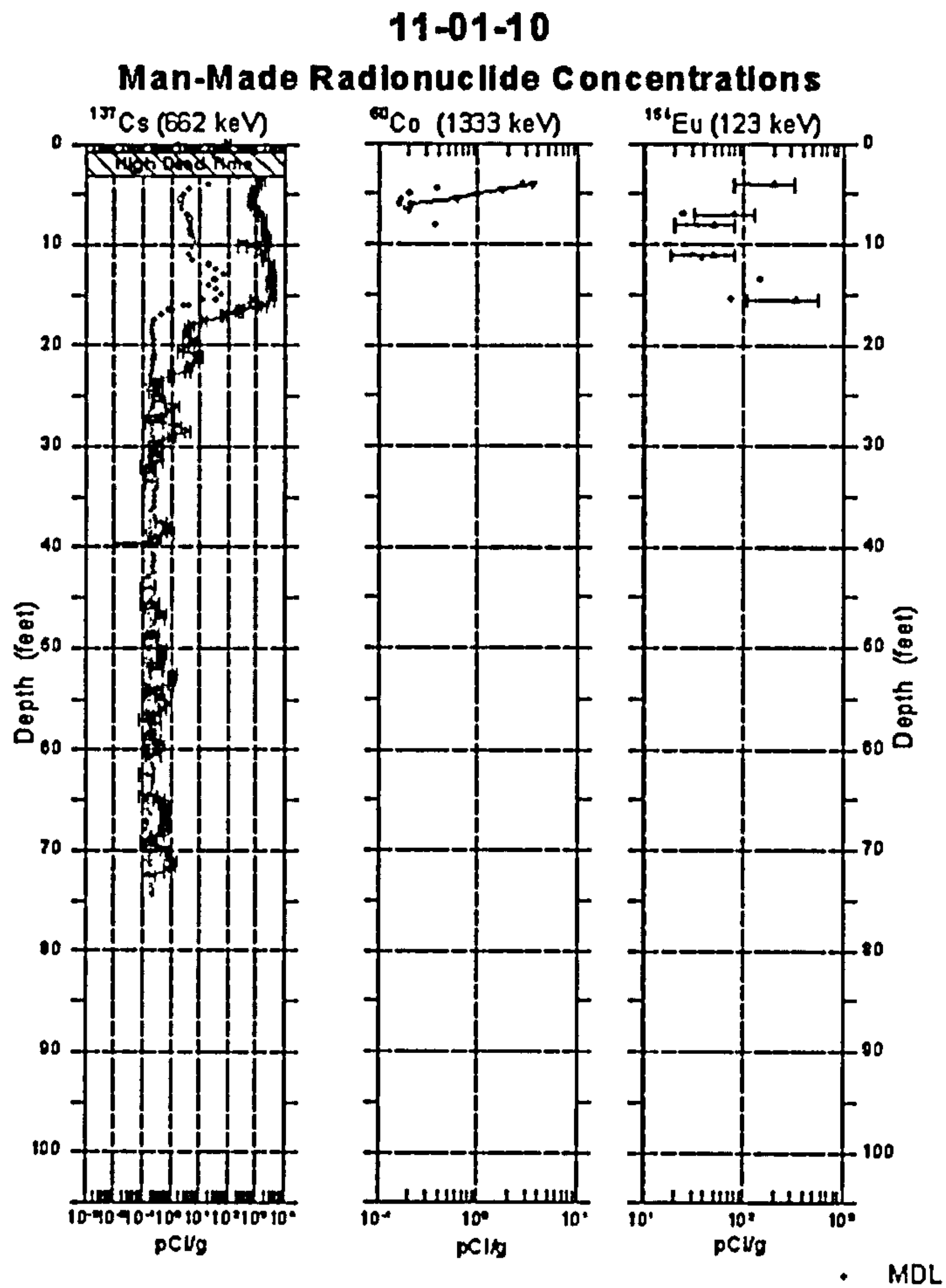


Figure E-47. 11-01-10 Summary of High Rate Logging Results for the AX Tank Farm from DOE-GJO 2000a.

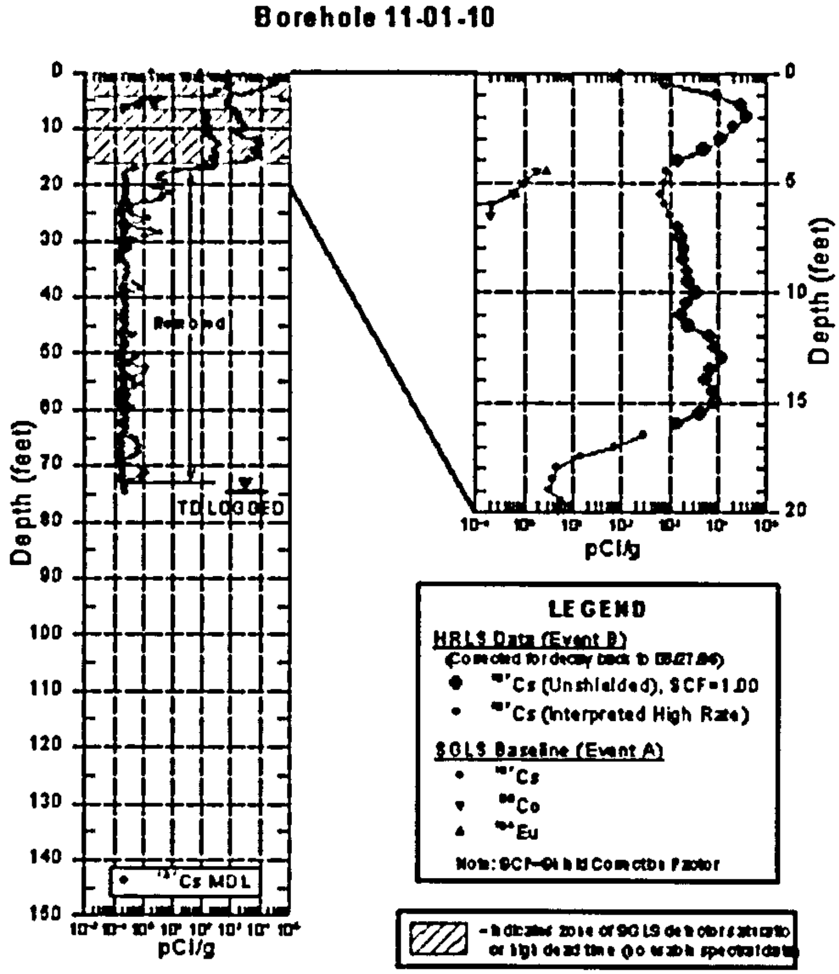


Figure A-1. Summary of High Rate Logging Results for the AX Tank Farm

Figure E-48. 11-02-12 Man-Made Radionuclide Concentrations from DOE-GJO 1997b.

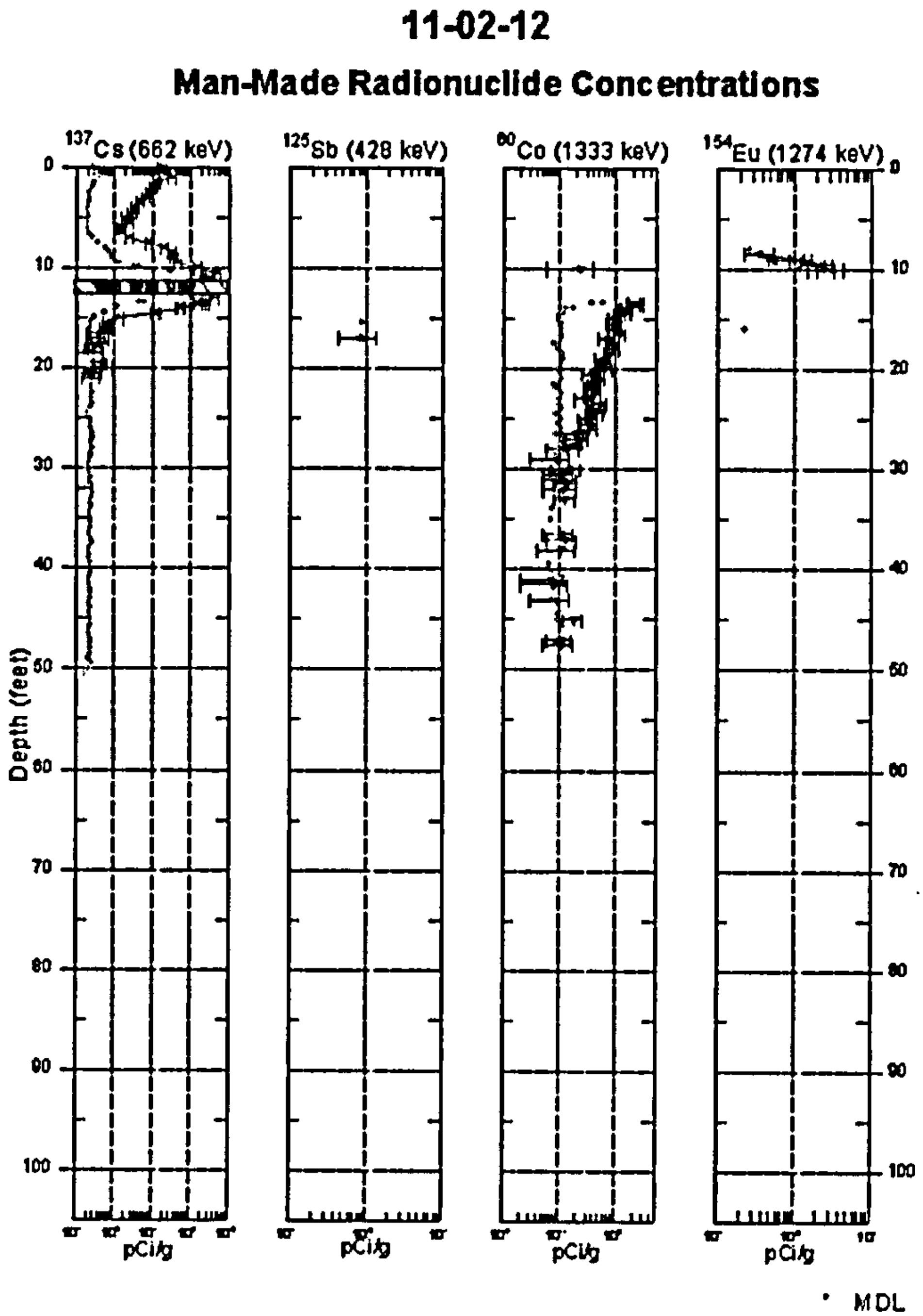


Figure E-49. 11-02-12 Summary of High Rate Logging Results for the AX Tank Farm from DOE-GJO 2000a.

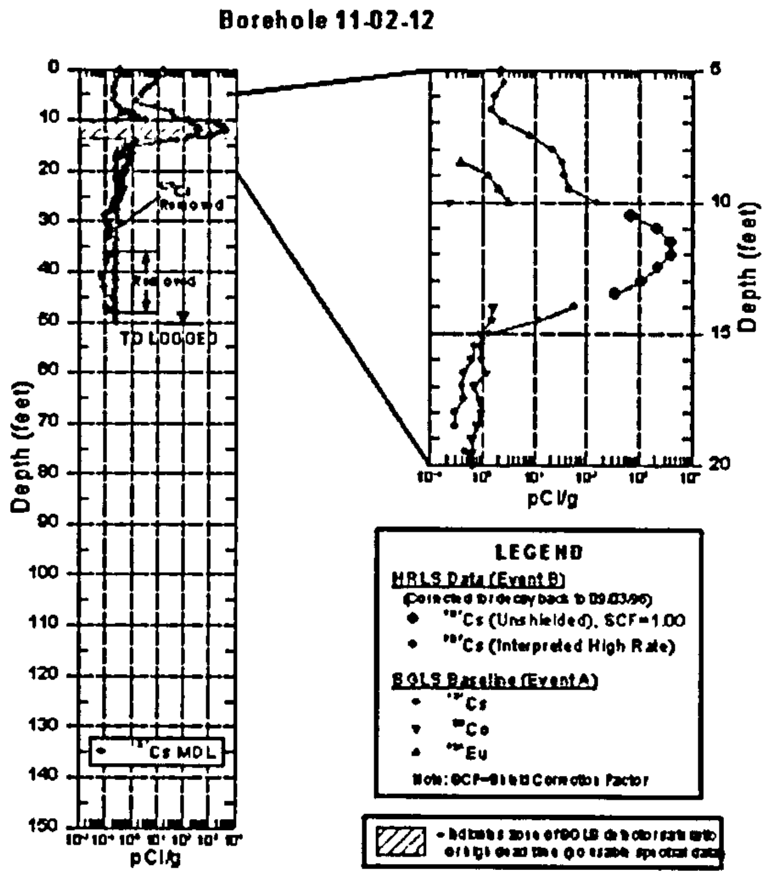


Figure A-2. Summary of High Rate Logging Results for the AX Tank Farm

Figure E-50. 11-03-02 Man-Made Radionuclide Concentrations from DOE-GJO 1997c.

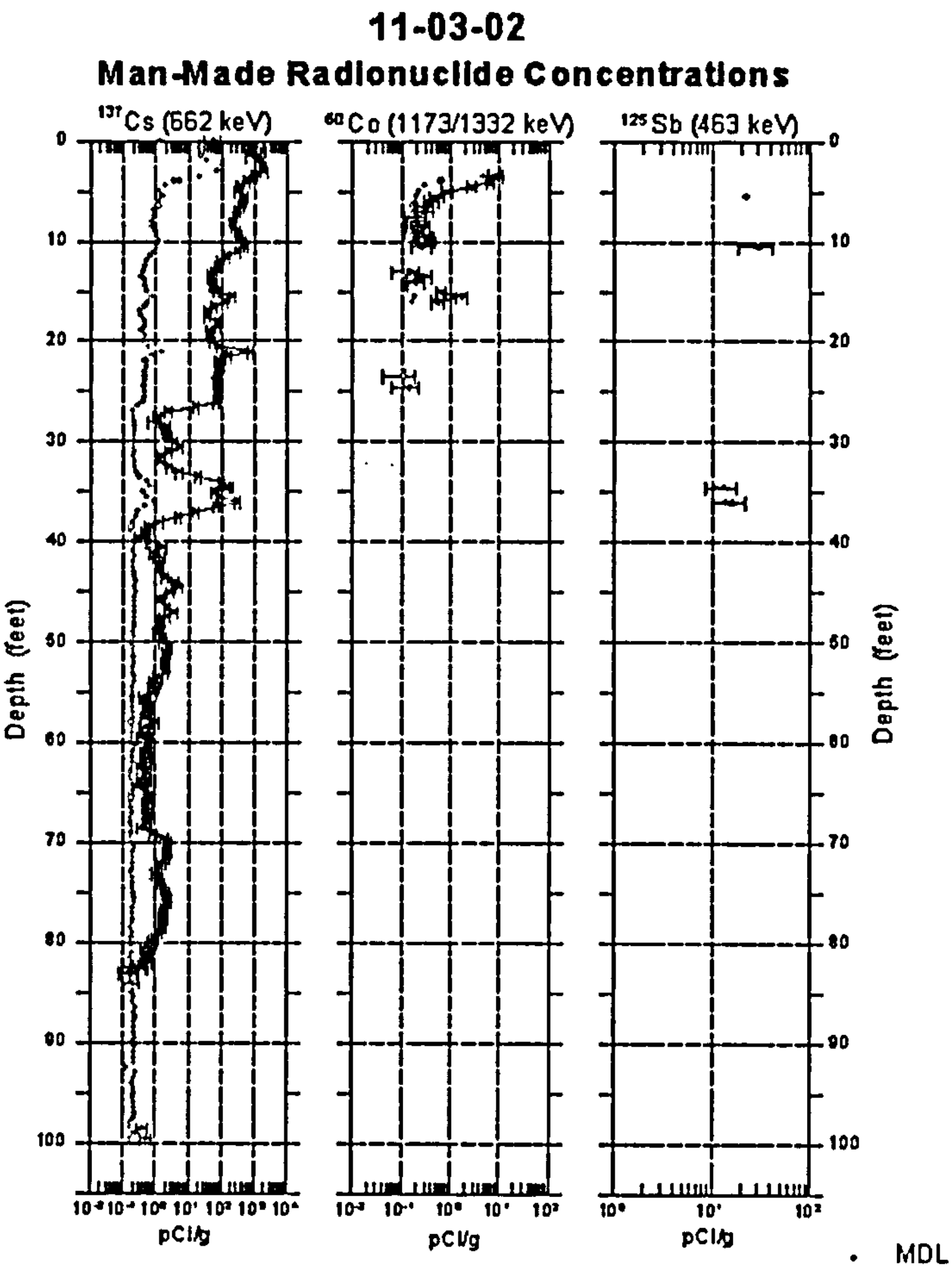
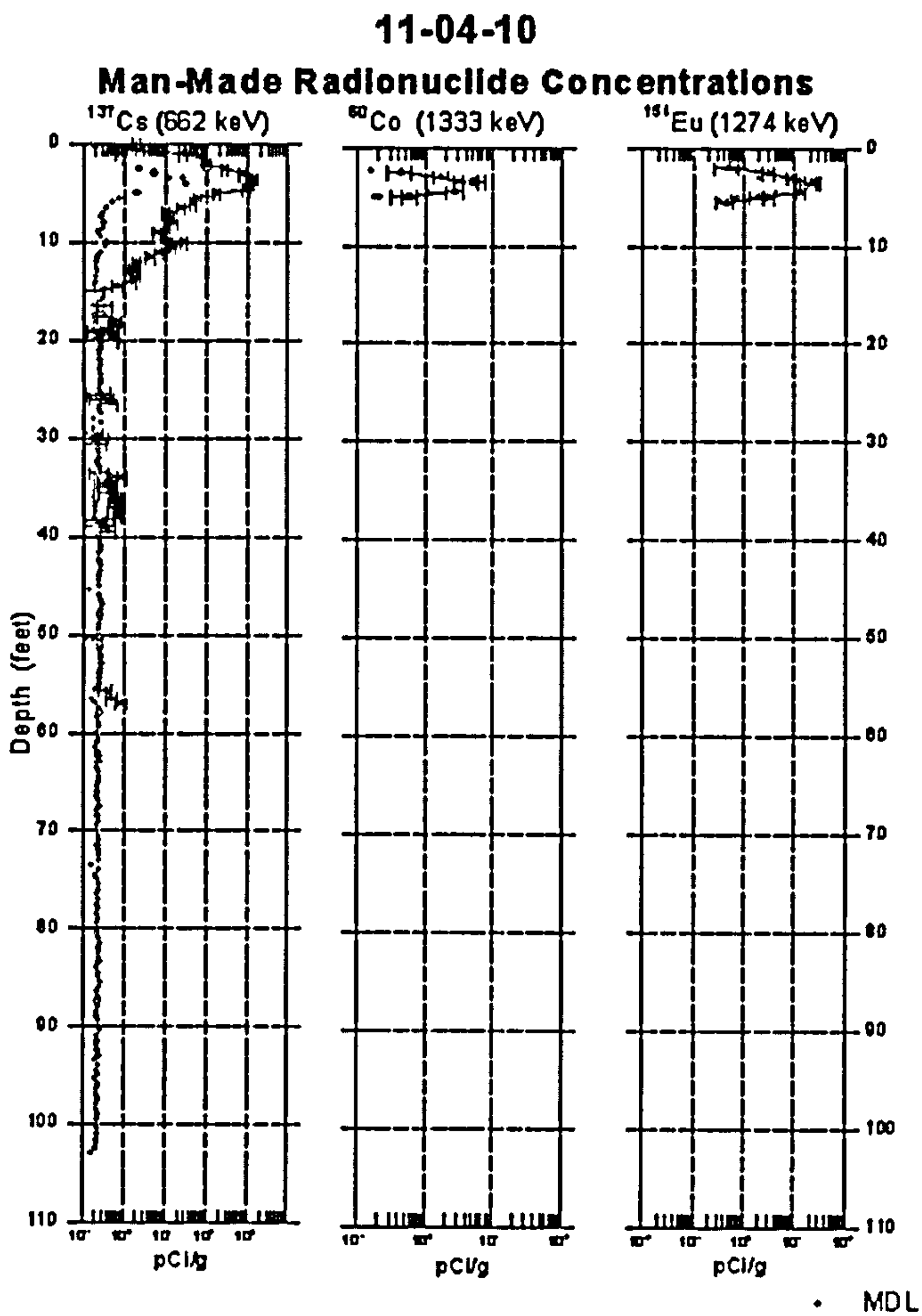
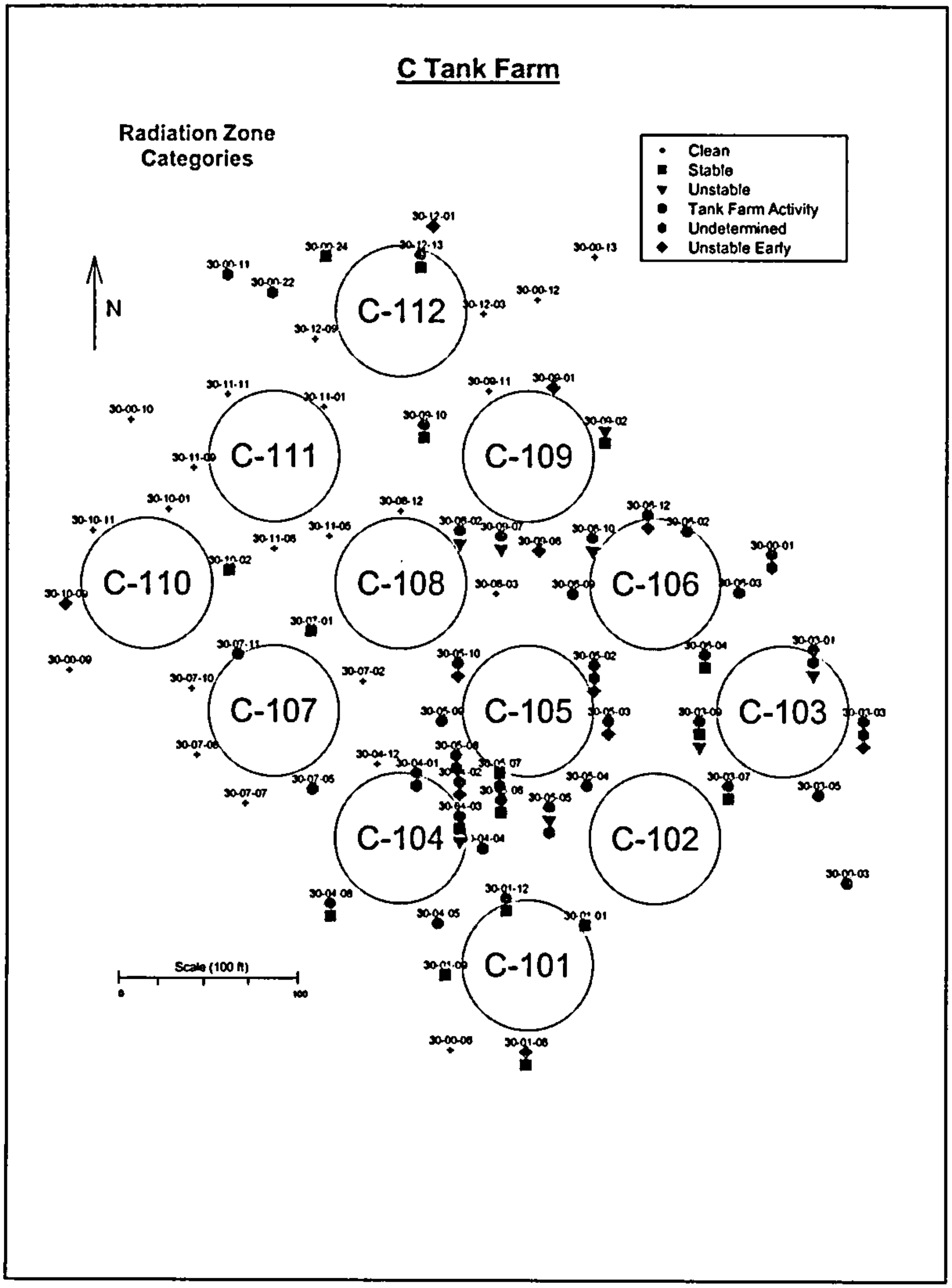


Figure E-51. 11-04-10 Man-Made Radionuclide Concentrations from DOE-GJO 1997d.



ANALYSIS AND SUMMARY REPORT OF HISTORICAL DRY WELL GAMMA LOGS FOR THE 241-C TANK FARM – 200 EAST FROM RANDALL AND PRICE 2001A


C Tank Farm
Radiation Zone
Categories
Clean
Stable
Unstable
Tank Farm Activity
Undetermined
Unstable Early
N
C-112
C-111
C-109
C-110
C-108
C-106
C-107
C-105
C-103
C-104
C-102
C-101
Scale (100 ft)

2.2.1 Tank Farm Activity

A sudden, significant change in the intensity of gross gamma rays between successive gross gamma surveys at or near the ground surface suggests that contamination may have resulted from tank farm activities or logging procedure changes. Radioactive contamination occurs at the surface in 35 wells, apparently as the result of tank farm activities (i.e., logging procedure changes, transfer line operations, valve box and conduit leaks, surface spills, etc.). These wells are listed in Table 3.

Table 3. C Tank Farm Activity Zones

Borehole Number	Survey Depth (feet)	Probe Type	Category	Zone Depth (feet)	Max GTP (ft x c/s)	Year Max GTP	Isotope Present
30-00-01	70	4	TF Activity	0-5	300	1984	^{137}Cs
30-00-03	120'	4	TF Activity	0-7	1300	1975	^{137}Cs
30-01-12	100	4	TF Activity	0-10	4500	1975	^{137}Cs
30-03-01	125	4	TF Activity	0-30	12K	1975	^{137}Cs
30-03-03	130	4	TF Activity	0-14	4K	1975	^{137}Cs
30-03-05	100	4	TF Activity	0-20	600	1984	^{137}Cs
30-03-07	130	4	TF Activity	0-12	2000	1980	^{137}Cs
30-03-09	100	4	TF Activity	0-12	8K	1980	^{137}Cs
30-04-01	50	4	TF Activity	0-8	3K	1975	^{137}Cs
30-04-02	135	4	TF Activity	0-12	2000	1975	^{137}Cs
30-04-03	50	4	TF Activity	0-15	600	1985	^{137}Cs
30-04-04	100	4	TF Activity	0-8	50K	1978	^{137}Cs
30-04-04	100	4	TF Activity	8-25	1800	1975	^{137}Cs
30-04-05	100	4	TF Activity	0-20	9K	1978	^{137}Cs
30-04-08	145	4	TF Activity	0-5	150	1975	^{137}Cs
30-05-02	130	4	TF Activity	0-14	5K	1975	^{137}Cs
30-05-03	100	4	TF Activity	0-39	9K	1985	^{137}Cs
30-05-04	120	4	TF Activity	0-8	900	1975	^{137}Cs
30-05-05	100	4	TF Activity	0-25	12K	1975	^{137}Cs
30-05-06	60	4	TF Activity	0-15	1100	1975	^{137}Cs
30-05-08	50	4	TF Activity	0-11	16K	1975	^{137}Cs
30-05-09	100	4	TF Activity	0-8	300	1985	^{137}Cs
30-05-10	135	4	TF Activity	0-17	300	1985	^{137}Cs
30-06-02	123	4	TF Activity	0-16	500	1984	^{137}Cs
30-06-03	100	4	TF Activity	0-10	800	1975	^{137}Cs
30-06-04	130	4	TF Activity	0-16	2000	1984	^{137}Cs
30-06-09	100	4	TF Activity	0-16	900	1985	^{137}Cs
30-06-10	130	4	TF Activity	0-10	800	1984	^{137}Cs
30-06-12	100	4	TF Activity	0-14	1500	1985	^{137}Cs
30-07-05	100	4	TF Activity	0-8	300	1975	^{137}Cs
30-07-11	100	4	TF Activity	0-10	80K	1993	^{137}Cs
30-08-02	100	4	TF Activity	0-6	4K	1985	^{137}Cs

Borehole Number	Survey Depth (feet)	Probe Type	Category	Zone Depth (feet)	Max GTP (ft x c/s)	Year Max GTP	Isotope Present
30-08-02	100	4	TF Activity	13-28	55K	1980	^{137}Cs
30-09-07	125	4	TF Activity	0-14	300	1985	^{137}Cs
30-09-10	100	4	TF Activity	0-20	4K	1975	^{137}Cs
30-12-13	120	4	TF Activity	0-20	23K	1978	^{137}Cs

2.2.2 Undetermined

Infrequently, stability cannot be determined due to gross gamma energy levels exceeding the system design criteria (both upper and lower limits), insufficient data, possible effects of depth shift, and surface activities. 11 of 92 zones in the 48 contaminated dry wells examined in the C Tank Farm are undetermined: These zones are listed in Table 4.

Table 4. C Tank Farm Undetermined Zones

Borehole Number	Survey Depth (feet)	Probe Type	Category	Zone Depth (feet)	Max GTP (ft x c/s)	Year Max GTP	Isotopes Present
30-00-01	70	4	Undetermined	58-70	300	1984	^{137}Cs
30-00-11	58	4	Undetermined	3-14	1000	1977	^{137}Cs
30-00-22	55	4	Undetermined	0-13	15K	1977	^{137}Cs
30-03-01	125	4	Undetermined	40-70	600	1976	^{137}Cs
30-03-03	130	4	Undetermined	14-40	2800	1975	^{137}Cs
30-04-01	50	4	Undetermined	8-22	400	1975	^{137}Cs
30-05-02	130	4	Undetermined	14-26	600	1975	^{137}Cs
30-05-05	100	4	Undetermined	56-80	1800	1975	^{137}Cs, ^{60}Co
30-05-07	67	4	Undetermined	45-66	400	1981	^{137}Cs
30-05-08	50	4	Undetermined	11-26	12K	1975	^{137}Cs, ^{60}Co, ^{154}Eu
30-05-08	50	4	Undetermined	26-53	14K	1975	^{137}Cs, ^{60}Co

2.2.3 Stable

The subsurface condition of a zone with radioactive contamination is considered stable when:

- The decay rate of the isotope(s) identified with SGLS matches the trend observed in the GTP of the gross gamma ray data, or
- Contaminants continue to decay at a rate consistent with the hypothesized isotope(s) half-life, and
- No noticeable change in concentration is apparent over the short time interval that data were collected.

Twenty-four are considered stable in C Tank Farm and these zones are listed in Table 5.

Table5. C Tank Farm Stable Zones

Borehole Number	Survey Depth (feet)	Probe Type	Category	Zone Depth (feet)	Max GTP (ft x c/s)	Year Max GTP	Isotopes Present
30-00-24	60	4	Stable	14-24	800	1977	^{106}Ru
30-00-24	60	4	Stable	24-40	700	1977	^{106}Ru
30-01-01	100	4	Stable	30-53	1200	1975	^{137}Cs,^{106}Ru
30-01-06	100	4	Stable	71-83	600	1975	^{106}Ru
30-01-06	100	4	Stable	83-95	220	1975	^{106}Ru
30-01-09	100	4	Stable	20-33	40K	1975	^{137}Cs
30-01-09	100	4	Stable	33-60	14K	1975	^{137}Cs,^{106}Ru
30-01-12	100	4	Stable	10-18	100	1975	^{137}Cs
30-03-07	130	4	Stable	42-54	170	1975	^{137}Cs
30-03-09	100	4	Stable	40-52	150	1975	^{137}Cs
30-04-03	50	4	Stable	16-30	70K	1983	^{137}Cs
30-04-08	145	4	Stable	10-26	1000	1975	^{137}Cs
30-04-08	145	4	Stable	26-38	150	1975	^{137}Cs
30-04-08	145	4	Stable	38-50	120	1975	^{137}Cs
30-05-06	60	4	Stable	40-53	400	1975	^{137}Cs,^{60}Co
30-05-07	67	2	Stable	30-45	20K	1983	^{137}Cs
30-06-04	130	4	Stable	16-32	600	1975	^{137}Cs
30-07-01	100	4	Stable	0-14	120	1975	^{137}Cs
30-09-02	100	4	Stable	82-100	200	1975	^{60}Co
30-09-10	100	4	Stable	20-38	200	1975	^{137}Cs
30-09-10	100	4	Stable	50-70	100	1975	^{137}Cs
30-09-10	100	4	Stable	70-94	200	1975	^{137}Cs
30-10-02	100	4	Stable	42-50	80	1975	^{137}Cs
30-12-13	120	4	Stable	20-50	1800	1978	^{137}Cs, ^{60}Co, ^{154}Eu ^{106}Ru

The term "Stable", as used in this analysis, is defined as the apparent match of the decay curve to that for the isotopes known or hypothesized to be present, and does not refer to the inherent condition of the contamination. The mobility of the radioactive contaminants in the subsurface soils before or after the gross gamma ray and SGLS data collection period is undetermined. If a new driver were introduced (e.g., the influx of a large volume of liquid), contaminants could be remobilized. Similarly, a change in geochemical conditions in the soil could also affect mobility. Given the current gross gamma and SGLS data, it cannot be determined if remobilization will or will not occur.

2.2.4 Unstable

The subsurface condition of a zone with radioactive contamination is considered unstable when, at some point within the time interval of data collection, contamination was not decreasing at the decay rate of the isotope(s) identified with SGLS. In this case, the decay curve does not match the trend observed in the GTP of the identified or hypothesized isotope. In the C Tank Farm, 20 zones are identified which exhibited instability within the time period that gross gamma ray data were collected. In 11 of these zones, instability occurs during the earlier years of data collection for certain depth intervals; however, in later years, the GTP follows the decay curve of the known or hypothesized isotopes. A listing of "unstable early" and unstable zones is presented in Table 6.

Table 6. C Tank Farm Unstable Early and Unstable Zones

Borehole Number	Survey Depth (feet)	Probe Type	Category	Zone Depth (feet)	Max GTP (ft x c/s)	Year Max GTP	Isotopes Present
30-01-06	100	4	Unstable Early	30-41	250	1980	137Cs
30-03-03	130	4	Unstable Early	78-100	1500	1975	60Co, ^{106}Ru
30-04-02	135	4	Unstable Early	32-60	3K	1975	^{60}Co
30-05-02	130	4	Unstable Early	68-84	250	1976	^{137}Cs, ^{60}Co
30-05-10	135	4	Unstable Early	17-35	500	1976	^{137}Cs, ^{60}Co, ^{106}Ru
30-06-12	100	4	Unstable Early	14-26	300	1979	^{137}Cs, ^{60}Co
30-09-01	100	4	Unstable Early	88-100	400	1977	^{137}Cs, ^{60}Co
30-09-06	100	4	Unstable Early	72-88	1000	1983	^{60}Co
30-10-09	100	4	Unstable Early	40-60	1700	1975	^{106}Ru
30-12-01	100	4	Unstable Early	34-48	200	1978	^{60}Co, ^{106}Ru
30-03-01	125	4	Unstable	90-125	300	1984	^{60}Co
30-03-09	100	4	Unstable	73-94	500	1988	^{60}Co
30-04-03	50	4	Unstable	30-48	8K	1981	^{60}Co
30-05-03	100	4	Unstable	67-80	400	1975	^{60}Co
30-05-05	100	4	Unstable	40-56	550	1976	^{137}Cs
30-06-10	130	4	Unstable	86-115	300	1989	^{60}Co
30-08-02	100	4	Unstable	46-55	1500	1980	^{60}Co
30-08-02	100	4	Unstable	55-84	12K	1980	^{60}Co
30-09-02	100	4	Unstable	40-58	1100	1976	^{60}Co
30-09-07	125	4	Unstable	72-90	1100	1983	^{60}Co

ANALYSIS AND SUMMARY REPORT OF HISTORICAL DRY WELL GAMMA LOGS FOR THE 241-A TANK FARM-200 EAST FROM RANDALL AND PRICE 2001B

Europium-154 is present in three zones in combination with cesium-137, and present in one of these three zones with both cesium-137 & cobalt-60.

Ruthenium-106 is present as the sole isotope in seven zones.

The isotopes identified in A Tank Farm with the SGLS exist primarily under three categories of subsurface conditions: tank farm activity, stable, and undetermined. Two unstable conditions, and five "unstable early" conditions are present in A Tank Farm. Dry well locations (centered on the borehole name) are labeled with the conditions of subsurface zones and are shown in Figure 2. A single symbol for a dry well may indicate multiple zones of the same designation.

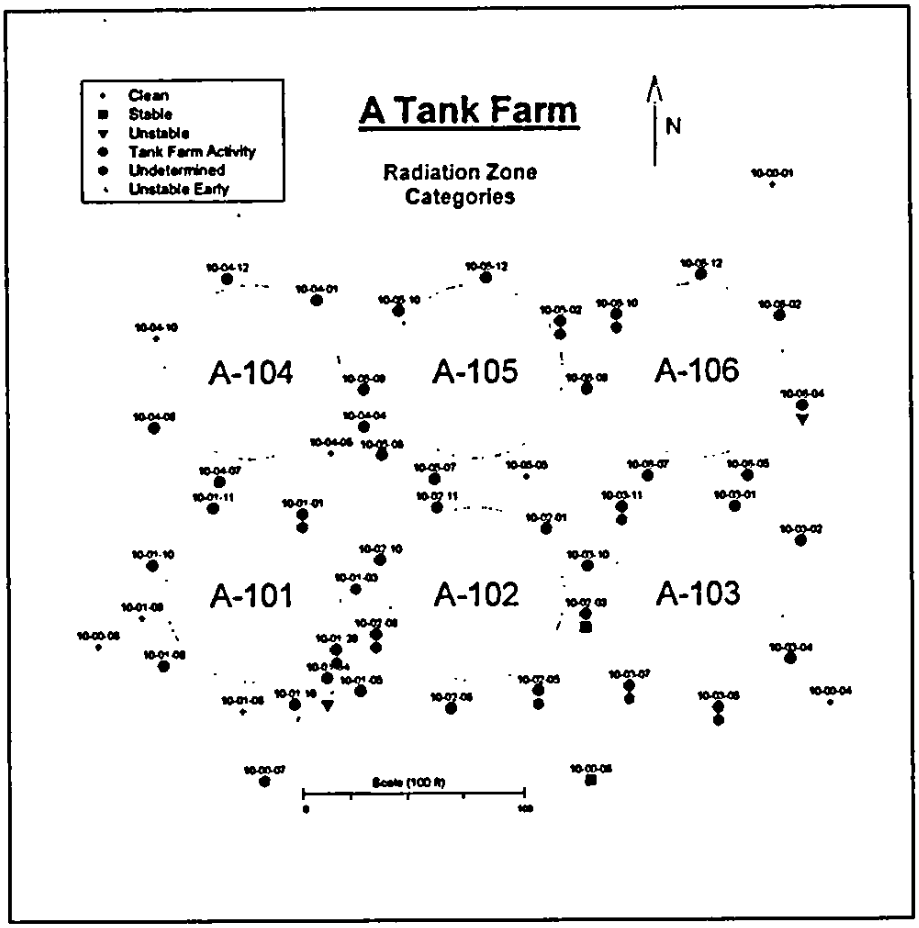


Figure 2. A Tank Farm Radiation Zone Categories

2.2.1 Tank Farm Activity

A sudden, significant change in the intensity of gross gamma rays between successive gross gamma surveys at or near the ground surface suggests that contamination may have resulted from tank farm activities or logging procedure changes. Radioactive contamination occurs at the surface in 40 wells as the result of tank farm activities (i.e., logging procedure changes, transfer line operations, valve box and conduit leaks, surface spills, etc.). These wells and two with deep tank farm activity are listed in Table 3.

Table 3. A Tank Farm Activity Zones

Borehole Number	Survey Depth (feet)	Probe Type	Category	Zone Depth (feet)	Max GTP (ft x c/s)	Year Max GTP	Isotope Present
10-01-01	125	4	TF Activity	0-16	1000	1985	^{137}Cs
10-01-04	125	4	TF Activity	0-16	1000	1984	^{137}Cs
10-01-05	155	4	TF Activity	0-10	1000	1976	^{137}Cs
10-01-08	125	4	TF Activity	0-13	700	1977	^{137}Cs
10-01-10	125	4	TF Activity	0-15	300	1984	^{137}Cs
10-01-11	125	4	TF Activity	0-18	1200	1984	^{137}Cs
10-01-16	55	4	TF Activity	0-16	500	1985	^{137}Cs
10-01-28	45	4	TF Activity	0-10	700	1984	^{137}Cs, ^{60}Co
10-02-01	125	4	TF Activity	0-18	4K	1980	^{137}Cs
10-02-03	125	4	TF Activity	0-20	600	1985	^{137}Cs
10-02-05	125	4	TF Activity	0-10	300	1984	^{137}Cs
10-02-06	90	4	TF Activity	0-10	600	1975	^{137}Cs
10-02-08	125	4	TF Activity	0-10	200K	1994	^{137}Cs
10-02-10	125	4	TF Activity	0-11	12K	1991	^{137}Cs
10-02-11	125	4	TF Activity	0-20	600	1984	^{137}Cs
10-03-01	125	4	TF Activity	0-16	1000	1985	^{137}Cs
10-03-02	130	4	TF Activity	0-25	600	1984	^{137}Cs
10-03-04	125	4	TF Activity	0-20	500	1984	^{137}Cs
10-03-05	125	4	TF Activity	0-20	600	1984	^{137}Cs
10-03-07	125	4	TF Activity	0-20	2K	1984	^{137}Cs
10-03-10	150	4	TF Activity	0-14	3K	1980	^{137}Cs, ^{154}Eu
10-03-11	90	4	TF Activity	0-12	15K	1976	^{137}Cs
10-04-01	125	4	TF Activity	0-10	200	1975	^{137}Cs
10-04-04	150	4	TF Activity	0-14	6K	1976	^{137}Cs
10-04-07	125	4	TF Activity	0-10	100	1975	^{137}Cs
10-04-08	125	4	TF Activity	0-10	250	1984	^{137}Cs
10-04-12	75	4	TF Activity	0-14	2K	1979	^{137}Cs, ^{154}Eu
10-05-02	125	4	TF Activity	0-10	200	1979	^{137}Cs
10-05-07	75	4	TF Activity	0-8	200	1984	^{137}Cs
10-05-08	60	4	TF Activity	0-18	3K	1975	^{137}Cs
10-05-09	75	4	TF Activity	0-10	500	1985	^{137}Cs

Borehole Number	Survey Depth (feet)	Probe Type	Category	Zone Depth (feet)	Max GTP (ft x c/s)	Year Max GTP	Isotope Present
10-05-10	125	4	TF Activity	0-22	1000	1979	^{137}Cs
10-05-12	75	4	TF Activity	0-15	3K	1975	^{137}Cs
10-05-12	75	4	TF Activity	72-80	1000	1975	^{137}Cs
10-06-02	125	4	TF Activity	0-15	1000	1979	^{137}Cs
10-06-04	125	4	TF Activity	0-12	400	1984	^{137}Cs
10-06-05	75	4	TF Activity	0-18	4K	1980	^{137}Cs
10-06-07	125	4	TF Activity	0-18	600	1979	^{137}Cs
10-06-09	125	4	TF Activity	0-18	800	1985	^{137}Cs
10-06-09	125	4	TF Activity	80-90	300	1975	^{137}Cs
10-06-10	125	4	TF Activity	0-10	10K	1976	^{137}Cs
10-06-12	105	4	TF Activity	0-20	1400	1984	^{137}Cs

2.2.2 Undetermined

Infrequently, stability cannot be determined due to gross gamma energy levels exceeding the system design criteria (both upper and lower limits), insufficient data, possible effects of depth shift, and surface activities. Thirty-two of 95 zones in the 61 contaminated dry wells or laterals examined in the A Tank Farm are undetermined. These zones are listed in Table 4.

Table 4. A Tank Farm Undetermined Zones

Borehole Number	Survey Depth (feet)	Probe Type	Category	Zone Depth (feet)	Max GTP (ft x c/s)	Year Max GTP	Isotopes Present
10-00-07	150	4	Undetermined	0-8	300	1991	^{137}Cs
10-01-01	125	4	Undetermined	68-80	600	1975	^{137}Cs
10-01-03	80	4	Undetermined	0-14	300K	1975	^{137}Cs
10-01-28	45	4	Undetermined	10-45	160K	1984	^{137}Cs, ^{60}Co, ^{154}Eu
10-02-05	125	4	Undetermined	10-17	100	1979	^{137}Cs
10-02-08	125	4	Undetermined	70-80	100	1975	^{137}Cs
10-02-08	125	4	Undetermined	80-90	50	1989	^{60}Co
10-03-05	125	4	Undetermined	70-85	200	1975	^{137}Cs
10-03-07	125	4	Undetermined	50-75	4K	1975	^{137}Cs
10-03-07	125	4	Undetermined	75-88	200	1978	^{137}Cs
10-03-11	90	4	Undetermined	80-90	400	1976	^{137}Cs
10-05-02	125	4	Undetermined	60-80	15K	1975	^{106}Ru
10-05-02	125	4	Undetermined	90-108	4K	1978	^{106}Ru
10-06-10	125	4	Undetermined	100-110	200	1979	^{106}Ru
Laterals							
10-01-01L	150	1	Undetermined	20-30	500	1978	^{137}Cs
10-01-02L	160	1	Undetermined	20-30	500	1978	^{137}Cs
10-01-03L	150	1	Undetermined	20-30	500	1978	^{137}Cs
10-02-01L	175	1	Undetermined	20-30	500	1978	^{137}Cs

10-02-02L	180	1	Undetermined	20-30	500	1978	^{137}Cs
10-02-03L	175	1	Undetermined	20-30	500	1978	^{137}Cs
10-03-01L	175	1	Undetermined	20-30	500	1978	^{137}Cs
10-03-02L	180	1	Undetermined	20-30	500	1978	^{137}Cs
10-03-03L	175	1	Undetermined	20-30	500	1978	^{137}Cs
10-04-01L	178	1	Undetermined	20-30	500	1978	^{137}Cs
10-04-02L	190	1	Undetermined	20-30	500	1978	^{137}Cs
10-04-02L	190	1	Undetermined	140-170	1K	1978	^{106}Ru
10-04-03L	175	1	Undetermined	20-30	500	1978	^{137}Cs
10-04-03L	175	1	Undetermined	152-164	50	1978	^{106}Ru
10-05-03L	175	2	Undetermined	148-163	20K	1981	^{137}Cs
10-06-01L	155	1	Undetermined	20-30	500	1978	^{137}Cs
10-06-02L	165	1	Undetermined	20-30	500	1978	^{137}Cs
10-06-03L	155	1	Undetermined	20-30	500	1978	^{137}Cs

2.2.3 Stable

The subsurface condition of a zone with radioactive contamination is considered stable when:

- The decay rate of the isotope(s) identified with the SGLS matches the trend observed in the GTP of the gross gamma ray data, or
- Contaminants continue to decay at a rate consistent with the hypothesized isotope(s) half-life, and
- No noticeable change in concentration is apparent over the short time interval that data were collected.

Fourteen zones are classified as stable in A Tank Farm and these zones are listed in Table 5.

Table 5. A Tank Farm Stable Zones

Borehole Number	Survey Depth (feet)	Probe Type	Category	Zone Depth (feet)	Max GTP (ft x c/s)	Year Max GTP	Isotopes Present
10-00-06	150	4	Stable	12-25	200	1975	^{137}Cs
10-02-03	125	4	Stable	72-82	100	1980	^{137}Cs
10-03-01L	175	1	Stable	54-70	800	1978	^{137}Cs
10-03-02L	180	1	Stable	54-70	800	1978	^{137}Cs
10-03-03L	175	1	Stable	54-70	800	1978	^{137}Cs
10-04-01L	178	1	Stable	94-130	800	1977	^{106}Ru
10-04-02L	190	1	Stable	108-116	70	1977	^{106}Ru
10-04-02L	190	1	Stable	140-170	1500	1977	^{106}Ru
10-04-03L	175	1	Stable	152-164	100	1977	^{106}Ru
10-05-01L	175	2	Stable	150-170	400	1980	^{137}Cs
10-05-02L	185	2	Stable	85-110	7K	1977	^{137}Cs

10-05-02L	185	2	Stable	165-180	300	1977	^{137}Cs
10-05-03L	175	2	Stable	94-110	700	1980	^{137}Cs
10-06-01L	155	1	Stable	56-75	1000	1978	^{137}Cs
10-06-02L	165	1	Stable	56-75	1000	1978	^{137}Cs
10-06-03L	155	1	Stable	56-75	1000	1978	^{137}Cs

The term "Stable", as used in this analysis, is defined as the apparent match of the GTP values to the decay curve for the isotopes known or hypothesized to be present, and does not refer to the inherent condition of the contamination. The mobility of the radioactive contaminants in the subsurface soils before or after the gross gamma ray and SGLS data collection period is undetermined. If a new driver were introduced (e.g., the influx of a large volume of liquid), contaminants could be remobilized. Similarly, a change in geochemical conditions in the soil could also affect mobility. Given the current gross gamma and SGLS data, it cannot be determined if remobilization will or will not occur.

2.2.4 Unstable

The subsurface condition of a zone with radioactive contamination is considered unstable when, at some point within the time interval of data collection, contamination was not decreasing at the decay rate of the isotope(s) identified with SGLS. In this case, the decay curve does not match the trend observed in the GTP of the identified or hypothesized isotope. In the A Tank Farm, seven zones are identified which exhibited instability within the time period that gross gamma ray data were collected. In five of these zones, instability occurs during the earlier years of data collection for certain depth intervals; however, in later years, the GTP follows the decay curve of the known or hypothesized isotopes. A listing of "unstable early" and unstable zones is presented in Table 6.

Table 6. A Tank Farm Unstable Early and Unstable Zones

Borehole Number	Survey Depth (feet)	Probe Type	Category	Zone Depth (feet)	Max GTP (ft x c/s)	Year Max GTP	Isotopes Present
10-01-04	125	4	Unstable-Early	33-48	6K	1984	^{60}Co
10-01-04	125	4	Unstable-Early	48-62	1100	1986	^{60}Co
10-01-16	55	4	Unstable-Early	16-54	50K	1984	^{60}Co
10-05-10	125	4	Unstable-Early	22-60	2K	1979	^{137}Cs
10-05-10	125	4	Unstable-Early	73-90	500	1975	^{137}Cs
10-01-04	125	4	Unstable	62-70	400	1987	^{60}Co
10-06-04	125	4	Unstable	12-24	600	1975	^{60}Co

3 Details of Contaminated Conditions

Characteristics of the contaminated zones are summarized in the following discussions.

3.1 Stable Zones

The fixed decay rate of the isotope(s) present is used to calculate the decay curves (Figure 3). Table 7 lists the half-life of the isotopes encountered in the A Tank Farm.

ANALYSIS AND SUMMARY REPORT OF HISTORICAL DRY WELL GAMMA LOGS FOR THE 241-AX TANK FARM – 200 EAST FROM PRICE 2001

Cesium-137 was identified in 18 zones, most often as the sole isotope in a zone, although it is found with other gamma-emitting isotopes in six zones.

Antimony-125, Cobalt-60, and europium-154 were identified by the HPGe survey in six total zones, always with other isotopes (generally cesium-137).

Ruthenium-106 is hypothesized as the sole isotope in nine zones and is present with cobalt-60 in one zone.

The isotopes identified in AX Tank Farm with the HPGe detector exist primarily under three categories of subsurface conditions: tank farm activity, unstable early, and stable. Nine unstable early conditions, two stable, and seventeen tank farm activity zones are present in AX Tank Farm. Dry well locations (centered on the borehole name) and the conditions of subsurface zones are shown in Figure 2. A single symbol for a dry well may indicate multiple zones of the same designation.

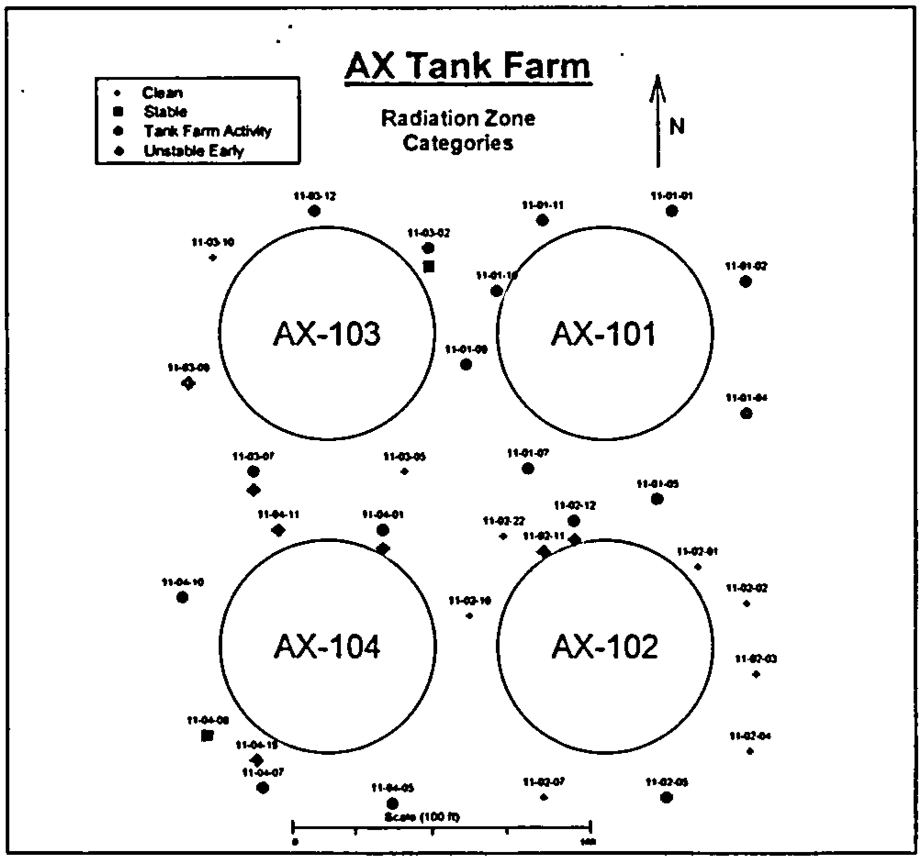


Figure 2. AX Tank Farm Radiation Zone Categories

2.2.1 Tank Farm Activity

A sudden, significant change in the intensity of gross gamma rays between successive gross gamma surveys at or near the ground surface suggests that contamination may have resulted from tank farm activities or logging procedure changes. Radioactive contamination occurs at the surface in seventeen wells, apparently as the result of tank farm activities (i.e., logging procedure changes, transfer line operations, valve box and conduit leaks, surface spills, etc.). These wells are listed in Table 3.

Table 3. AX Tank Farm Activity Zones

Borehole Number	Survey Depth (feet)	Probe Type	Category	Zone Top (feet)	Zone Base (feet)	Max GTP (ft x c/s)	Year Max	Isotopes Present
11-01-01	100'	4	TF Activity	0	22	400	1975	^{137}Cs
11-01-02	100'	4	TF Activity	0	10	300	1984	^{137}Cs
11-01-04	100'	4	TF Activity	0	12	200	1975	^{137}Cs
11-01-05	100'	4	TF Activity	0	18	500	1984	^{137}Cs
11-01-07	100'	4	TF Activity	0	12	4K	1975	^{137}Cs, ^{154}Eu
11-01-09	103'	4	TF Activity	0	14	400	1983	^{137}Cs
11-01-10	75'	4	TF Activity	0	20	350K	1985	^{137}Cs, ^{154}Eu
11-01-11	100'	4	TF Activity	0	8	400	1984	^{137}Cs
11-02-05	100'	4	TF Activity	0	8	300	1975	^{137}Cs
11-02-12	50'	4	TF Activity	0	27	200K	1975	^{137}Cs
11-03-02	100'	4	TF Activity	0	29	140K	1975	^{137}Cs
11-03-07	104'	4	TF Activity	0	14	75K	1975	^{137}Cs, ^{154}Eu
11-03-12	100'	4	TF Activity	0	20	5K	1975	^{137}Cs, ^{125}Sb
11-04-01	100'	4	TF Activity	0	12	200	1985	^{137}Cs
11-04-05	100'	4	TF Activity	0	10	400	1975	^{137}Cs
11-04-07	96'	4	TF Activity	0	8	400	1976	^{137}Cs
11-04-10	102'	4	TF Activity	0	15	35K	1985	^{137}Cs

2.2.2 Undetermined

Infrequently, stability cannot be determined due to gross gamma energy levels exceeding the system design criteria (both upper and lower limits), insufficient data, possible effects of depth shift, and surface activities. No zones in the AX Tank Farm are categorized as undetermined.

2.2.3 Stable

The subsurface condition of a zone with radioactive contamination is considered stable when:

- The decay rate of the isotope(s) identified with HPGe survey matches the trend observed in the GTP of the gross gamma ray data,

- Contaminants continue to decay at a rate consistent with the hypothesized isotope(s) half-life, and
- No noticeable change in concentration is apparent over the short time interval that data were collected.

Two zones are considered stable in AX Tank Farm and are listed in Table 5.

Table 4. AX Tank Farm Stable Zones

Borehole Number	Survey Depth (feet)	[a]Probe Type	[b]Category	Zone Top (feet)	Zone Base (feet)	Max GTP (ft x c/s)	Year Max	[c]Isotopes Present
11-03-02	100'	4	Stable	29	40	2K	1975	^{137}Cs, ^{125}Sb
11-04-08	100'	4	Stable	60	72	500	1980	^{106}Ru

The term "Stable", as used in this analysis, is defined as the apparent match of the GTP values to the decay curve for the isotopes known or hypothesized to be present, and does not refer to the inherent condition of the contamination. The mobility of the radioactive contaminants in the subsurface soils before or after the gross gamma ray and HPGe data collection period is undetermined. If a new driver were introduced (e.g., the influx of a large volume of liquid), contaminants could be remobilized. Similarly, a change in geochemical conditions in the soil could also affect mobility. Given the current gross gamma and HPGe data, it cannot be determined if remobilization will or will not occur.

2.2.4 Unstable

The subsurface condition of a zone with radioactive contamination is considered unstable when, at some point within the time interval of data collection, contamination was not decreasing at the decay rate of the isotope(s) identified with HPGe detector. In this case, the decay curve does not match the trend observed in the GTP of the identified or hypothesized isotope. In the AX Tank Farm, nine zones are identified which exhibited instability within the time period that gross gamma ray data were collected. In each of these nine zones the instability occurred during the earlier years of data collection for certain depth intervals; however, in later years, the GTP follows the decay curve of the known or hypothesized isotopes. A listing of the nine unstable early zones is presented in Table 6.

The rate of decrease in the GTP for four of the unstable early zones is faster than the hypothesized isotope (^{106}Ru) which may indicate that either the isotope selection may need to be revised, or that the contaminant migration rate could be high, or both (boreholes: 11-03-07; 14-40 ft, 11-03-09, 11-04-01, and 11-04-11; 18-33 ft).

Table 5. AX Tank Farm Unstable Early Zones

Borehole Number	Survey Depth (feet)	[a]Probe Type	[b]Category	Zone Top (feet)	Zone Base (feet)	Max GTP (ft x c/s)	Year Max	[c]Isotopes Present
11-02-11	100'	4	Unstable Early	50	65	700	1980	^{106}Ru
11-02-12	50'	14	Unstable Early	32	50	20K	1975	^{106}Ru, ^{60}Co

11-03-07	104'	4	Unstable Early	14	40	5K	1976	^{106}Ru
11-03-07	104'	4	Unstable Early	66	82	400	1976	^{106}Ru
11-03-09	120'	4	Unstable Early	48	106	14K	1975	^{106}Ru
11-04-01	100'	4	Unstable Early	14	68	50K	1975	^{106}Ru
11-04-11	125'	4	Unstable Early	18	82	11K	1975	^{106}Ru
11-04-11	125'	4	Unstable Early	90	102	300	1977	^{106}Ru
11-04-19	125'	4	Unstable Early	56	78	200	1978	^{106}Ru

3 Details of Contaminated Conditions

Characteristics of the contaminated zones are summarized in the following discussions.

3.1 Stable Zones

The fixed decay rate of the isotope(s) present is used to calculate the decay curves (Figure 3). Table 6 lists the half-life of the isotopes encountered in the AX Tank Farm.

When a contaminated interval contains multiple isotopes, the intensity of the slowest decay component is plotted to match the data over the most recent time period for which data exist. Faster decay isotopes are then clearly indicated as necessary to match the trend of the GTP values. When the decay curve fits the GTP plot, a stable condition is said to exist. When the decay curve does not fit any portion of the GTP plot, stability cannot be established. The factors responsible for instability are beyond the scope of this report.

Several zones within a number of wells in the AX Tank Farm exhibit gross gamma ray activity above natural background. Some of these radioactive intervals are observed to be stable as verified by the change in GTP over time which coincides with the decay rate of the isotope(s) identified or hypothesized to have been present in the soil surrounding the dry well during the time interval data were collected. The isotopes present in these zones vary and are presented above in Table 3 through Table 5. In general, they occur as follows:

- Cs-137 is present in all of the tank farm activity zones, in half (one) of the stable zones and in none of the unstable early zones.
- Ru-106 is hypothesized as present in half (one) of the stable zones and all of the unstable early zones. In several unstable early zones the rate of decline in the GTP is greater than the decay rate of Ru-106, which may indicate a contaminant with high mobility.
- Co-60 occurs in one zone (unstable early) and in combination with other isotopes.
- Eu-154 occurs in three tank farm activity zones, each time with Cs-137.
- Sb-125 occurs in two zones, one tank farm activity and one stable zone. Each time Sb-125 occurs with Cs-137.

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APPENDIX F

ADDITIONAL CHARACTERIZATION DATA OF UNPLANNED RELEASES UPR-200-E-82 AND UPR-200-E-86

CONTENTS

F.1.0 INTRODUCTION

Appendix F provides summary documentation from field investigations of transfer line leaks that occurred in the western part of the C WMA and released derivatives of PUREX high activity waste near surface (Maxfield 1979). The leaks occurred in 1969 (UPR-200-E-82) and 1971 (UPR-200-E-86). In these investigations, several shallow auger holes were drilled around the leak sources and soil samples collected and analyzed for Cs-137 content. From these data approximate three-dimensional mappings of the nature and extent of the leaks were determined, at least for the chemically reactive constituents in the waste.

F.2.0 UPR-200-E-82 FIELD CHARACTERIZATION DATA

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B PLANT ION EXCHANGE FEED LINE LEAK

INTRODUCTION

One of the objectives of the Waste Management Program is to separate the long-lived heat emitter ^{137}Cs from the bulk of the high-level liquid wastes. This separation is accomplished by the ion exchange process in the 221-B Building. Interim storage of the cesium is in solution as a nitrate. The cesium will later be converted to a solid salt as cesium chloride and encapsulated for permanent storage.

The feed for the B Plant cesium ion exchange process is pumped from the lag storage tank, 105-C, through a pipeline and several diversion boxes to the 221-B Building. On December 19, 1969, a leak was discovered near the 241-C-152 diversion box in the section of this line, V-122, from the 105-C tank.

Although the leak represented a loss of feed for the processing of ^{137}Cs, more important, however, was the consequence of environmental contamination to the soil from the line leak. For this reason, an investigation was made to establish the extent of the radioactivity spread. This report summarizes the results of a well drilling operation undertaken to define the boundary and to estimate the extent of the leak.

SUMMARY

Ten wells were drilled at radial distances from 4 to 16 feet from the leak source and to depths of 30 feet, whenever possible. Analytical results of ^{137}Cs, the major constituent of the waste solution, were used as the basis for determining the configuration and content of the leak volume. Three general concentration zones of 550, 100, and 10 μCi ^{137}Cs/gram of soil were plotted from the analytical data. The highest concentration zone, 550 μCi ^{137}Cs/gm of soil, corresponds to soil saturated with waste solution that contains 4.0 Ci ^{137}Cs/gal. Within an error 10 percent, this saturated region is verified by the ion exchange feed concentration of 4.34 Ci ^{137}Cs/gal.

The volume of waste solution that leaked to the soil was estimated at 2600 gallons. This volume, which included an approximate 100 gallons that surfaced and collected near a

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fence line, contained 11,300 Ci ^{137}Cs, 260 Ci ^{144}Ce, 260 Ci $^{95}ZrNb$, 130 Ci ^{106}Ru, and 100 Ci ^{134}Cs. About 705 cubic feet of soil was contaminated with ^{137}Cs. The ^{144}Ce and $^{95}ZrNb$ content of the soil is located in about 40 cubic feet of soil surrounding the leak source. The analytical results indicate that ^{106}Ru has a greater radial migration and deeper penetration than ^{137}Cs. Ruthenium-106 appears to have collected in a spheroidal band from 4 to 8 feet beyond the ^{137}Cs boundary.

No heat problems are expected to result from an estimated maximum temperature increase of 30 °F in the soil near the source of the leak. Also, the radioactivity from the leak will not reach the ground water because of the ion exchange properties of the soil, the depth of the water table level and the light regional rainfall.

LEAK DESCRIPTION

The ion exchange feed line, V-122, was buried about 11 feet below grade level. This line was installed in July 1964, and hydrostatic pressure tested to 200 psig for 30 minutes. It was placed into service in December 1967.

The leak was visually detected by Radiation Monitoring personnel who were passing in the vicinity of the 241-C-152 diversion box. The waste stream flowed through a surface area of about one square foot, northeastward, down a slightly declining grade, and pooled along the side of a small dike outside the tank farm fence line. The pool was estimated to be 5 feet square. Pumping from the 105-C tank to B Plant was immediately halted. Two to three feet of gravel and soil were spread over the leak area to absorb, cover, and shield the surface contamination.

The leak surfaced through an area directly above the location of the joint that connects a 3-inch stainless steel pipe to a 3-inch carbon steel pipe(1). Between the flanges of these pipes is a 3/16-inch linear polyethylene gasket which is speculated to have ruptured. No attempt was made to determine the exact cause of the leak, since the high radioactivity in the vicinity of the leak prohibited the excavation and direct examination of the pipeline.

EVALUATION METHOD

Pacific Northwest Laboratory's Earth Sciences Department personnel drilled 10 wells and obtained all soil samples. These samples were analyzed by the Redox Analytical Laboratory. An excavation permit was issued describing the location of the initial wells, precautions to be taken while drilling, instructions for RM coverage, timekeeping, survey of leak vicinity, and staking of the well locations.

The suspected leak source, the flange near a 36° bend in the pipeline, was used as a base point. From this base point, four initial wells were surveyed and staked to surround the area of the leak. Thereafter, wells were drilled at varied radii closer to the source to obtain data for iso-concentration lines at various depths. The location of these subsequent wells was based upon the position of other existing pipelines(2), the degree of contamination in preceding wells, and an effort to secure sufficient data to evaluate the leak. The number of wells was kept at a minimum to minimize the radiation exposure to the drillers. Well locations are shown in Figure 1.

The drilling rig used a 350-pound cylindrical hammer to drive the sectioned 2-1/4-inch OD steel pipe into the ground. Attached to the end of the steel pipe was a Shelby[R] sampler, a 24-inch long, split-barrel, stainless steel section with a tapered tip. With this sampler, 1-3/4-inch core samples were obtained. During drilling, the split-barrel sampler was withdrawn from the well at two-foot intervals, disassembled, and its contents examined. The exposed soil was then surveyed with a CP. If any contamination was detected, a field reading was recorded and samples were taken. For significantly high levels of radiation, greater than 50 mR/hr, samples were taken at smaller interval depths.

A variety of soil textures was encountered during drilling, as shown in Figures 2 and 3. The soil layers ranged from sandy clay to kaliche, an almost impenetrable rock-like layer. The very non-porous kaliche layer, nearly 6 inches thick, lay at a depth between 13 to 14 feet, sloping slightly eastward. Except for a few isolated areas, the results from the analytical data indicate that this layer had obstructed the movement of ^{137}Cs to lower depths. Most of the radioactive material was adsorbed more readily onto the sandy clay type of soil, rather than the coarser soils.

[R] Trade name

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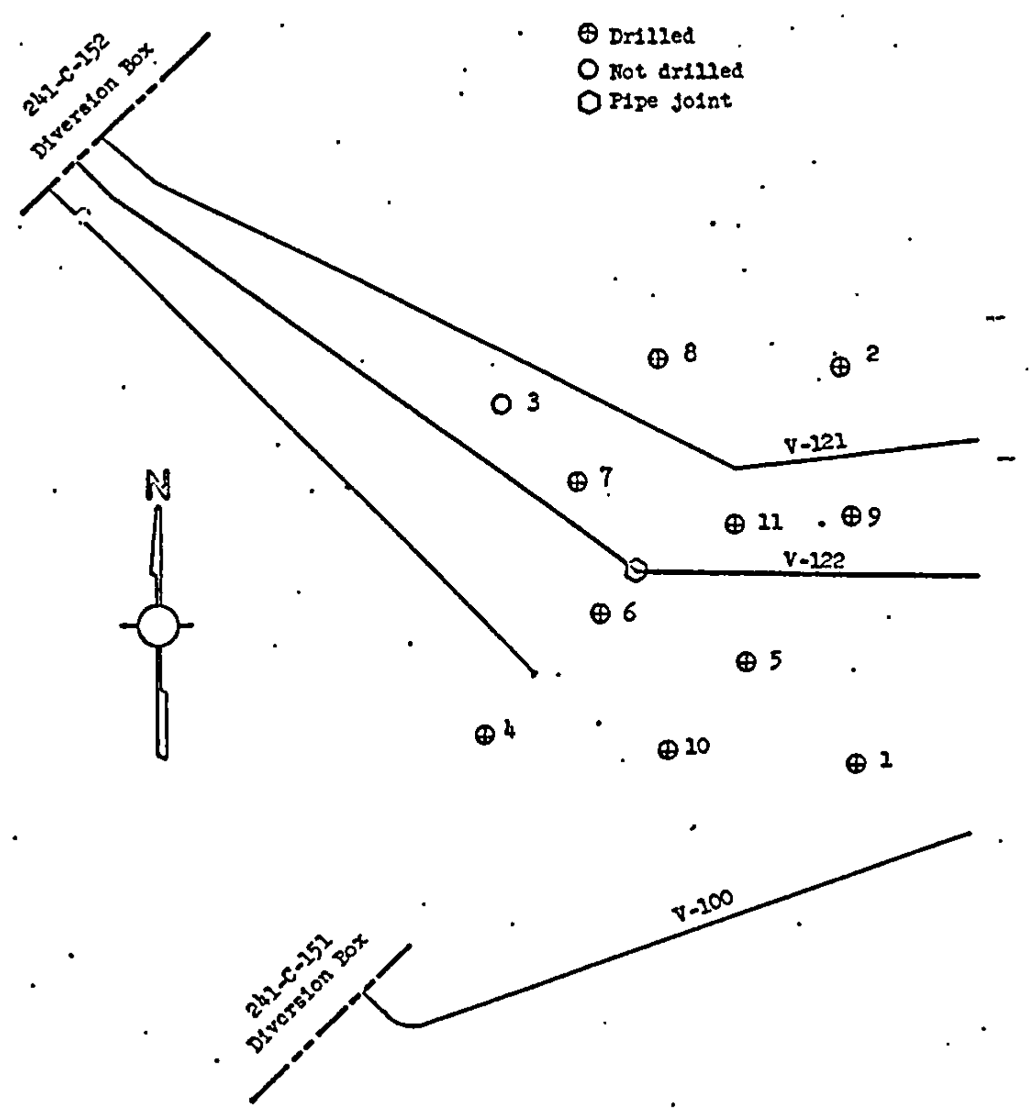
FIGURE 1 - SKETCH OF WELL LOCATIONS



Samples were placed in pint-size glass jars. As the drilling operations progressed, aluminum cans were found to be more suitable sample containers to eliminate the breakage hazard of glass jars. Also, the aluminum cans could be accommodated within a 75-pound lead-shielded "pig". Highly radioactive samples, i.e., greater than 5 rad/hr., were handled in a special waste container designed to minimize surface contamination and exposure to the drillers prior to transfer into sample containers.

An attempt was made to obtain uniform sample volumes to aid in the laboratory analyses. The soil samples were analyzed by the quantitative gamma spectrum analyses and the results reported on a weight basis, μCi/gm of soil. From these results, the vertical depth profiles were plotted. Concentration profiles for Wells 5 and 11 are shown in Figures 4 and 5. From these profiles, horizontal iso-concentration zones were mapped as shown in Figure 6. The slope of the soil layers and the incline of the pipeline places the center of the iso-concentration contours about two feet east of the base point.

The theoretical shape of the leak in the soil is a sphere for low leak rates of 3 to 10 gpm or teardrop-shaped for higher flow rate leaks of 10 to 20 gpm or greater. The actual shape of the contaminated region based upon the drilling data looks somewhat like that depicted in Figure 7. The kaliche layer and a high leak rate probably caused the leak to move laterally and upward, rather than uniformly outward from the leak source. The concentration contours were considered as circular-shaped in the horizontal plane for calculation purposes. The shape of the iso-concentration lines in the vertical plane is elliptical. The volumes in the lateral directions are calculated as the volumes of an oblate spheroid. The volumes in the vertical direction are one-half the volumes of a prolate spheroid. The major axis is along the center line from the base point to the point where the leak surfaced. See Figure 8.

The average ^{137}Cs concentration of the region surrounding the leak source was 550 μCi ^{137}Cs/gm of soil or 4.0 Ci ^{137}Cs/gal of solution, assuming the soil has a 35 percent void fraction with a volumetric ^{137}Cs distribution coefficient of 0.6 (Ci/ft^3 soil)/(ci/ft^3 sol'n)(3) and an average bulk density of 1.8 gm/cc. This value is within 10 percent of the ion exchange feed concentration of 4.34 Ci ^{137}Cs/gal of solution and verifies that this region around the leak source is saturated.

FIGURE 4 - CONCENTRATION PROFILE OF WELL #5

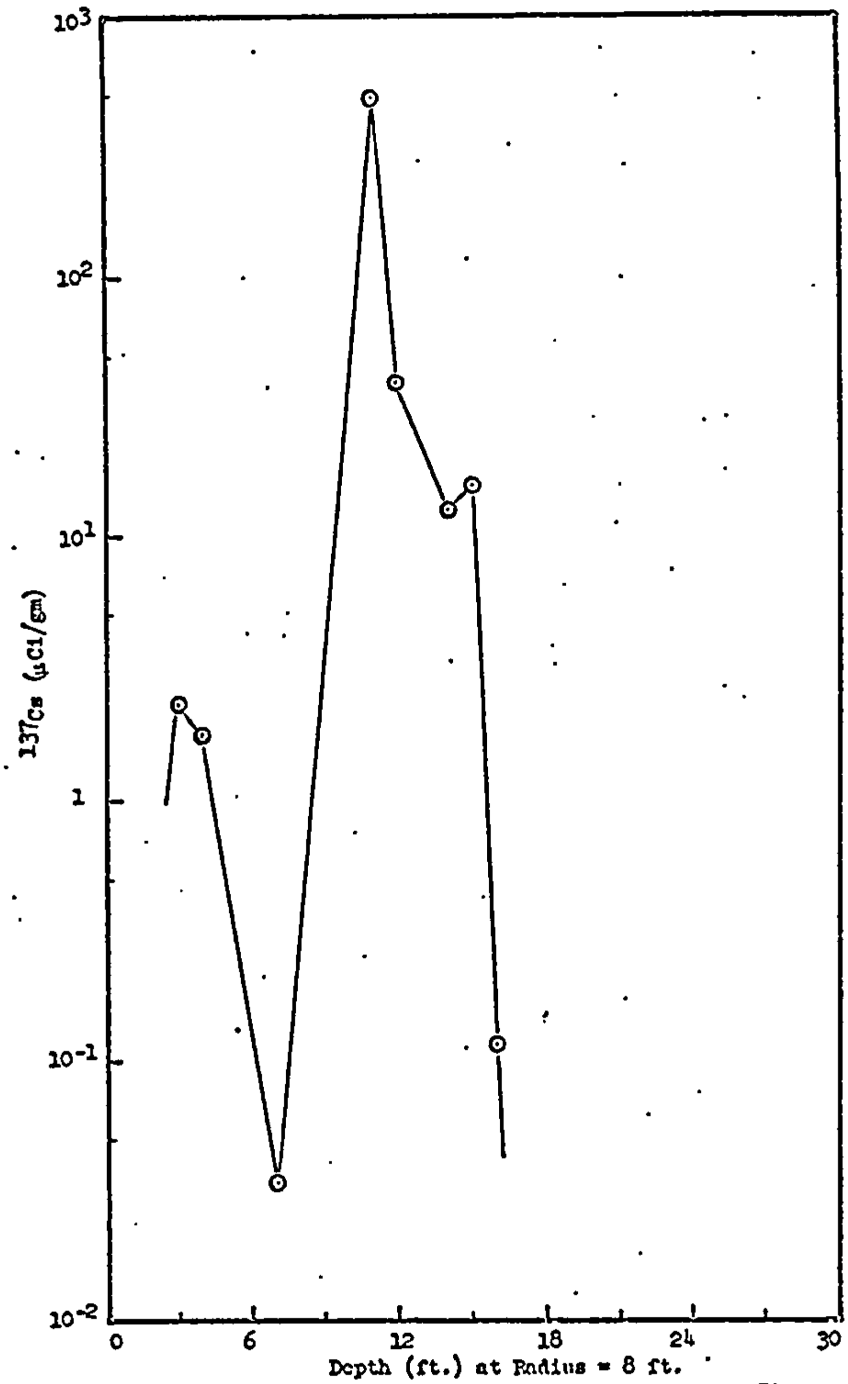


FIGURE 5 - CONCENTRATION PROFILE OF WELL #11

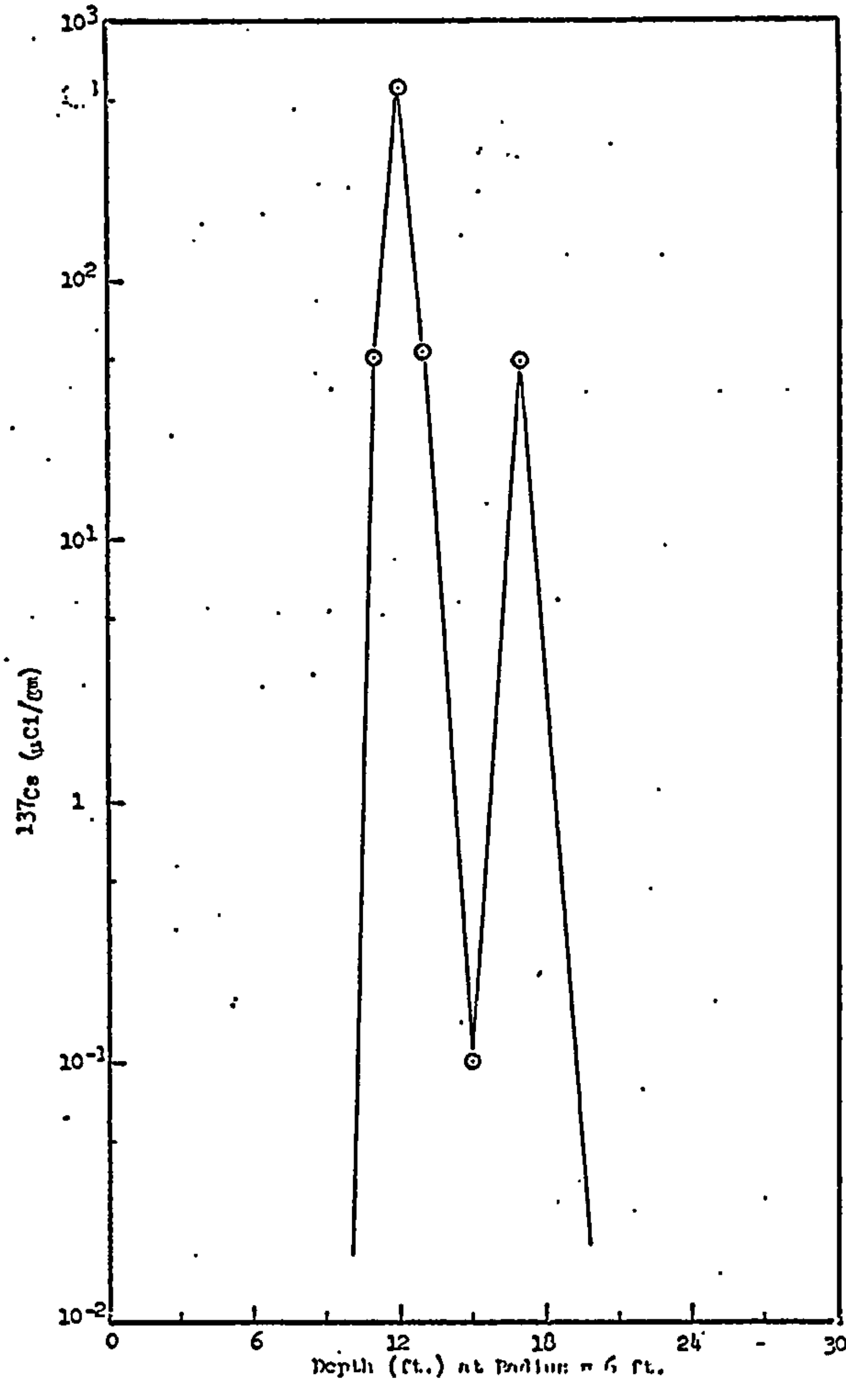


FIGURE 6 - ISO-CONCENTRATION CONTOURS

(μCi ^{137}Cs/gm soil) at a Depth of 11 feet
Relative to Test Wells and Pipe Line

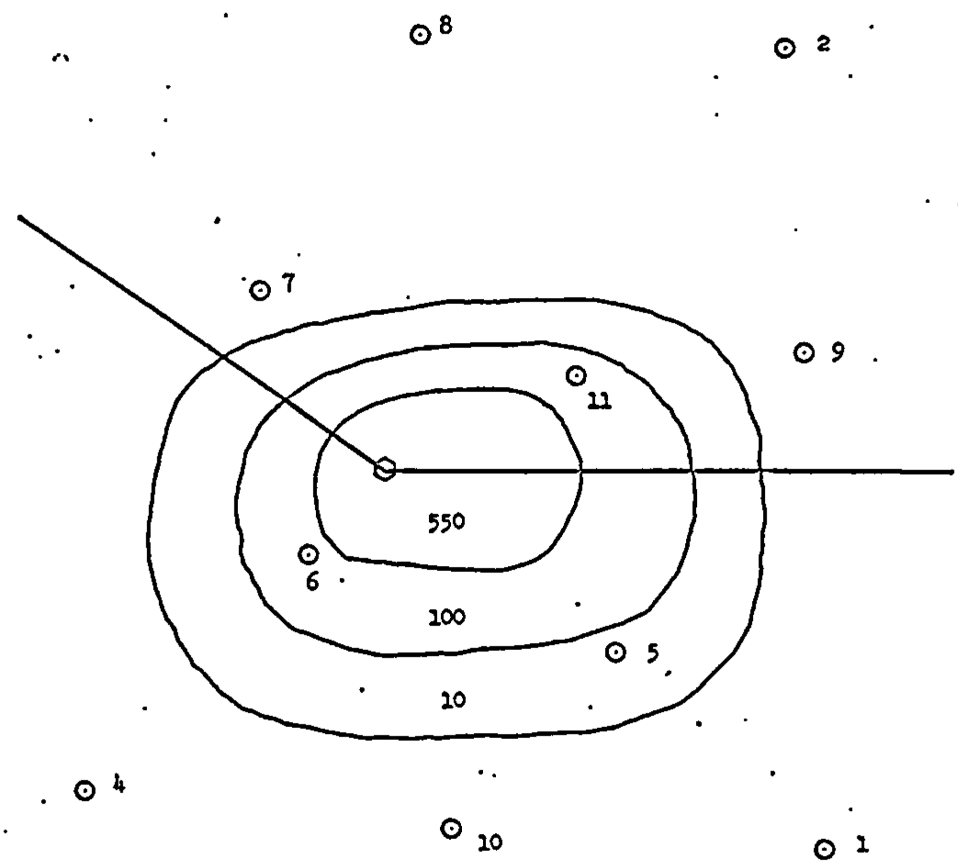


FIGURE 7 -- ACTUAL LEAK CONFIGURATION

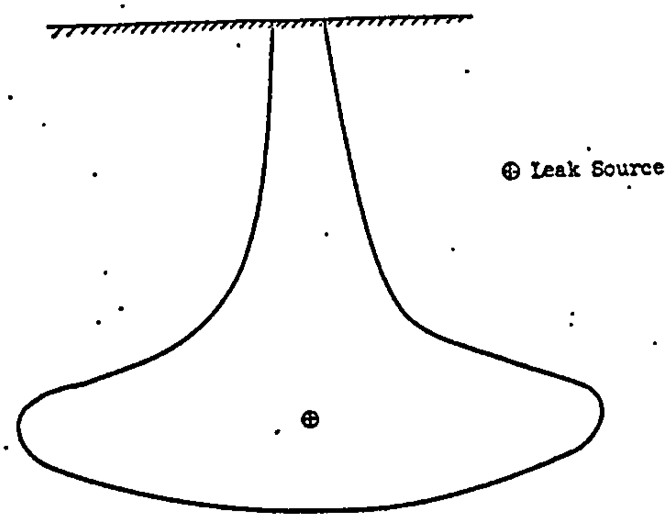
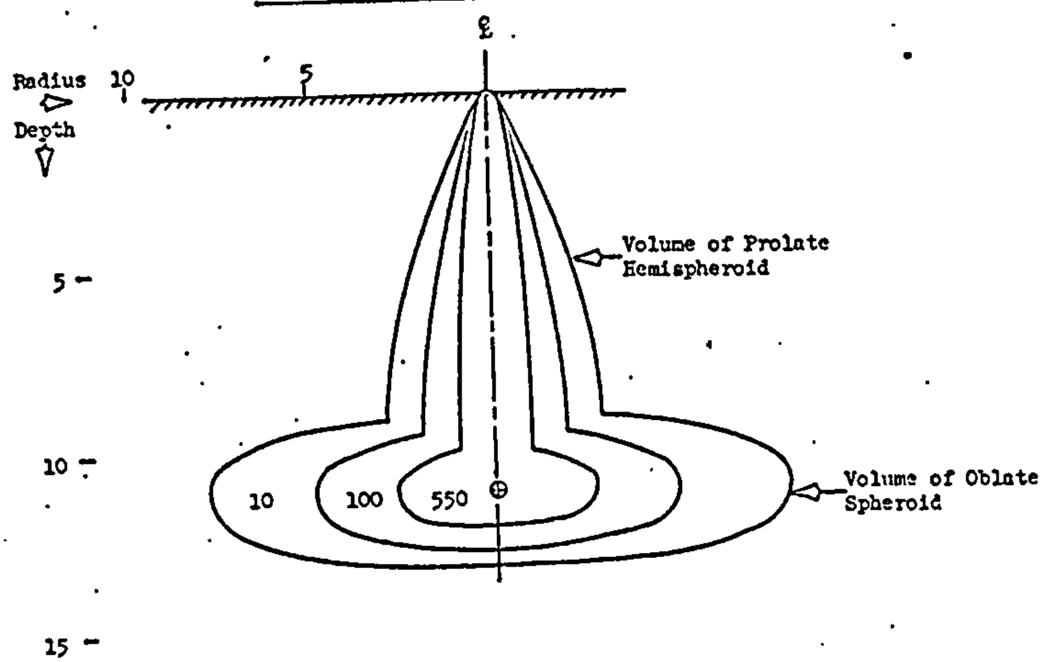


FIGURE 8 - CALCULATIONAL LEAK CONFIGURATION



The ^{137}Cs curie content of each of the iso-concentration regions was calculated from the product of the volume multiplied by the concentration. The total calculated volume of soil contaminated with ^{137}Cs was 705 cubic feet. The total curies of ^{137}Cs that leaked, the sum of each region and the quantity that surfaced, divided by the ion exchange feed solution concentration equals the number of gallons of feed lost through the leak. A leak loss of 2600 gallons and 11,300 curies of ^{137}Cs was calculated. Other radionuclide losses are listed in Table 1, together with the ion exchange feed composition.

TABLE 1

PSN-IX FEED COMPOSITION AND RADIONUCLIDES LEAKED TO THE SOIL

Radionuclide	Feed Composition μCi/gal	Activity Leaked to Soil, Ci
^{137}Cs	4.34	11,300
^{144}Ce	0.10	260
$^{106}RuRh$	0.05	130
$^{95}ZrNb$	0.10	260
^{134}Cs	0.04	130

Drilling in Well No. 6 was terminated when a sample reading of 110 rad/hr was encountered at a depth of 11 feet. Facilities for handling such a hot sample were not available at that time so the soil was knocked out of the sampler and left in the well. The 110 rad/hr soil undoubtedly contained, in addition to ^{137}Cs, ^{144}Ce and $^{95}ZrNb$ from the feed, since the radiation reading of 30 rad/hr was measured from a sample saturated with only ^{137}Cs. These radionuclides, whose volumetric distribution coefficient, K_D, is greater than 500, were sorbed or precipitated onto an estimated 40 cubic feet of soil around the leak source.

Analytical results indicate that a broader and deeper migration of ^{106}Ru than ^{137}Cs into a spheroidal band between 4 and 8 feet beyond the ^{137}Cs boundary. The short-lived ^{106}Ru (one year half-life) presents less of a potential hazard than ^{137}Cs (30-year half-life).

A complete thermal analysis of the pipeline leak was not made. Only a maximum temperature increase in the saturated region near the leak source was estimated. From a previous study[5], a computer program generated data for estimating the temperature increase in the soil of a leak from a waste tank containing the similar type of waste solution that was used for the ion exchange feed. Based on a calculated volumetric heat generation rate of 0.60 Btu/hr/ft^3 for the feed solution and the previously mentioned soil characteristics, a 30 °F maximum temperature increase in the soil was estimated.

Due to the ion exchange properties of the soil, the depth of the water table level, and the light regional rainfall, it is concluded that the radioactive contamination from the leak will not reach the ground water. The water table level in the vicinity of the leak is located more than 200 feet below the ground level. The average annual rainfall in this region is less than 6 inches and would require a flooding storm of disastrous proportions to force the migration of radioactivity to such depths through the soil. In addition, the ion exchange properties of the Hanford soil will sorb the radioactive contaminants before they could reach the ground water.

REFERENCES

1. H-2-32484, Cesium Transfer Line No. V-122 - 241-CR-05A to 241-C-152

2. H-2-35450, Line V-106 and Replacement Line V-122 - Details

3. G. Jansen, Jr., W. E. Willingham, and W. V. DeMier, Buried Radioactive Waste Storage Tank Temperatures and Soil Temperatures Near Leaks, BNWL-181, March 1966

4. J. R. Raymond and E. G. Shdo, Characterization of Subsurface Contamination in the SX Tank Farm, BNWL-CC-701, June 14, 1966

5. Op. cit., G. Jansen, Jr.

F.3.0 UPR-200-E-86 FIELD CHARACTERIZATION DATA

RHO-CD-673
I. NE

CONTAMINATED LIQUID DISPOSAL SITES

Name/Type of Facility	Fast Designation	Number
Unplanned Release	241-C-Tank Farm Line Leak, SW Corner	UN-216-E-14

Location	Service Dates	Status
200 East, N.E. Quadrant Near SW corner of 241-C Tank Farm	2/25/71	—

Site Coordinates (Approximate)	Reference Drawings	Elevations
N-42725, W-48745	H-2-44500 Sheet 7	Ground 680 ft Water Table 402 ft(1973) Site Depth 8 ft

Source and Description of Waste

Waste from process transfer line.

Description of Facility

A leak in the process transfer line No. 812 from AR Vault to 241-C Tank Farm near the SW corner of the 241-C Tank Farm. Contaminated soil volume estimated at 1300 ft^3. Test wells indicated penetration of waste to a depth of 20 ft.

Radionuclide Content (calculated from discharge data)

Radionuclide	At Time of Discharge	As of 12/31/73
^{137}Cs, Ci	~23,000	~21,000

History:

Process transfer line #812 from AR Vault to 241-C Tank Farm was found leaking near southwest corner of that farm. At that location, the line is eight-feet deep. Contaminated soil zone was estimated at 1,300 cubic feet. Test wells driven into the ground indicated the contamination did not extend below a depth of 20 feet.

(See Attachment)

NOV 28 1972

UN-216-E-14

2/25/71

Date: November 9, 1972

To: G. L. Borshiem

From: W. P. Metz

Subject: PSS LINE LEAK (LINE No. 812)

Reference:
(1) Letter, June 2, 1971, J. R. Irish to R. C. Tabasinske, "Line No. 812 Leak Investigation"

(2) Letter, June 22, 1971, J. R. Irish, G. C. Oberg to P. F. Pritchard, "PSS' Leak-Well Stake Out"

(3) Letter, August 19, 1971, W. P. Metz, G. L. Borsheim to R. C. Tabasinske, "Line No. 812 Leak Investigation

(4) B. W. Anderson, Monthly Report, February 1971.

INTRODUCTION

During routine line monitoring near C-Farm, in March 1971 a radiation zone was detected in the vicinity of line No. 812, the line used to transport PSS from AR Vault to C-Farm. An investigation was initiated to determine the extent of the fission product loss (references 1,2, and 3).

SUMMARY

The investigation concluded that about 25,000 curies of ^{137}Cs were lost via the leak. Eight wells were drilled in the leak area and the apparent boundaries of the contaminated soil were established. The ground surface in the leak vicinity should be stabilized to prevent contamination spread.

[illegible]
Page 2
November 9, 1972

DISCUSSION

Evaluation of the AR Vault process data indicated that at or around February 25, 1971, 17,385 gallons of PSS (Containing about 1.35 Ci/gal of ^{137}Cs had been lost (reference 4). Routine line radiation monitoring indicated that a leak had occurred in line No. 812 near C-Farm. To assist in the investigation PNL was contacted to drill eight dry wells in the vicinity of the leak.

Figure I is a sketch of the leak vicinity in the vertical and horizontal view and shows the line, the eight wells, and the estimated extent of the contaminated soil. The contaminated soil zone is estimated to contain about 1300 $feet^3$. The contamination did not extend below a depth of 20 feet in any of the test wells.

Line 812 is a 2 inch direct buried line which is about 8 feet below grade. The line has a carbon steel to stainless steel joint near the bend as indicated. Well Nos. 1,2,3,6 and 7 were found to be uncontaminated to a depth of 15 to 20 feet. Well Nos. 4,5, and 8 were found to have soil contaminated up to 334 uCi of ^{137}Cs per gram. Wells 5 and 8 were drilled to a depth of 16 to 19 feet where uncontaminated soil was found. Drilling in well No. 4 was terminated at a depth of 6 feet due to radiation exposure. Table I lists various soil sample analyses at the depths of sampling for wells 5 and 8, and lists soil exposure rates for well 4.

The line has been abandoned. The wells should be closed. The ground surface should be sterilized to prevent plant growth and stabilized to prevent wind erosion.

WPM:bri

Att:

cc: RB Guenther
J Dunn
DJ Larkin
WP Metz
LW Roddy
File 1124-A
LB

54-6000-031 (10-68)

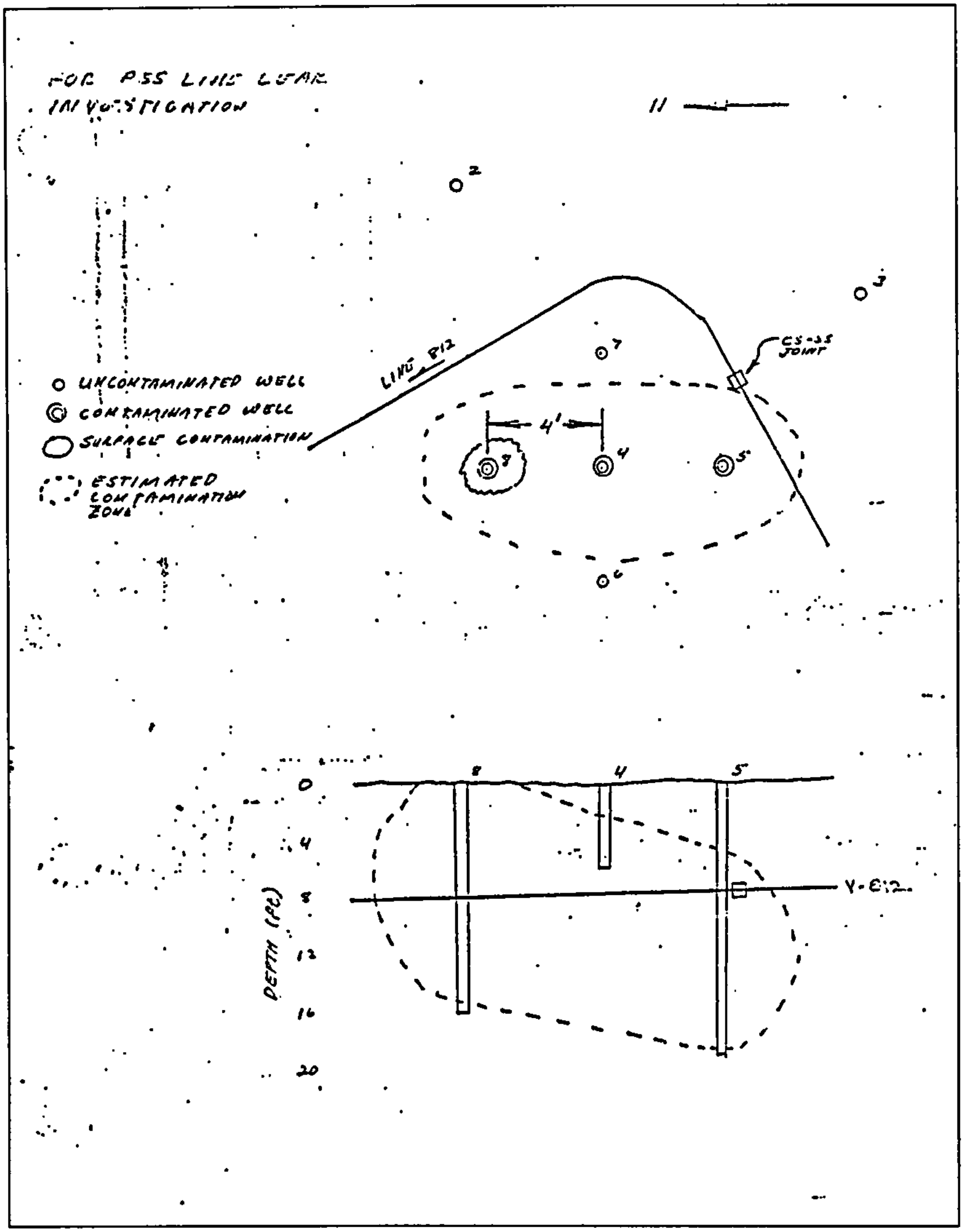

FOR P55 LINE LEAK
INVESTIGATION
N
LINE 812
CS-SS JOINT
UNCONTAMINATED WELL
CONTAMINATED WELL
SURFACE CONTAMINATION
ESTIMATED CONTAMINATION ZONE
4'
DEPTH (ft)
0
4
8
12
16
20
V-812

TABLE I

WELL LOGS FOR CONTAMINATED WELLS

Well No.

	4	5	8
Depth (Ft)	Exposure	uCi ^{137}Cs/gram	uCi ^{137}Cs/gram
0			
1	1000 cpm		
2			334.
3	5R		
4			
5		0.065	
6	5R at 2"		0.104
7			
8			50.7
9			
10			
11			
12		3.48	.295
13			
14		0.268	0.064
15			
16		0.272	Clean
17			
18		0.291	
19		Clean	

F.4.0 REFERENCE

Maxfield, H.L., 1979, *Handbook 200 Areas Waste Sites*, RHO-CD-673, Rockwell Hanford Operations, Richland, Washington.