Tables

Table 4-1
Minimum Number of Sample Points per Survey Subunit
Extended Scoping Survey of Structures
Former Kaiser Aluminum Specialty Products Facility
Tulsa, Oklahoma

Survey Subunit Number	Survey Subunit Description	Floor Area (m^2)	Fraction of Area	Sample Points per Subunit (N)[1]	L[2] (m)
1	North Extrusion Building, First Floor of Original Structure	605	0.088	18	6.2
2	North Extrusion Building, Loft Area	160	0.022	4	6.2
3	North Extrusion Building, Basement Level of Addition	945	0.140	28	6.2
4	North Extrusion Building, First Floor of Addition	1,325	0.197	39	6.2
5	Maintenance Building, Main Structure	760	0.113	23	6.2
6	Maintenance Building, Scale House Addition	35	0.005	1	6.2
7	Office Building, First Floor	310	0.046	9	6.2
8	Office Building, Second Floor	310	0.046	9	6.2
9	Warehouse Building, Western Section	695	0.099	20	6.2
10	Warehouse Building, Central Section	405	0.060	12	6.2
11	Warehouse Building, Eastern Section	215	0.032	6	6.2
12	Crusher Building	500	0.074	15	6.2
13	Crusher Addition Building	540	0.078	16	6.2
	Total Class 3 Survey Unit Area:	*6,805*		*200*	

Notes:
[1]N represents the minimum number of sample points required per survey subunit. The calculated minimum number of sample points for the survey unit was 200.
[2]L represents the calculated triangular grid spacing interval.

Table 4-2
Statistical Analysis Summary
Gross Alpha Activity (dpm/100 cm^2)
Extended Scoping Survey of Structures
Former Kaiser Aluminum Specialty Products Facility
Tulsa, Oklahoma

Total Surface Activity Levels

	Survey Subunit												
Statistics	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12	SS13
Average	10.2	14.0	16.8	16.3	7.3	6.7	4.0	-0.9	8.7	4.2	10.6	5.4	13.0
Standard Deviation	8.1	5.7	1.6	2.8	7.2	5.6	4.1	5.8	6.6	2.8	6.6	8.2	5.6
Minimum	-2.3	5.5	15.0	11.0	-8.1	0.8	-3.1	-9.4	-4.6	-0.5	5.4	-5.8	3.1
Maximum	21.4	17.6	20.0	20.0	21.3	12.0	10.2	9.4	20.5	9.3	20.0	17.9	21.4
Median	11.7	16.4	17.5	17.0	6.8	7.3	3.7	-0.9	8.6	4.0	7.2	4.0	13.7
GA-DCGL	*21.5*	*21.5*	*21.5*	*21.5*	*21.5*	*21.5*	*21.5*	*21.5*	*21.5*	*21.5*	*21.5*	*21.5*	*21.5*

Removable Surface Activity Levels

	Survey Subunit												
Statistics	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12	SS13
Average	0.06	0.14	0.42	0.20	0.08	0.34	-0.08	0.04	0.12	-0.02	0.12	0.16	0.05
Standard Deviation	0.27	0.34	0.51	0.31	0.28	0.27	0.20	0.21	0.32	0.24	0.27	0.32	0.27
Minimum	-0.20	-0.20	-0.21	-0.20	-0.20	0.07	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20
Maximum	0.61	0.61	1.70	0.89	0.61	0.61	0.34	0.34	0.89	0.34	0.34	0.89	0.61
Median	0.07	0.07	0.34	0.07	0.07	0.34	-0.20	0.07	0.07	-0.20	0.21	0.07	0.07
GA-DCGL	*2.15*	*2.15*	*2.15*	*2.15*	*2.15*	*2.15*	*2.15*	*2.15*	*2.15*	*2.15*	*2.15*	*2.15*	*2.15*

Note:
Supporting information presented in Appendix B-2.

Table 4-3
Gamma Scan Survey Results
Characterization Survey of Land Areas
Former Kaiser Aluminum Specialty Products Facility
Tulsa, Oklahoma

Survey Area	Instrument Serial Number	Detector Serial Number	Bkg. Count Rate (cpm)	Scan of the Area (gross cpm)			Scan of the Area (net cpm)		
				Maximum	Minimum	Average	Maximum	Minimum	Average
Survey Unit 1									
SU1-A1	102034	105942	6967	9200	5700	6900	2233	-1267	-67
SU1-A2	102034	105942	6568	8100	5700	6800	1532	-868	232
SU1-A3	102034	105942	8353	9400	7000	8700	1047	-1353	347
SU1-A4	102034	105942	8203	9200	6600	7500	997	-1603	-703
SU1-B1	86312	181297	6613	7300	6000	6500	687	-613	-113
SU1-B2	86312	181297	7708	9200	6800	8300	1492	-908	592
SU1-B3	86312	181297	7758	9200	6400	7900	1442	-1358	142
SU1-B4	86312	181297	7604	9400	6500	8400	1796	-1104	796
SU1-C1	86312	181297	6425	9100	5100	7200	2675	-1325	775
SU1-C2	102034	105942	6197	7100	5500	6200	903	-697	3
SU1-C3	86312	181297	7544	9000	6700	7900	1456	-844	356
SU1-C4	102034	105942	8084	9300	6400	8200	1216	-1684	116
Survey Unit 2									
SU2-A	102034	105942	9700	62000	8000	20000	52300	-1700	10300
SU2-B	102034	105942	9815	50000	8000	15000	40185	-1815	5185
SU2-C	102034	105942	8317	15000	7000	8500	6683	-1317	183
SU2-D	102034	105942	8455	12500	8000	9500	4045	-455	1045
SU2-E	102034	105942	8729	13000	7000	10000	4271	-1729	1271
Survey Unit 3									
SU3-A1/A-1	86312	181297	8239	11500	6200	8400	3261	-2039	161
SU3-A2	86312	181297	7906	12400	6800	7900	4494	-1106	-6
SU3-A3	97799	533	8256	11056	6900	9100	2800	-1356	844
SU3-A4/A5	86312	181297	7862	9300	6200	8100	1438	-1662	238
SU3-B1/B-1	86312	181297	8028	10400	6400	7100	2372	-1628	-928
SU3-B2	97799	533	8215	10200	7000	8500	1985	-1215	285
SU3-B3	97799	533	8116	34463	6500	8800	26347	-1616	684
SU3-B4	86312	181297	7791	10500	5800	7700	2709	-1991	-91
SU3-C1/C-1	102034	105942	8071	12000	7000	8100	3929	-1071	29
SU3-C2	97799	533	8329	9900	6500	8600	1571	-1829	271
SU3-C3	97799	533	8391	15500	7100	9000	7109	-1291	609
SU3-C4	86312	181297	8185	9400	6300	7800	1215	-1885	-385
SU3-D-1	97799	533	8314	9900	7200	8700	1586	-1114	386
SU3-D1/D2	97799	533	8547	9800	7400	8800	1253	-1147	253
SU3-E1	97799	533	8417	9600	6400	8500	1183	-2017	83
SU3-F1	86312	181297	7427	9000	6000	8200	1573	-1427	773
SU3-F-1	86312	181297	9520	10700	6400	7300	1180	-3120	-2220

Table 4-3
Gamma Scan Survey Results
Characterization Survey of Land Areas
Former Kaiser Aluminum Specialty Products Facility
Tulsa, Oklahoma

Survey Area	Instrument Serial Number	Detector Serial Number	Bkg. Count Rate (cpm)	Scan of the Area (gross cpm)			Scan of the Area (net cpm)		
				Maximum	Minimum	Average	Maximum	Minimum	Average
Survey Unit 4									
SU4-A1	86312	181297	7265	10600	5100	7000	3335	-2165	-265
SU4-A2	86312	181297	6506	7400	5500	6300	894	-1006	-206
SU4-B1	86312	181297	6430	7900	5200	6500	1470	-1230	70
SU4-B2	86312	181297	6054	8000	5800	7000	1946	-254	946
SU4-C1	102034	105942	7011	8200	5500	7300	1189	-1511	289
SU4-C2	102034	105942	5970	8300	5200	6800	2330	-770	830
SU4-D1	102034	105942	11547	12200	5900	8500	653	-5647	-3047
SU4-D2	102034	105942	6095	9100	5800	6300	3005	-295	205
Survey Unit 5									
SU5-A1/A-1	97799	533	8523	11500	7900	9100	2977	-623	577
SU5-A2	86312	181297	8077	10300	6900	10000	2223	-1177	1923
SU5-A3	97799	533	9645	11900	8900	10000	2255	-745	355
SU5-B1	102034	105942	8127	10000	7900	8400	1873	-227	273
SU5-B-1	102034	105942	9731	10000	9500	9800	269	-231	69
SU5-B2	86312	181297	8961	10700	800	10100	1739	-8161	1139
SU5-B3	97799	533	9763	11800	8600	9800	2037	-1163	37
SU5-C1	102034	105942	10198	11000	9700	10300	802	-498	102
SU5-C-1	97799	533	9816	10200	8100	9600	384	-1716	-216
SU5-C2	86312	181297	9640	11000	9400	10300	1360	-240	660
SU5-D1	97799	533	10673	13700	8900	9800	3027	-1773	-873
SU5-D-1	86312	181297	8522	10200	6400	8300	1678	-2122	-222
SU5-D2	86312	181297	9439	14400	8300	9900	4961	-1139	461
SU5-E1	102034	105942	9813	10500	9000	10000	687	-813	187
SU5-E-1	86312	181297	10141	10500	8400	9200	359	-1741	-941
SU5-F-1	86312	181297	9478	11300	7900	8800	1822	-1578	-678
SU5-G-1	102034	105942	10402	14500	10000	125000	114598	-402	4098
SU5-H-1	86312	181297	11001	12300	9900	10400	1299	-1101	-601
SU5-I-1	102034	105942	11321	22000	10000	12600	114679	-1321	10679

Table 4-3
Gamma Scan Survey Results
Characterization Survey of Land Areas
Former Kaiser Aluminum Specialty Products Facility
Tulsa, Oklahoma

Survey Area	Instrument Serial Number	Detector Serial Number	Bkg. Count Rate (cpm)	Scan of the Area (gross cpm)			Scan of the Area (net cpm)		
				Maximum	Minimum	Average	Maximum	Minimum	Average
Survey Unit 6									
SU6	102034	105942	15166	13000	15400	14700	-2166	234	-466
Survey Unit 7									
SU7-A1	86312	181297	6988	8700	6900	7800	1712	-88	812
SU7-A2	86312	181297	6859	7800	6000	7600	941	-859	741
SU7-B1	86312	181297	7008	8800	6300	7500	1792	-708	492
SU7-B2	102034	105942	7823	9200	6900	7900	1377	-923	77
SU7-C1	86312	181297	7346	9400	7100	8900	2054	-246	1554
SU7-C2	102034	105942	7562	9800	6300	8800	2238	-1262	1238
SU7-D1	86312	181297	7948	8600	5600	8300	652	-2348	352
SU7-D2	102034	105942	8547	15300	6800	9200	6753	-1747	653
SU7-E1	86312	181297	7824	9300	6900	8700	1476	-924	876
SU7-E2	102034	105942	8669	29300	6900	9400	20631	-1769	731
SU7-F1	86312	181297	7203	9300	6800	7900	2097	-403	697
SU7-F2	102034	105942	8103	36000	6200	9800	27897	-1903	1697
SU7-G1	86312	181297	7835	9100	5700	7800	1265	-2135	-35
SU7-G2	102034	105942	9807	12300	5700	10800	2493	-4107	993
SU7-H1	86312	181297	7559	8500	6300	7800	941	-1259	241
SU7-H2	102034	105942	9133	18400	6900	10500	9267	-2233	1367
Survey Unit 8									
SU8-A1	102034	105942	15997	17000	15500	16300	1003	-497	303
SU8-B1	102034	105942	16847	175000	16000	16850	158153	-847	3
SU8-C1/C-1	86312	181297	13274	14900	9900	11600	1626	-3374	-1674
SU8-D1/D-1	102034	105942	16448	17000	15000	16300	552	-1448	-148
SU8-E-1/E1	86312	181297	12391	15800	9100	12300	3409	-3291	-91
SU8-F-1/F1	86312	181297	13757	17900	11200	14100	4143	-2557	343
SU8-F-2	86312	181297	11879	25200	8700	11400	13321	-3179	-479
SU8-F-3	102034	105942	12999	13500	12000	13000	501	-999	1
SU8-G-2/G-1	86312	181297	12051	15000	10000	12700	2949	-2051	649
SU8-G-3	102034	105942	13725	14200	13500	13700	475	-225	-25
SU8-H-2/H-1	86312	181297	12522	16800	10700	12500	4278	-1822	-22
SU8-H-3	102034	105942	13314	21000	10000	15000	7686	-3314	1686
SU8-I-2	102034	105942	16512	30000	14900	22000	13488	-1612	5488
SU8-I-3	86312	181297	10146	25500	10100	15200	15354	-46	5054
SU8-J-2	102034	105942	14260	15000	11000	14500	740	-3260	240

Table 4-3
Gamma Scan Survey Results
Characterization Survey of Land Areas
Former Kaiser Aluminum Specialty Products Facility
Tulsa, Oklahoma

Survey Area	Instrument Serial Number	Detector Serial Number	Bkg. Count Rate (cpm)	Scan of the Area (gross cpm)			Scan of the Area (net cpm)		
				Maximum	Minimum	Average	Maximum	Minimum	Average
Survey Unit 9									
SU9-A1	102034	105942	8879	9700	8300	9200	821	-579	321
SU9-A2	102034	105942	8953	10300	8900	9400	1347	-53	447
SU9-B1	86312	181297	8844	10500	8200	9600	1656	-644	756
SU9-B2	86312	181297	9572	10200	7600	9600	628	-1972	28
SU9-B3	86312	181297	8357	20300	7100	8300	11943	-1257	-57
SU9-C1	102034	105942	9233	10100	7300	9400	867	-1933	167
SU9-C2	102034	105942	9018	11800	5900	10400	2782	-3118	1382
SU9-C3	86312	181297	8322	10800	5900	8900	2478	-2422	578
SU9-D1	86312	181297	9341	11100	7900	9500	1759	-1441	159
SU9-D2	86312	181297	9185	11100	5600	9800	1915	-3585	615
SU9-A3	86312	181297	9835	11800	7500	10700	1965	-2335	865

Note:
2,500 cpm above background was the field limit used to designate areas of possible subsurface contamination.

Table 4-4
Survey Unit 1 - Land Area Beneath the North Extrusion Building
Soil Core Scans, Net Gamma Count
(cpm)

Depth (ft)	Sample Point B1	Sample Point B2	Sample Point B3	Sample Point B4	Sample Point B5	Sample Point B6	Sample Point B7	Sample Point B8	Sample Point B9
(0-1)	**628**	318	-82	-82	118	318	318	118	218
(1-2)	618	118	-182	118	318	218	418	318	-182
(2-3)	218	118	118	18	218	**618**	318	118	**618**
(3-4)	318	-82	318	**418**	**438**	118	18	**318**	418
(4-5)	518	118	18	118	318	218	-282		218
(5-6)	118	118	118		418	-182	118		118
(6-7)	-82	218	318			-282	18		
(7-8)	218	**418**	518			518	**518**		
(8-9)			-82						
(9-10)			**618**						
(10-11)			318						

Notes:
Background was determined to be 4,382 cpm using soil known to be nonimpacted.
Bold numbers represent the segment of the sample that was sent to the laboratory for analytical analysis.
Instrumentation used for core scans was Ludlum 2221 (SN 117370) with Ludlum 44-10 detector (SN 0551).

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Table 4-5

Survey Unit 2 - Land Area North of the Maintenance Building and the North Extrusion Building

Soil Core Scans, Net Gamma Count

(cpm)

Depth (ft)	Sample Point B1	Sample Point B2	Sample Point B3	Sample Point B4	Sample Point B5	Sample Point B6	Sample Point B7	Sample Point B8	Sample Point B9
(0-1)	**541**	-159	141	141	541	**341**	-59	341	241
(1-2)	141	**141**	-59	**241**	341	-59	-259	**421**	341
(2-3)	41	141	**541**	41	-459	341	**441**	351	-359
(3-4)	141	-259	-59	-459	441	41	141	141	41
(4-5)	541	-159	-59		-359	-59			421
(5-6)	141	41	341		341	241			-59
(6-7)	241		141		**641**	141			**424**
(7-8)	141		441		241	341			41
(8-9)	-59								-359
(9-10)	41								-4559
(10-11)	-459								-4559

Notes:
Background was determined to be 4,382 cpm using soil known to be nonimpacted.
Bold numbers represent the segment of the sample that was sent to the laboratory for analytical analysis.
Instrumentation used for core scans was Ludlum 2221 (SN 117370) with Ludlum 44-10 detector (SN 0551).

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Table 4-6

Survey Unit 3 - Land Area North of the Office Building and South, Southwest of the Maintenance Building

Soil Core Scans, Net Gamma Count

(cpm)

Depth (ft)	Sample Point B1	Sample Point B2	Sample Point B3	Sample Point B4	Sample Point B5	Sample Point B6	Sample Point B7	Sample Point B8	Sample Point B9	Sample Point A1	Sample Point A2	Sample Point C1
(0-1)	-559	231	-59	41	141	41	-159	**641**	**341**	341	-159	241
(1-2)	141	-159	141	**541**	**541**	41	**341**	41		-259	241	301
(2-3)	**441**	41	241		41	**241**	-159	141		441	271	231
(3-4)	141	**441**	**291**		41	141		211		**701**	**641**	141
(4-5)		141	141		241			641		-559		41
(5-6)		341	-359		141			41		671		**641**
(6-7)		341	-459							241		-159
(7-8)		-59								341		

Notes:
Background was determined to be 4,382 cpm using soil known to be nonimpacted.
Bold numbers represent the segment of the sample that was sent to the laboratory for analytical analysis.
Instrumentation used for core scans was Ludlum 2221 (SN 117370) with Ludlum 44-10 detector (SN 0551).

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Table 4-7
Survey Unit 4 - Land Area Beneath the Maintenance Building
Soil Core Scans, Net Gamma Count
(cpm)

Depth (ft)	Sample Point B1	Sample Point B2	Sample Point B3	Sample Point B4	Sample Point B5	Sample Point B6	Sample Point B7	Sample Point B8	Sample Point B9
(0-1)	-159	141	-159	-159	**651**	-59	41	**341**	-259
(1-2)	361	121	**141**	41	-159	241	171	-59	-59
(2-3)	**401**	**341**		**341**	-559	**321**	-159	-259	41
(3-4)	-35	141		41	-59		**341**	41	**141**

Notes:
Background was determined to be 4,382 cpm using soil known to be nonimpacted.
Bold numbers represent the segment of the sample that was sent to the laboratory for analytical analysis.
Instrumentation used for core scans was Ludlum 2221 (SN 117370) with Ludlum 44-10 detector (SN 0551).

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Table 4-8
Survey Unit 5 - Land Area North of the Warehouse Building
Soil Core Scans, Net Gamma Count
(cpm)

Depth (ft)	Sample Point B1	Sample Point B2	Sample Point B3	Sample Point B4	Sample Point B5	Sample Point B6	Sample Point B7	Sample Point B8	Sample Point B9	Sample Point A2	Sample Point D2	Sample Point G1	Sample Point I1
(0-1)	-459	-159	-159	261	371	211	-59	**781**	-59	3221	141	**741**	41
(1-2)	**161**	**501**	41	311	-159	421	41	-89	561	**5661**	**272**	241	321
(2-3)	11	141	211	-159	-159	-159	241	-59	191	601		-159	1441
(3-4)		-39	**941**	141	**461**	241	141	191	441	341		241	**3941**
(4-5)		311	341	**421**	141	241	**741**	141	**591**	141		-159	741
(5-6)		341	441	411	241	241	641			671		511	41
(6-7)		481	-59	-359	461	141	641			941		341	
(7-8)		141	378	-359	41	241	141			341			
(8-9)		-59		141		41				341			
(9-10)		241		141		241				141			
(10-11)		441				-159				-109			
(11-12)						**441**							

Notes:
Background was determined to be 4,382 cpm using soil known to be nonimpacted.
Bold numbers represent the segment of the sample that was sent to the laboratory for analytical analysis.
Instrumentation used for core scans was Ludlum 2221 (SN 117370) with Ludlum 44-10 detector (SN 0551).

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Table 4-9
Survey Unit 6 - Land Area Around the Footprint of the Former Smelter Building
Soil Core Scans, Net Gamma Count
(cpm)

Depth (ft)	Sample Point B1	Sample Point B2	Sample Point B3	Sample Point B4	Sample Point B5	Sample Point B6	Sample Point B7	Sample Point B8	Sample point B9
(0-1)	174	274	424	324	-26	-226	344	694	44
(1-2)	604	-126	374	194	634	134	474	274	264
(2-3)	674	344	74	**434**	734	-26	374	434	**574**
(3-4)	344	**964**	174		174	**344**	**524**	**744**	
(4-5)	174	474	534		**1064**				
(5-6)	-126	174	264		574				
(6-7)	474	574	514						
(7-8)	174	274	**2354**						
(8-9)	-26	674	754						
(9-10)	174	574	724						
(10-11)	**774**	174	674						
(11-12)	74		224						
(12-13)	324		464						
(13-14)	174		804						
(14-15)	**274**								

Notes:
Background was determined to be 4,382 cpm using soil known to be nonimpacted.
Bold numbers represent the segment of the sample that was sent to the laboratory for analytical analysis.
Instrumentation used for core scans was Ludlum 2221 (SN 117370) with Ludlum 44-10 detector (SN 0551).

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Table 4-10
Survey Unit 7 - Land Area Beneath the Warehouse Building
Soil Core Scans, Net Gamma Count
(cpm)

Depth (ft)	Sample Point B1	Sample Point B2	Sample Point B3	Sample Point B4	Sample Point B5	Sample Point B6	Sample Point B7	Sample Point B8	Sample Point B9	Sample Point C1	Sample Point D2	Sample Point F2	Sample Point H1	Sample Point H2
(0-1)	-126	594	**4874**	344	24	374	174	-126	174	**1974**	74	374	74	**1974**
(1-2)	274	374	844	234	**544**	274	-26	334	**734**	574	474	434	**854**	
(2-3)	44	474	164	374	374	-26	-126	544	574	464	274	364	374	
(3-4)	224	274	-26	624		**414**	**474**	174	364	374	174	274	-126	
(4-5)	404	274	474	644		74		174	524	574	**734**	174	374	
(5-6)	504	**634**	674	**674**		174		464	274	774	374	**774**	274	
(6-7)	674	474	974	-26				-226	274	874	374	-26	174	
(7-8)	-226	254		424				**844**	474	574			174	
(8-9)	274	424		-156						374				
(9-10)	274	74		314						-26				
(10-11)	**694**	374												
(11-12)	224													
(12-13)	-146													

Notes:
Background was determined to be 4,382 cpm using soil known to be nonimpacted.
Bold numbers represent the segment of the sample that was sent to the laboratory for analytical analysis.
Instrumentation used for core scans was Ludlum 2221 (SN 117370) with Ludlum 44-10 detector (SN 0551).

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Table 4-11
Survey Unit 8 - Land Area North and East of the Crusher Building
Soil Core Scans, Net Gamma Count
(cpm)

Depth (ft)	Sample Point B1	Sample Point B2	Sample Point B3	Sample Point B4	Sample Point B5	Sample Point B6	Sample Point B7	Sample Point B8	Sample Point B9	Sample Point F1	Sample Point F2	Sample Point F3
(0-1)	374	344	1144	374	874	624	174	174	174	**16124**	**1734**	**1564**
(1-2)	274	374	**2204**	374	**2174**	374	274	274	274	2624	374	374
(2-3)	**434**	74	424	354	474	614	**864**	394	74	274	274	474
(3-4)	274	424	274	-26	274	474	74	174	374	2574	594	374
(4-5)	374	594	664	**504**	274	174	474	74	**674**	974	654	-226
(5-6)		**694**	744	94	374	604	374	274	174	74	374	274
(6-7)		174	174	74	174	**1104**	474	174		374		474
(7-8)		374						**554**				374
(8-9)												574
(9-10)												74
(10-11)												274

Notes:
Background was determined to be 4,382 cpm using soil known to be nonimpacted.
Bold numbers represent the segment of the sample that was sent to the laboratory for analytical analysis.
Instrumentation used for core scans was Ludlum 2221 (SN 117370) with Ludlum 44-10 detector (SN 0551).

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Table 4-12

Survey Unit 9 - Land Area Beneath the Crusher and Crusher Addition Buildings

Soil Core Scans, Net Gamma Count

(cpm)

Depth (ft)	Sample Point B1	Sample Point B2	Sample Point B3	Sample Point B4	Sample Point B5	Sample Point B6	Sample Point B7	Sample Point B8	Sample Point B9
(0-1)	**174**	274	374	**274**	2174	514	374	374	474
(1-2)	-326	474	**2374**	184	**2614**	**734**	174	274	-226
(2-3)		474	764		1134	224	374	174	74
(3-4)		784	374		274	474	364	464	**504**
(4-5)		694	694			274	-226	74	274
(5-6)		74	-426			354	-26	74	494
(6-7)		**894**				174	**504**	**624**	374
(7-8)		574				174	474	574	
(8-9)		-126					334	374	
(9-10)		774						274	
(10-11)		174						614	

Notes:
Background was determined to be 4,382 cpm using soil known to be nonimpacted.
Bold numbers represent the segment of the sample that was sent to the laboratory for analytical analysis.
Instrumentation used for core scans was Ludlum 2221 (SN 117370) with Ludlum 44-10 detector (SN 0551).

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Table 4-13
Th-232 Analytical Results for Soil Core Samples
Characterization Survey of Land Areas
Former Kaiser Aluminum Specialty Products Facility
Tulsa, Oklahoma

Sample Location	Sample Depth (ft)	Analytical Results Gross Conc. Th-232 (pCi/g)	Net Conc. Th-232 (pCi/g)	Uncert. (+/- pCi/g)	Detection Limit (pCi/g)
SU1 - Land Area Beneath the North Extrusion Building					
1	0-1	5.67E-01	0.00E+00	3.30E-02	1.03E-01
2	7-8	2.23E-01	0.00E+00	2.60E-02	7.20E-02
3	9-10	7.83E-01	0.00E+00	8.20E-02	2.80E-01
4	3-4	1.06E+00	0.00E+00	8.20E-02	2.60E-01
5	3-4	1.03E+00	0.00E+00	1.02E-01	2.91E-01
6	2-3	2.10E-01	0.00E+00	1.80E-02	2.40E-02
7	7-8	1.03E+00	0.00E+00	4.10E-02	1.76E-01
8	3-4	8.15E-01	0.00E+00	1.02E-01	3.53E-01
9	2-3	5.03E+00	3.93E+00	3.32E-01	7.56E-01
Average		1.19E+00	4.37E-01		
Std. Deviation		1.47E+00	1.31E+00		
Min		2.10E-01	0.00E+00		
Max		5.03E+00	3.93E+00		
Median		8.15E-01	0.00E+00		
SU2 - Land Area North of the Maintenance Building and the North Extrusion Building					
1	0-1	1.67E+00	5.70E-01	2.29E-01	5.16E-01
2	1-2	9.92E-01	0.00E+00	7.80E-02	3.19E-01
3	2-3	8.79E-01	0.00E+00	1.21E-01	5.84E-01
4	1-2	1.30E+00	2.00E-01	2.35E-01	2.94E-01
5	6-7	7.79E-01	0.00E+00	1.21E-01	5.06E-01
6	0-1	9.95E-01	0.00E+00	1.12E-01	4.23E-01
7	2-3	7.01E-01	0.00E+00	1.00E-01	4.64E-01
8	1-2	8.56E-01	0.00E+00	1.61E-01	5.17E-01
9	6-7	9.24E-01	0.00E+00	9.70E-02	4.39E-01
*25	0-1	8.47E+00	7.37E+00	3.84E-01	7.45E-01
Average		1.76E+00	8.14E-01		
Std. Deviation		2.38E+00	2.31E+00		
Min		7.01E-01	0.00E+00		
Max		8.47E+00	7.37E+00		
Median		9.58E-01	0.00E+00		
SU3 - Land Area East of the North Extrusion Building and North of the Office Building Area					
1	2-3	8.89E-01	0.00E+00	1.87E-01	5.37E-01
2	3-4	9.08E-01	0.00E+00	1.49E-01	5.10E-01
3	3-4	1.25E+00	1.50E-01	1.96E-01	5.59E-01
4	1-2	1.27E+00	1.70E-01	1.56E-01	4.17E-01
5	1-2	8.22E-01	0.00E+00	1.04E-01	3.53E-01
6	2-3	9.12E-01	0.00E+00	1.44E-01	5.58E-01
7	1-2	8.10E-01	0.00E+00	1.19E-01	3.50E-01
8	0-1	8.93E-01	0.00E+00	1.35E-01	3.53E-01
9	0-1	1.51E+00	4.10E-01	1.04E-01	2.93E-01

Table 4-13
Th-232 Analytical Results for Soil Core Samples
Characterization Survey of Land Areas
Former Kaiser Aluminum Specialty Products Facility
Tulsa, Oklahoma

Sample Location	Sample Depth (ft)	Analytical Results Gross Conc. Th-232 (pCi/g)	Net Conc. Th-232 (pCi/g)	Uncert. (+/- pCi/g)	Detection Limit (pCi/g)
A1	3-4	9.20E-01	0.00E+00	1.36E-01	3.75E-01
A2	3-4	7.37E-01	0.00E+00	9.70E-02	4.34E-01
C1	5-6	7.36E-01	0.00E+00	1.15E-01	3.88E-01
*24	0-2	9.57E+00	8.47E+00	1.67E+00	1.30E+00
Average		1.63E+00	4.03E-01		
Std. Deviation		2.40E+00	2.34E+00		
Min		7.36E-01	0.00E+00		
Max		9.57E+00	8.47E+00		
Median		9.08E-01	0.00E+00		
SU4 - Land Area Beneath the Maintenance Building					
1	2-3	8.47E-01	0.00E+00	1.38E-01	4.74E-01
2	2-3	7.18E-01	0.00E+00	9.00E-02	3.00E-01
3	1-2	8.43E-01	0.00E+00	1.20E-01	4.86E-01
4	2-3	7.85E-01	0.00E+00	1.15E-01	5.09E-01
5	0-1	5.46E-01	0.00E+00	5.30E-02	2.16E-01
6	2-3	8.20E-01	0.00E+00	8.30E-02	3.88E-01
7	3-4	9.21E-01	0.00E+00	8.10E-02	4.92E-01
8	0-1	1.03E+00	0.00E+00	1.82E-01	5.76E-01
9	3-4	8.56E-01	0.00E+00	1.41E-01	5.25E-01
Average		8.18E-01	0.00E+00		
Std. Deviation		1.34E-01	0.00E+00		
Min		5.46E-01	0.00E+00		
Max		1.03E+00	0.00E+00		
Median		8.43E-01	0.00E+00		
SU5 - Land Area North of the Warehouse Building					
1	1-2	BDL	0.00E+00	BDL	5.13E-01
2	1-2	8.95E-01	0.00E+00	1.03E-01	5.65E-01
3	3-4	8.40E-01	0.00E+00	1.15E-01	5.55E-01
4	4-5	6.20E-01	0.00E+00	1.22E-01	4.68E-01
5	3-4	1.03E+00	0.00E+00	7.50E-02	4.41E-01
6	11-12	7.54E-01	0.00E+00	1.01E-01	5.23E-01
7	4-5	7.63E-01	0.00E+00	1.42E-01	3.80E-01
8	0-1	BDL	0.00E+00	BDL	4.50E-01
9	4-5	1.11E+00	1.00E-02	1.46E-01	3.41E-01
A2	1-2	7.44E+01	7.33E+01	1.51E+00	2.21E+00
D2	1-2	BDL	0.00E+00	BDL	4.56E-01
G1	0-1	7.20E-01	0.00E+00	1.30E-01	5.34E-01
I1	3-4	8.11E+01	8.00E+01	1.46E+00	1.50E+00
Average		1.62E+01	1.53E+01		
Std. Deviation		3.25E+01	3.24E+01		
Min		6.20E-01	0.00E+00		
Max		8.11E+01	8.00E+01		
Median		8.68E-01	0.00E+00		

Table 4-13
Th-232 Analytical Results for Soil Core Samples
Characterization Survey of Land Areas
Former Kaiser Aluminum Specialty Products Facility
Tulsa, Oklahoma

Sample Location	Sample Depth (ft)	Analytical Results Gross Conc. Th-232 (pCi/g)	Net Conc. Th-232 (pCi/g)	Uncert. (+/- pCi/g)	Detection Limit (pCi/g)
SU6 - Land Area Around the Footprint of the Former Smelter Building					
1	10-11	1.01E+00	0.00E+00	1.27E-01	5.40E-01
2	3-4	1.25E+00	1.50E-01	1.22E-01	4.60E-01
3	7-8	2.18E+01	2.07E+01	6.39E-01	1.14E+00
4	2-3	2.98E+00	1.88E+00	2.03E-01	5.07E-01
5	4-5	8.30E-01	0.00E+00	9.90E-02	2.87E-01
6	3-4	9.49E-01	0.00E+00	7.70E-02	4.93E-01
7	3-4	8.10E-01	0.00E+00	1.73E-01	4.80E-01
8	3-4	7.73E-01	0.00E+00	1.05E-01	4.95E-01
9	2-3	1.55E+00	4.50E-01	1.10E-01	4.75E-01
Average		3.55E+00	2.58E+00		
Std. Deviation		6.88E+00	6.82E+00		
Min		7.73E-01	0.00E+00		
Max		2.18E+01	2.07E+01		
Median		1.01E+00	0.00E+00		
SU7 - Land Area Beneath the Warehouse Building					
1	10-11	7.96E-01	0.00E+00	9.90E-02	4.22E-01
2	5-6	7.87E-01	0.00E+00	1.20E-01	4.30E-01
3	0-1	6.55E+01	6.44E+01	1.45E+00	1.84E+00
4	5-6	1.19E+00	9.00E-02	1.46E-01	5.61E-01
5	1-2	3.79E+00	2.69E+00	2.39E-01	7.32E-01
6	3-4	7.58E-01	0.00E+00	1.22E-01	3.62E-01
7	3-4	ND	0.00E+00	ND	4.15E-01
8	7-8	8.98E-01	0.00E+00	1.24E-01	3.96E-01
9	1-2	1.02E+00	0.00E+00	2.17E-01	6.86E-01
C1	0-1	1.92E+01	1.81E+01	5.09E-01	1.09E+00
D2	4-5	8.27E-01	0.00E+00	1.21E-01	5.09E-01
F2	5-6	5.79E+01	5.68E+01	1.21E+00	1.50E+00
H1	1-2	7.40E-01	0.00E+00	1.19E-01	3.72E-01
H2	0-1	1.43E+01	1.32E+01	5.00E-01	8.67E-01
*22	0-2	6.11E+00	5.01E+00	2.55E-01	3.34E-01
Average		1.24E+01	1.14E+01		
Std. Deviation		2.17E+01	2.16E+01		
Min		7.40E-01	0.00E+00		
Max		6.55E+01	6.44E+01		
Median		1.11E+00	4.50E-02		
SU8 - Land Area North and East of the Crusher Building					
1	2-3	1.00E+00	0.00E+00	1.35E-01	5.39E-01
2	5-6	7.70E-01	0.00E+00	1.06E-01	4.48E-01
3	1-2	2.27E+01	2.16E+01	6.67E-01	1.17E+00
4	4-5	BDL	0.00E+00	BDL	4.83E-01
5	1-2	4.26E+01	4.15E+01	8.85E-01	7.92E-01
6	6-7	1.28E+00	1.80E-01	1.73E-01	5.96E-01
7	2-3	2.91E+00	1.81E+00	1.95E-01	4.48E-01
8	7-8	8.82E-01	0.00E+00	1.13E-01	3.82E-01

Table 4-13
Th-232 Analytical Results for Soil Core Samples
Characterization Survey of Land Areas
Former Kaiser Aluminum Specialty Products Facility
Tulsa, Oklahoma

Sample Location	Sample Depth (ft)	Analytical Results Gross Conc. Th-232 (pCi/g)	Net Conc. Th-232 (pCi/g)	Uncert. (+/- pCi/g)	Detection Limit (pCi/g)
9	4-5	1.03E+00	0.00E+00	1.19E-01	3.97E-01
F1	0-1	1.33E+02	1.32E+02	2.61E+00	3.02E+00
F2	0-1	1.64E+01	1.53E+01	4.51E-01	6.10E-01
F3	0-1	1.19E+01	1.08E+01	4.91E-01	6.51E-01
*13	1-2	8.63E-01	0.00E+00	1.11E-01	2.56E-01
*14	0-1	6.26E+00	5.16E+00	2.56E-01	4.60E-01
*15	1-2	1.11E+01	1.00E+01	4.83E-01	6.05E-01
*17	2-3	6.74E-01	0.00E+00	1.11E-01	2.70E-01
*18	0-1	1.33E+00	2.30E-01	8.60E-02	2.01E-01
*19	4-5	5.63E+00	4.53E+00	2.46E-01	5.29E-01
Average		1.45E+01	1.35E+01		
Std. Deviation		3.15E+01	3.14E+01		
Min		1.28E-01	0.00E+00		
Max		1.33E+02	1.32E+02		
Median		2.12E+00	1.02E+00		
SU9 - Land Area Beneath the Crusher and the Crusher Addition Buildings					
1	0-1	5.25E-01	0.00E+00	1.11E-01	4.41E-01
2	6-7	2.17E+00	1.07E+00	1.98E-01	4.28E-01
3	1-2	3.20E+01	3.09E+01	6.49E-01	5.84E-01
4	0-1	1.32E+00	2.20E-01	1.59E-01	5.00E-01
5	1-2	4.98E+01	4.87E+01	1.22E+00	1.33E+00
6	1-2	1.00E+00	0.00E+00	1.41E-01	5.15E-01
7	6-7	7.90E-01	0.00E+00	1.19E-01	4.23E-01
8	6-7	5.42E-01	0.00E+00	9.20E-02	4.89E-01
9	3-4	7.24E-01	0.00E+00	9.80E-02	4.61E-01
*16	4-5	6.59E-01	0.00E+00	6.80E-02	2.82E-01
*20	0-2	2.83E-01	0.00E+00	8.50E-02	3.52E-01
*21	0-2	2.69E+00	1.59E+00	1.22E-01	3.98E-01
*23	1-2	4.57E+01	4.46E+01	8.51E-01	7.11E-01
Average		1.06E+01	9.78E+00		
Std. Deviation		1.86E+01	1.84E+01		
Min		2.83E-01	0.00E+00		
Max		4.98E+01	4.87E+01		
Median		1.00E+00	0.00E+00		

Notes:
1. Background established for the site is 1.1 pCi/g Th-232.
2. Sample locations which are denoted with an (*) are samples that were collected during the Additional Site Characterization Activities dated November 2001.

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Table 4-14
Thorium Concentrations of QA/QC Soil Samples
Characterization Survey of Land Areas
Former Kaiser Aluminum Specialty Products Facility
Tulsa, Oklahoma

Sample Location	Sample Depth (ft)	Analytical Results Gross Conc. Th-232 (pCi/g)	Net Conc. Th-232 (pCi/g)	Uncert. (+/- pCi/g)	Detection Limit (pCi/g)
Background Soil Samples (1)					
Bkg - 001	0-1	7.44E-01	N/A	9.10E-02	2.95E-01
Bkg - 002	1-2	8.97E-01	N/A	1.54E-01	4.70E-01
Bkg - 003	2-3	1.24E+00	N/A	1.34E-01	5.10E-01
Average		9.60E-01			
Std. Deviation		2.54E-01			
Min		7.44E-01			
Max		1.24E+00			
Median		8.97E-01			
Spike Soil Samples (2)					
RTP - 001	0-1	5.72E+01	5.61E+01	1.11E+00	9.23E-01
RTP - 002	0-1	5.98E+01	5.87E+01	1.38E+00	1.67E+00
RTP - 003	0-1	5.92E+01	5.81E+01	1.32E+00	1.13E+00
Average		5.87E+01	5.76E+01		
Std. Deviation		1.36E+00	1.36E+00		
Min		5.72E+01	5.61E+01		
Max		5.98E+01	5.87E+01		
Median		5.92E+01	5.81E+01		
Duplicate Soil Samples (3)					
(Original #1) PD - 004	0-1	5.46E+01	5.35E+01	1.47E+00	1.06E+00
(Duplicate #1) RTP - 001	0-1	5.72E+01	5.61E+01	1.11E+00	9.23E-01
(Original #2) PD - 005	0-1	5.92E+01	5.81E+01	1.66E+00	1.14E+00
(Duplicate #2) RTP - 002	0-1	5.98E+01	5.87E+01	1.38E+00	1.67E+00
(Original #3) PD - 006	0-1	5.49E+01	5.38E+01	1.49E+00	1.53E+00
(Duplicate #3) RTP - 003	0-1	5.92E+01	5.81E+01	1.32E+00	1.13E+00
Average		5.75E+01	5.64E+01		
Std. Deviation		2.29E+00	2.29E+00		
Min		5.46E+01	5.35E+01		
Max		5.98E+01	5.87E+01		
Median		5.82E+01	5.71E+01		
Composite Soil Sample Th-232 (4)					
Com - 001	N/A	8.03E+00	6.93E+00	3.68E-01	9.43E-01

Table 4-14
Thorium Concentrations of QA/QC Soil Samples
Characterization Survey of Land Areas
Former Kaiser Aluminum Specialty Products Facility
Tulsa, Oklahoma

Composite Soil Sample Th-230 (4)					
Sample Location	Sample Depth (ft)	Analytical Results Gross Conc. Th-230 (pCi/g)	Net Conc. Th-230 (pCi/g)	Uncert. (+/- pCi/g)	Detection Limit (pCi/g)
Com - 001	N/A	3.67E+01	3.32E+01	1.33E+00	5.18E-01

Notes:
1. Background soil samples were collected from a core sample collected from the nonimpacted land area in front of the Office Building Area.
2. Spike samples were collected from the impacted Retention Pond Area.
3. The spike samples that were submitted for analysis were samples that were previously submitted under the Adjacent Land Remediation Plan.
4. The composite sample that was submitted for analysis was comprised of a teaspoon of soil from all of the core samples that were submitted for analysis under this project.

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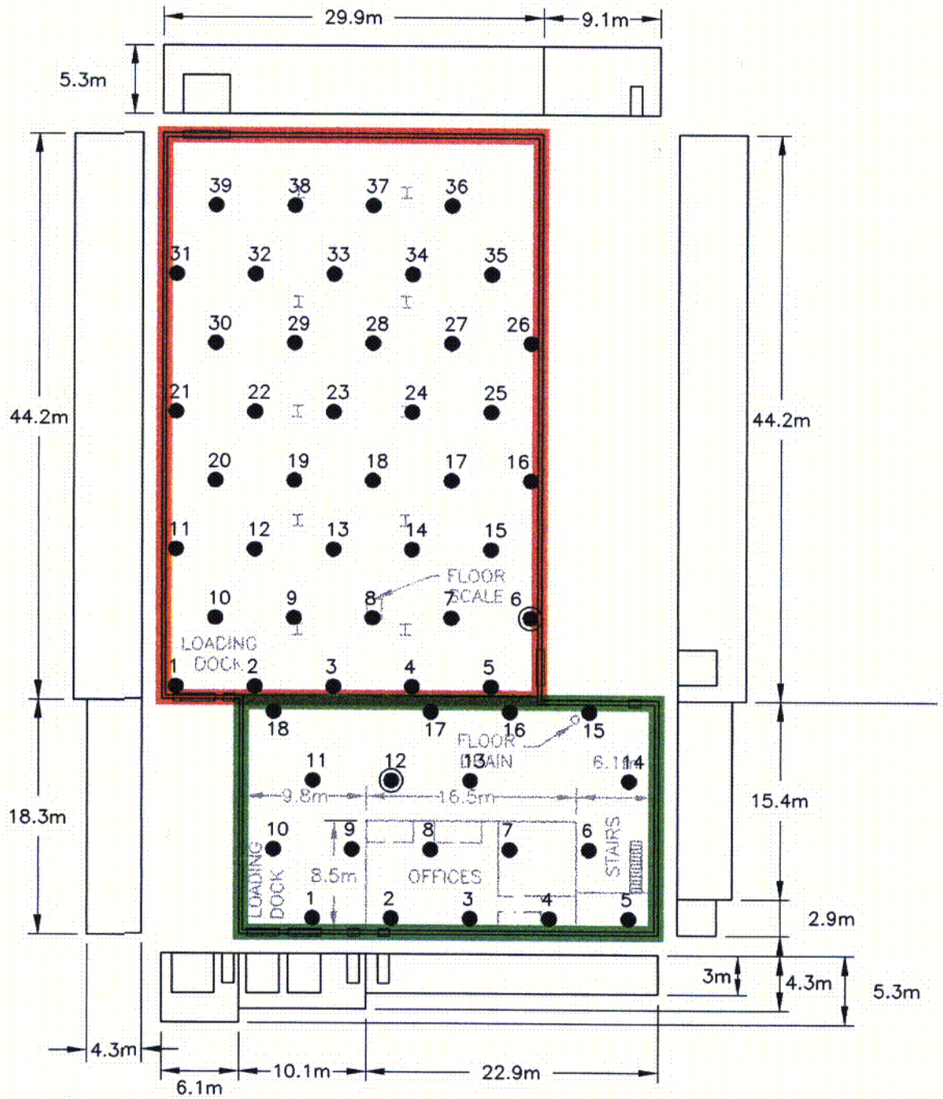
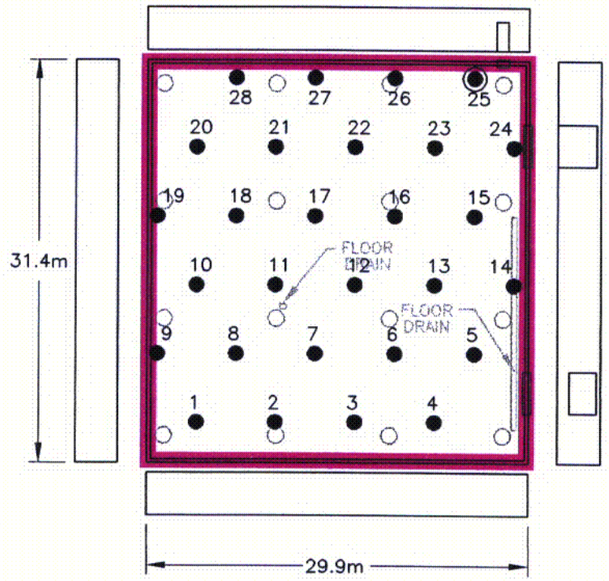
Figures



FIRST FLOOR

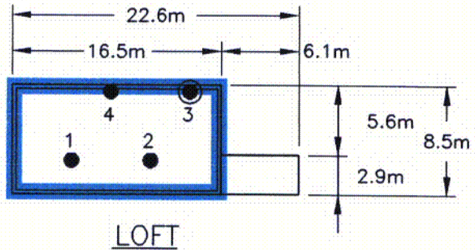
CONSTRUCTION MATERIAL

MAIN FLOOR – CONCRETE
MAIN WALLS – CONCRETE BLOCK
MAIN CEILING – CORRUGATED METAL
I – SUPPORT PILLAR



BASEMENT (1961 ADDITION)

MAIN FLOOR – CONCRETE
MAIN WALLS – CONCRETE BLOCK
MAIN CEILING – CONCRETE
○ – 30" DIA. CONCRETE SUPPORT PILLAR



LOFT

LEGEND

◉ RANDOM GENERATED START SAMPLE POINT

● TRIANGULAR GRID SYSTEMATIC SAMPLE POINT

SURVEY SUBUNIT 1 (FIRST FLOOR ORIGINAL)
L = 6.2m
A = 605m²
N = 18 SAMPLES

SURVEY SUBUNIT 2 (LOFT)
L = 6.2m
A = 160m²
N = 4 SAMPLES

SURVEY SUBUNIT 3 (BASEMENT)
L = 6.2m
A = 945m²
N = 28 SAMPLES

SURVEY SUBUNIT 4 (FIIRST FLOOR ADDITION)
L = 6.2m
A = 1,325m²
N = 39 SAMPLES

N

SCALE – FEET
40 0 40
10 0 10
SCALE – METERS

FIGURE 4A–1
STRUCTURAL SURFACES DISCRETE SAMPLE POINTS
NORTH EXTRUSION BUILDING LAYOUT
FORMER KAISER ALUMINUM
SPECIALTY PRODUCTS FACILITY
TULSA, OKLAHOMA

PREPARED FOR
KAISER ALUMINUM & CHEMICAL CORPORATION
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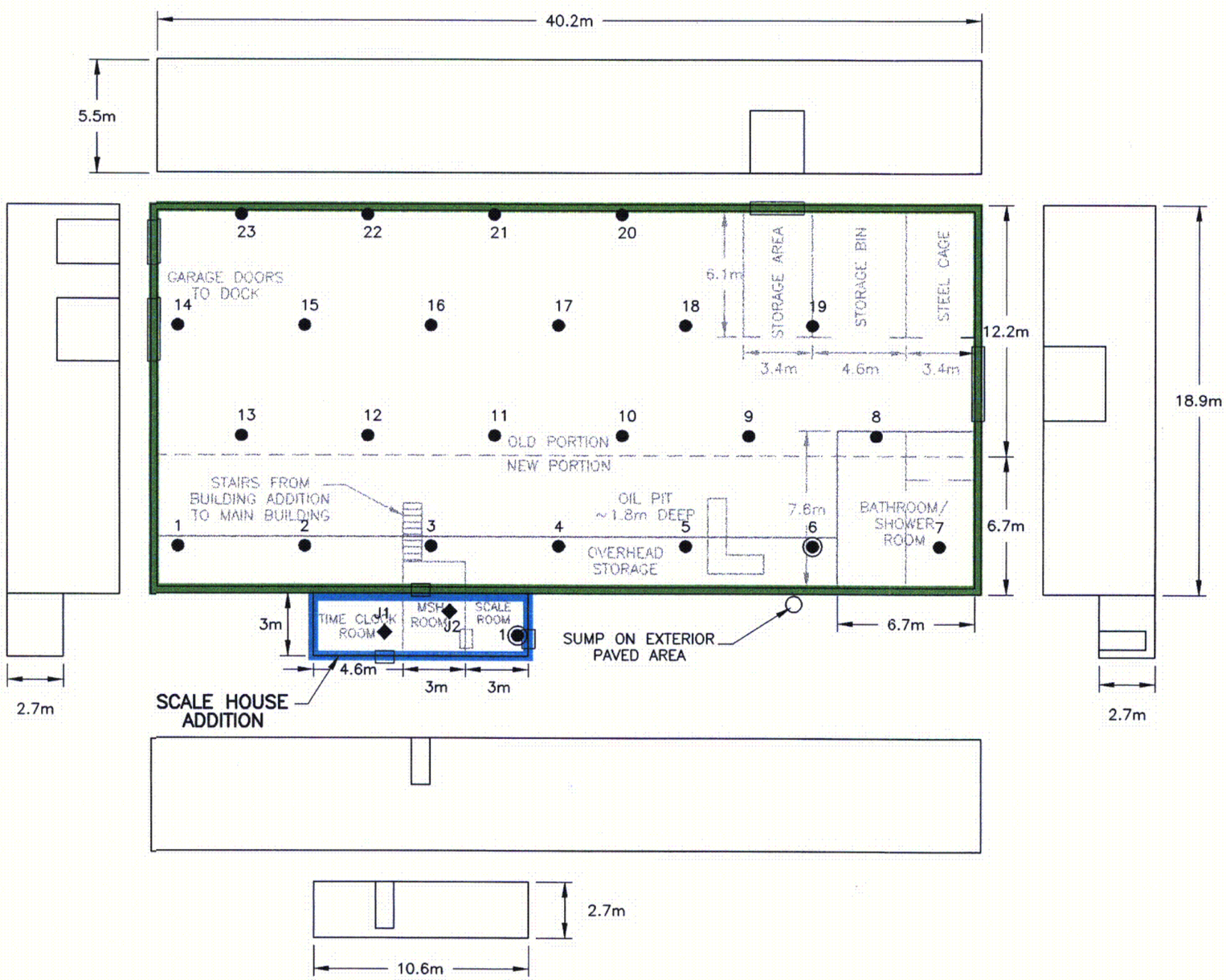

CONSTRUCTION MATERIAL

MAIN FLOOR – CONCRETE
MAIN WALLS – CONCRETE BLOCK
MAIN CEILING – CORRUGATED METAL

LEGEND

◉ RANDOM GENERATED START SAMPLE POINT

● TRIANGULAR GRID SYSTEMATIC SAMPLE POINT

◆ JUDGMENTAL SAMPLE POINT

SURVEY SUBUNIT 5 (MAIN BUILDING)

L = 6.2m
A = 760m^2
N = 23 SAMPLES

SURVEY SUBUNIT 6 (SCALE HOUSE ADDITION)

L = 6.2m
A = 35m^2
N = 1 SAMPLE

SCALE – FEET
20 0 20
6 0 6
SCALE – METERS

FIGURE 4A–2
STRUCTURAL SURFACES DISCRETE SAMPLE POINTS
MAINTENANCE BUILDING
FORMER KAISER ALUMINUM
SPECIALTY PRODUCTS FACILITY
TULSA, OKLAHOMA

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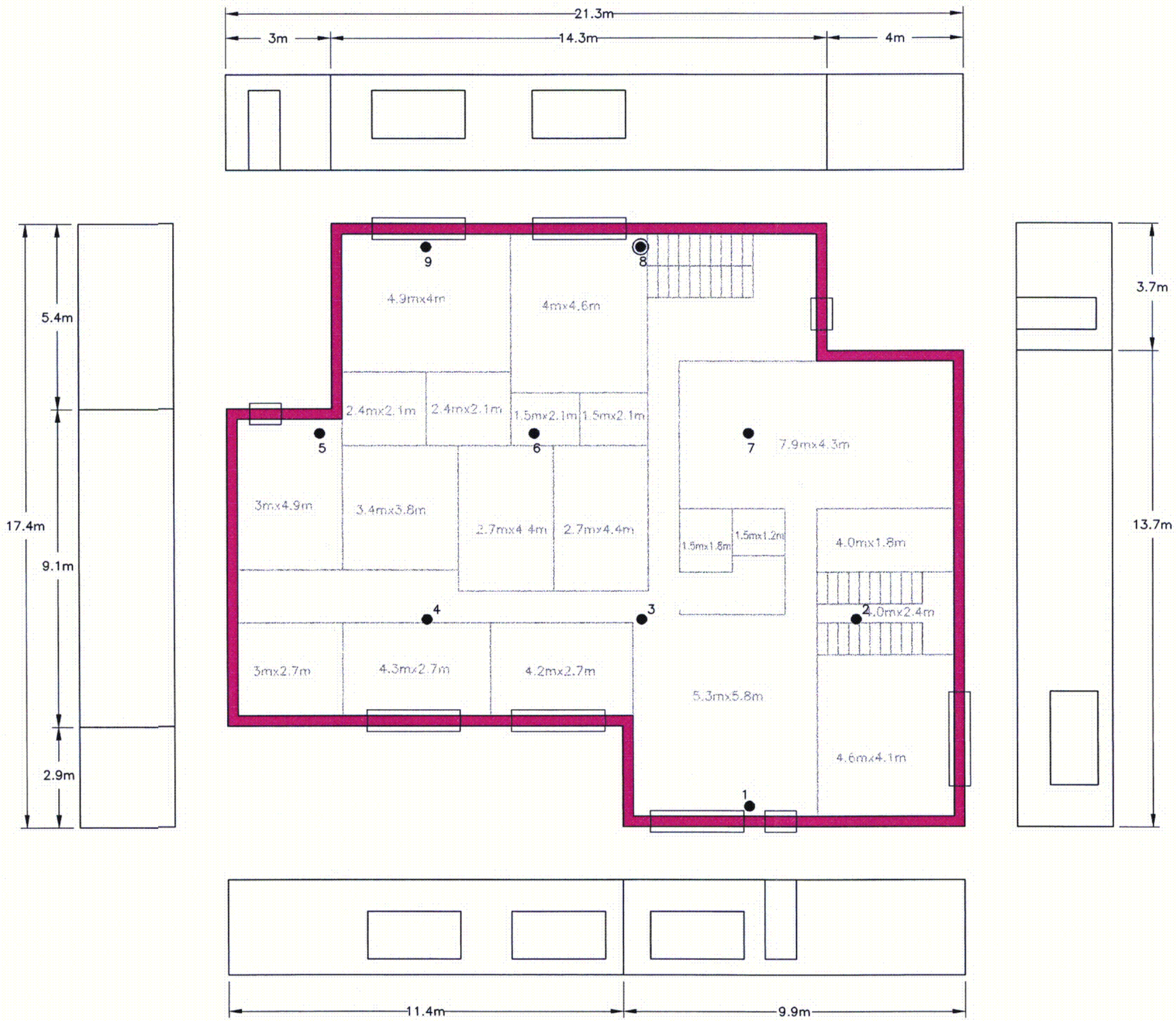

LEGEND

- RANDOM GENERATED START SAMPLE POINT
- TRIANGULAR GRID SYSTEMATIC SAMPLE POINT

SURVEY SUBUNIT 7

L = 6.2m
A = 310m^2
N = 9 SAMPLES

SCALE – FEET
10 0 10
3 0 3
SCALE – METERS

FIGURE 4A–3
STRUCTURAL SURFACES DISCRETE SAMPLE POINTS
OFFICE BUILDING–FIRST FLOOR
FORMER KAISER ALUMINUM
SPECIALTY PRODUCTS FACILITY
TULSA, OKLAHOMA

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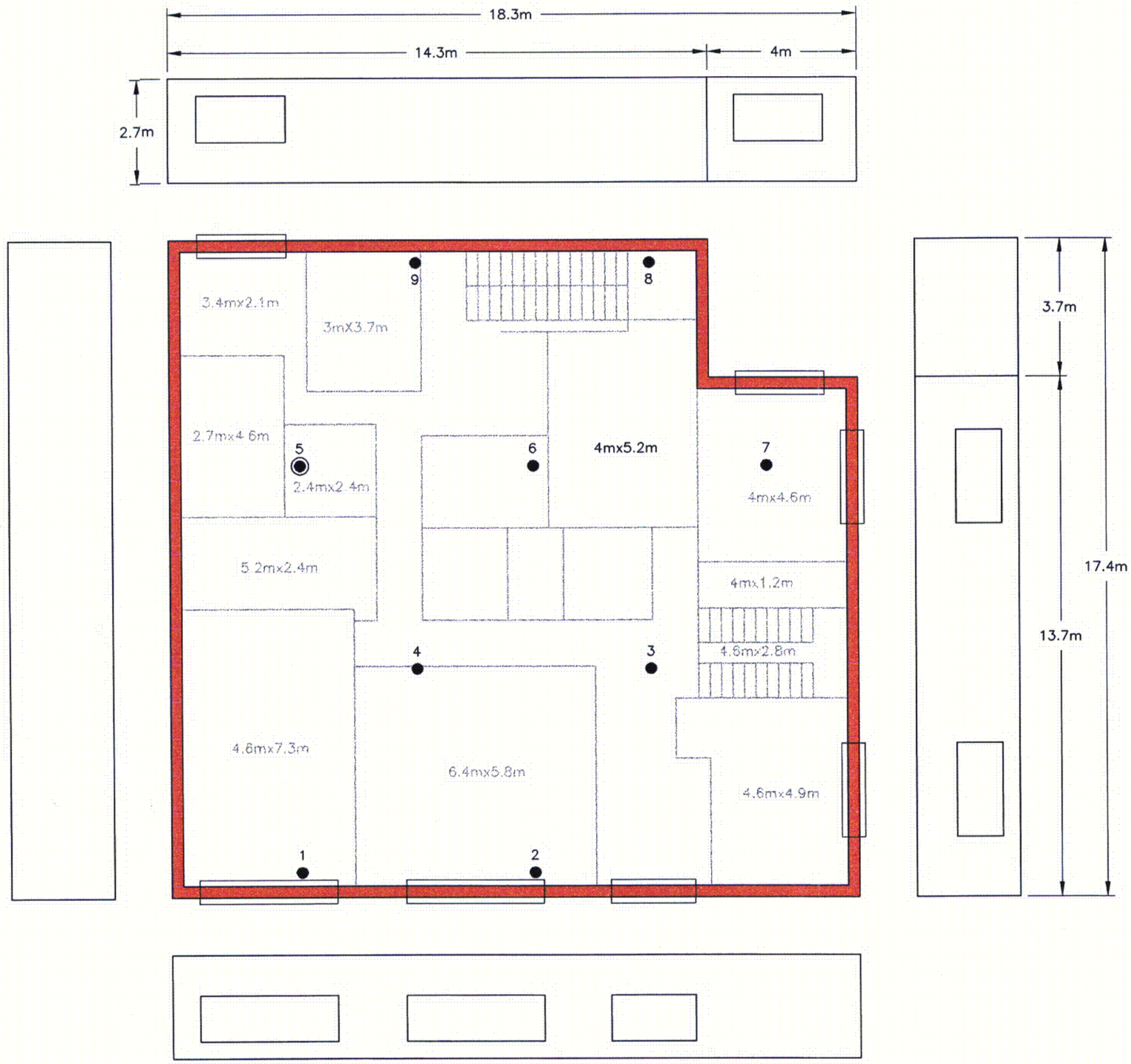

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LEGEND

- RANDOM GENERATED START SAMPLE POINT
- TRIANGULAR GRID SYSTEMATIC SAMPLE POINT

SURVEY SUBUNIT 8

L = 6.2m
A = 310m²
N = 9 SAMPLES

SCALE – FEET
10 0 10
3 0 3
SCALE – METERS

FIGURE 4A–4
STRUCTURAL SURFACES DISCRETE SAMPLE POINTS
OFFICE BUILDING–SECOND FLOOR
FORMER KAISER ALUMINUM
SPECIALTY PRODUCTS FACILITY
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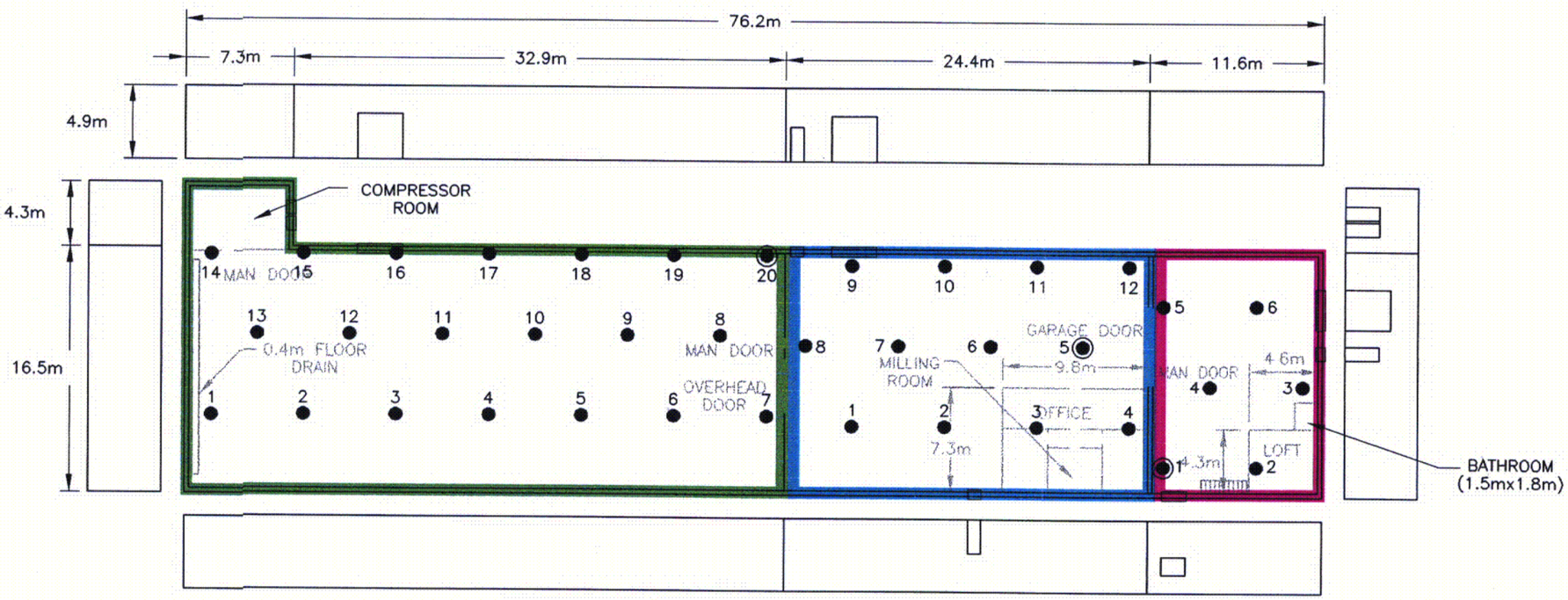

N

CONSTRUCTION MATERIAL

MAIN FLOOR – CONCRETE
MAIN WALLS – CONCRETE BLOCK
MAIN CEILING – CORRUGATED METAL

LEGEND

◉ RANDOM GENERATED START SAMPLE POINT

● TRIANGULAR GRID SYSTEMATIC SAMPLE POINT

SURVEY SUBUNIT 9 (WESTERN SECTION)

L = 6.2m
A = 695m²
N = 20 SAMPLES

SURVEY SUBUNIT 10 (CENTRAL SECTION)

L = 6.2m
A = 405m²
N = 12 SAMPLES

SURVEY SUBUNIT 11 (EASTERN SECTION)

L = 6.2m
A = 215m²
N = 6 SAMPLES

SCALE – FEET
30 0 30
9 0 9
SCALE – METERS

FIGURE 4A–5
STRUCTURAL SURFACES DISCRETE SAMPLE POINTS
WAREHOUSE BUILDING
FORMER KAISER ALUMINUM
SPECIALTY PRODUCTS FACILITY
TULSA, OKLAHOMA

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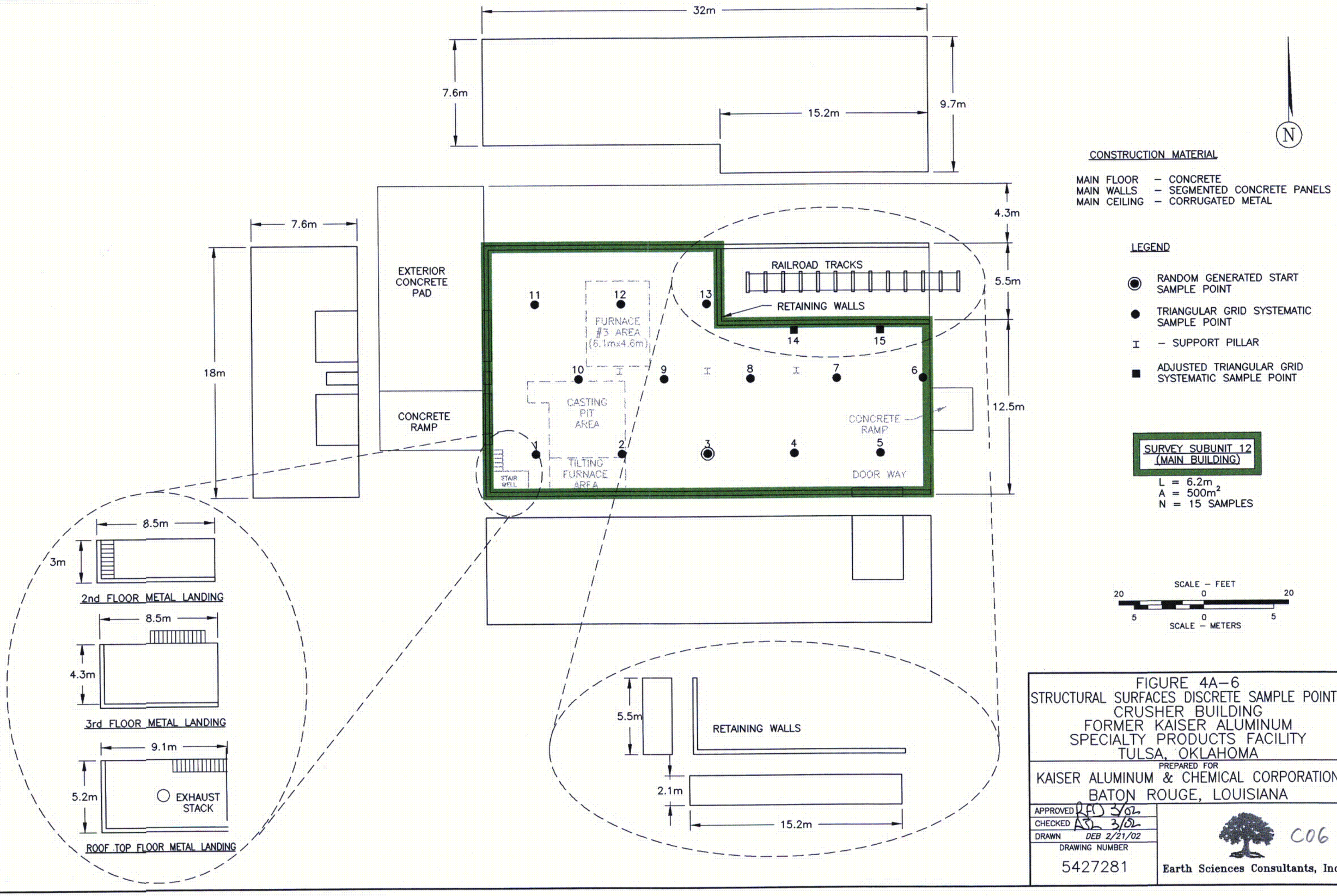

FIGURE 4A–6
STRUCTURAL SURFACES DISCRETE SAMPLE POINTS
CRUSHER BUILDING
FORMER KAISER ALUMINUM
SPECIALTY PRODUCTS FACILITY
TULSA, OKLAHOMA

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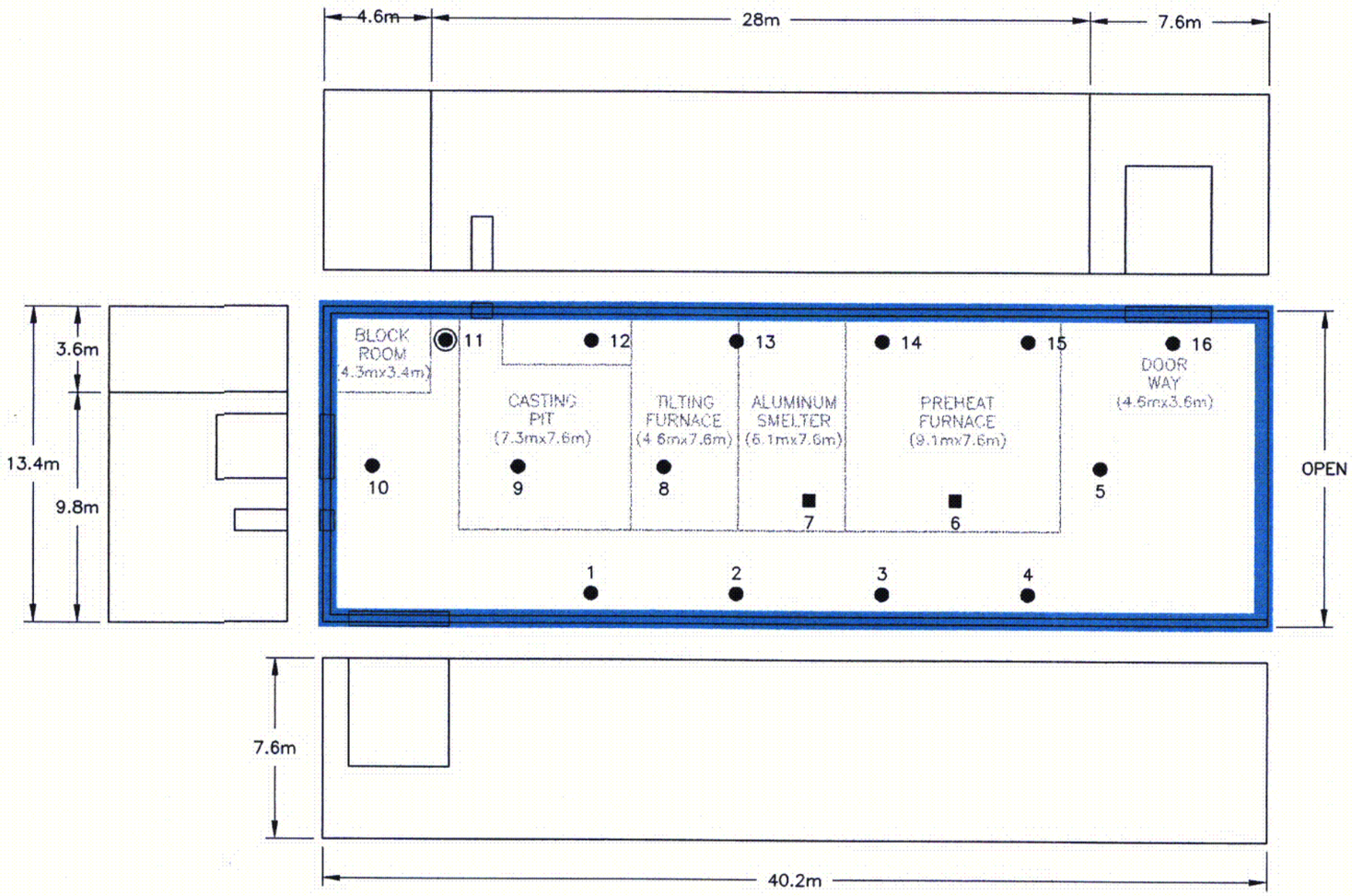

N

CONSTRUCTION MATERIAL

MAIN FLOOR – CONCRETE
MAIN WALLS – CONCRETE BLOCK
MAIN CEILING – CORRUGATED METAL

LEGEND

- RANDOM GENERATED START SAMPLE POINT
- TRIANGULAR GRID SYSTEMATIC SAMPLE POINT
- ADJUSTED TRIANGULAR GRID SYSTEMATIC SAMPLE POINT

SURVEY SUBUNIT 13

L = 6.2m
A = 540m^2
N = 16 SAMPLES

SCALE – FEET
20 0 20
5 0 5
SCALE – METERS

FIGURE4A–7
STRUCTURAL SURFACES DISCRETE SAMPLE POINTS
CRUSHER ADDITION BUILDING
FORMER KAISER ALUMINUM
SPECIALTY PRODUCTS FACILITY
TULSA, OKLAHOMA

PREPARED FOR
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FIGURE 4A-8

SURVEY UNIT DELINEATION
IMPACTED LAND AREAS
FORMER KAISER ALUMINUM
SPECIALTY PRODUCTS FACILITY
TULSA, OKLAHOMA

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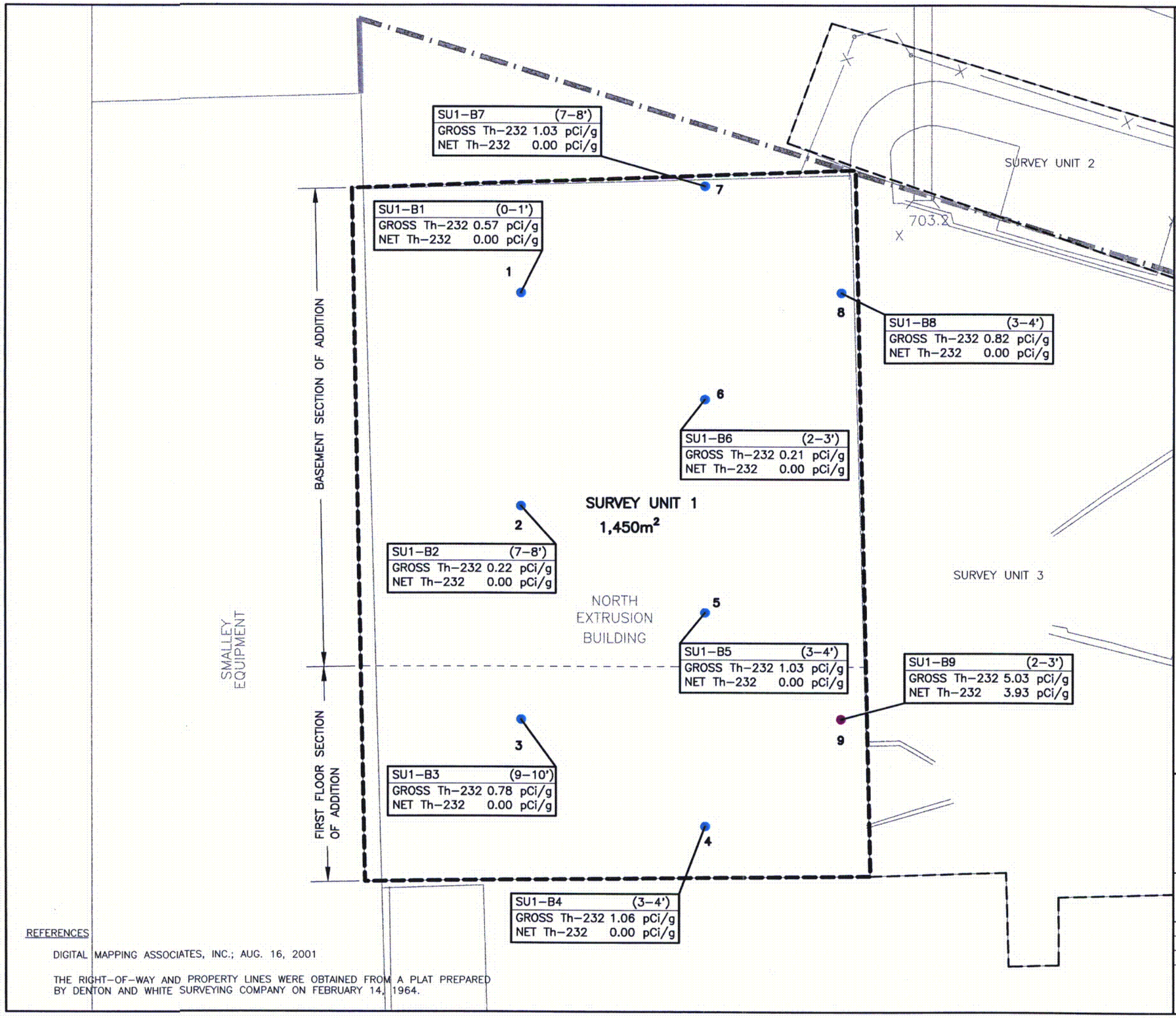

NOTE
BACKGROUND VALUE OF 1.1 pCi/g Th-232 SUBTRACTED FROM GROSS Th-232 ANALYTICAL RESULT.

LEGEND

- SAMPLE POINT WITH NET Th-232 ACTIVITY CONCENTRATION ≤3.0 pCi/g
- SAMPLE POINT WITH NET Th-232 ACTIVITY CONCENTRATION >3.0 pCi/g
- SURVEY UNIT BOUNDARY
- APPROXIMATE RIGHT-OF-WAY

SAMPLE ID (DEPTH)
GROSS Th-232
NET Th-232

ANALYTICAL RESULTS

SCALE – FEET
20 0 20
5 0 5
SCALE – METERS

REFERENCES

DIGITAL MAPPING ASSOCIATES, INC.; AUG. 16, 2001

THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM A PLAT PREPARED BY DENTON AND WHITE SURVEYING COMPANY ON FEBRUARY 14, 1964.

FIGURE 4A-9
TH-232 ANALYTICAL RESULTS SOIL CORE SAMPLES
SURVEY UNIT 1
FORMER KAISER ALUMINUM
SPECIALTY PRODUCTS FACILITY
TULSA, OKLAHOMA

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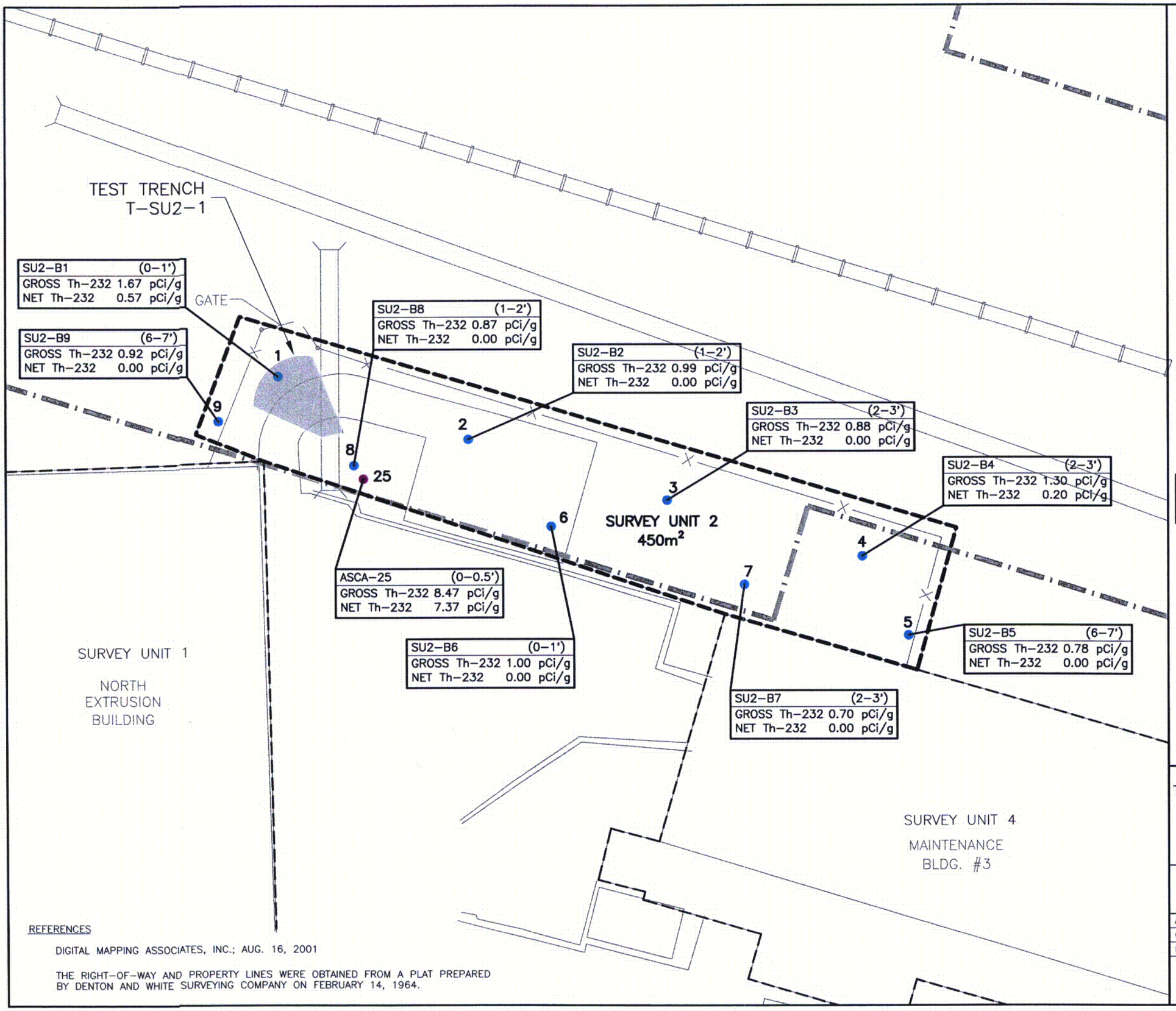

LEGEND

- SAMPLE POINT WITH NET Th-232 ACTIVITY CONCENTRATION ≤3.0 pCi/g
- SAMPLE POINT WITH NET Th-232 ACTIVITY CONCENTRATION >3.0 pCi/g
- APPROXIMATE SIZE AND LOCATION OF OF TEST TRENCH (4/4/02)
- SURVEY UNIT BOUNDARY
- APPROXIMATE RIGHT-OF-WAY

SAMPLE ID	(DEPTH)
GROSS Th-232	
NET Th-232	

ANALYTICAL RESULTS

NOTES

1. SAMPLE POINTS ADJUSTED TO FIT WITHIN SURVEY UNIT AREA.
2. BACKGROUND VALUE OF 1.1 pCi/g Th-232 SUBTRACTED FROM GROSS Th-232 ANALYTICAL RESULT.

SCALE – FEET
20 0 20
5 0 5
SCALE – METERS

REFERENCES

DIGITAL MAPPING ASSOCIATES, INC.; AUG. 16, 2001

THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM A PLAT PREPARED BY DENTON AND WHITE SURVEYING COMPANY ON FEBRUARY 14, 1964.

FIGURE 4A-10
Th-232 ANALYTICAL RESULTS SOIL CORE SAMPLES
SURVEY UNIT 2
FORMER KAISER ALUMINUM
SPECIALTY PRODUCTS FACILITY
TULSA, OKLAHOMA

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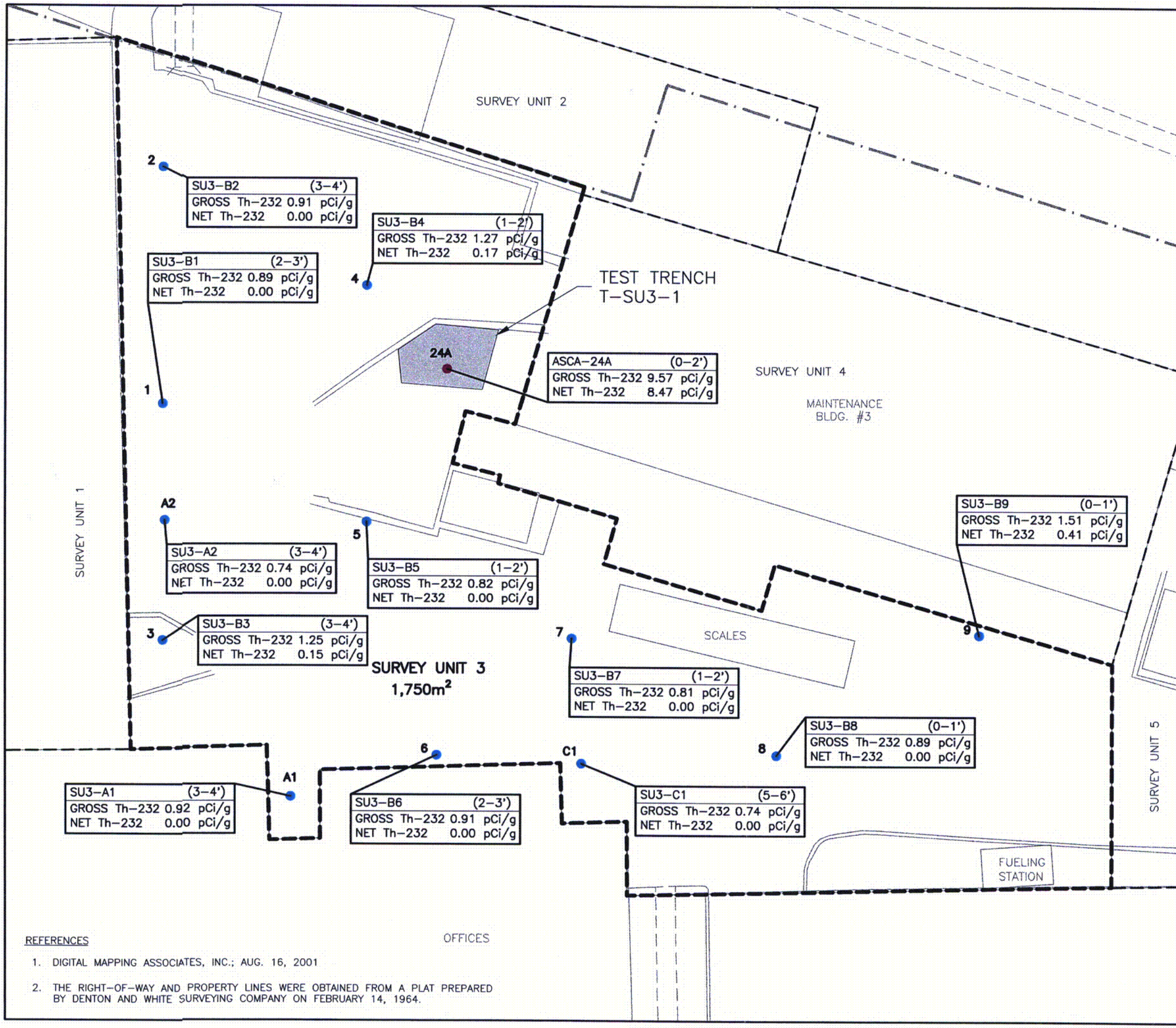

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NOTE
BACKGROUND VALUE OF 1.1 pCi/g Th-232 SUBTRACTED FROM GROSS Th-232 ANALYTICAL RESULT.

LEGEND

- SAMPLE POINT WITH NET Th-232 ACTIVITY CONCENTRATION ≤3.0 pCi/g
- SAMPLE POINT WITH NET Th-232 ACTIVITY CONCENTRATION >3.0 pCi/g
- APPROXIMATE SIZE AND LOCATION OF OF TEST TRENCH (4/4/02)
- SURVEY UNIT BOUNDARY
- APPROXIMATE RIGHT-OF-WAY

SAMPLE ID (DEPTH)
GROSS Th-232
NET Th-232

ANALYTICAL RESULTS

SCALE – FEET
20 0 20
5 0 5
SCALE – METERS

REFERENCES

1. DIGITAL MAPPING ASSOCIATES, INC.; AUG. 16, 2001
2. THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM A PLAT PREPARED BY DENTON AND WHITE SURVEYING COMPANY ON FEBRUARY 14, 1964.

FIGURE 4A-11
Th-232 ANALYTICAL RESULTS SOIL CORE SAMPLES
SURVEY UNIT 3
FORMER KAISER ALUMINUM
SPECIALTY PRODUCTS FACILITY
TULSA, OKLAHOMA

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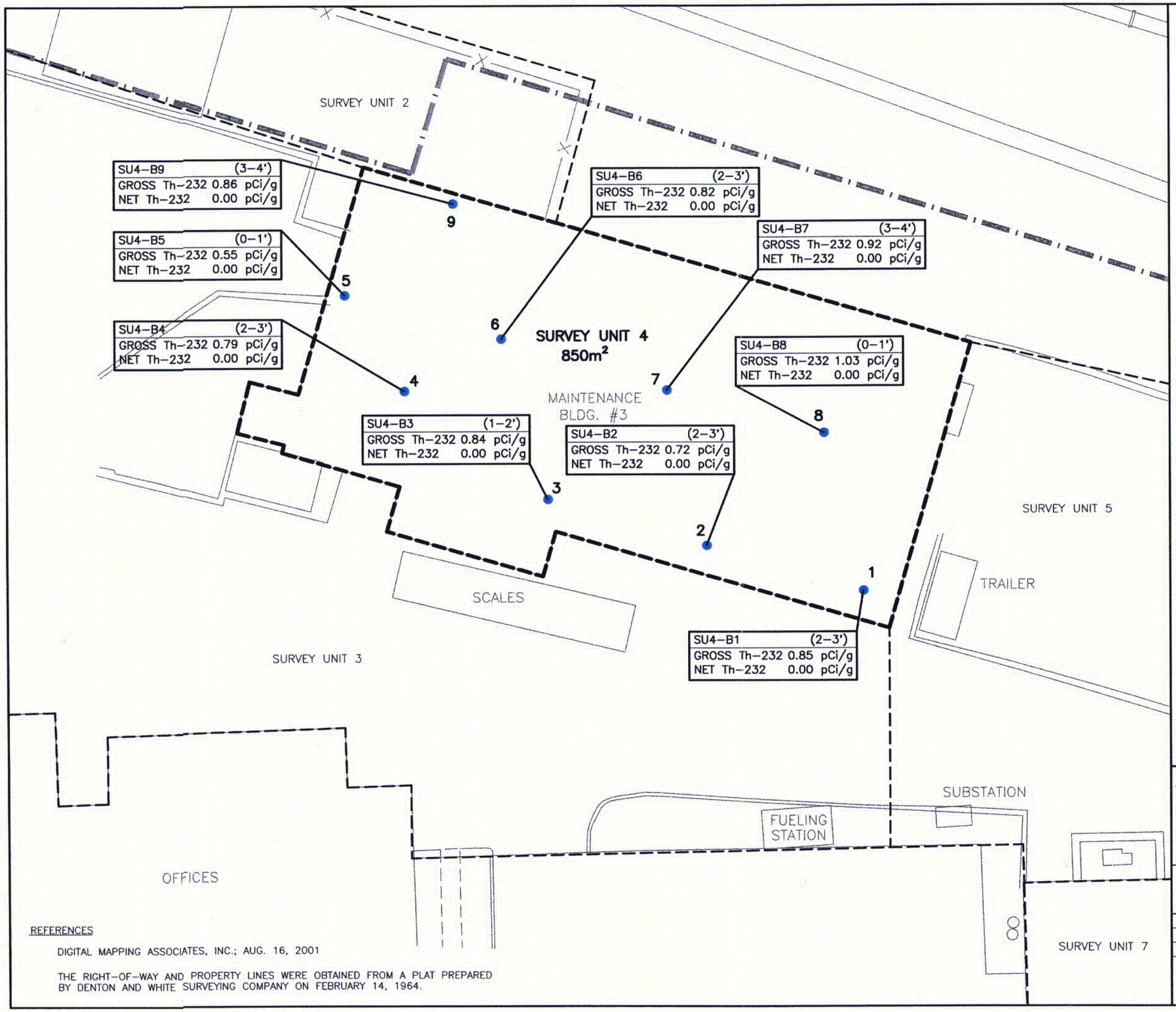

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NOTE
BACKGROUND VALUE OF 1.1 pCi/g Th–232 SUBTRACTED FROM GROSS Th–232 ANALYTICAL RESULT.

LEGEND

- SAMPLE POINT WITH NET Th–232 ACTIVITY CONCENTRATION ≤3.0 pCi/g
- SAMPLE POINT WITH NET Th–232 ACTIVITY CONCENTRATION >3.0 pCi/g
- SURVEY UNIT BOUNDARY
- APPROXIMATE RIGHT–OF–WAY

SAMPLE ID (DEPTH)
GROSS Th–232
NET Th–232

ANALYTICAL RESULTS

SCALE – FEET
20 0 20
5 0 5
SCALE – METERS

REFERENCES

DIGITAL MAPPING ASSOCIATES, INC.; AUG. 16, 2001

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FIGURE 4A–12
Th–232 ANALYTICAL RESULTS SOIL CORE SAMPLES
SURVEY UNIT 4
FORMER KAISER ALUMINUM
SPECIALTY PRODUCTS FACILITY
TULSA, OKLAHOMA

PREPARED FOR
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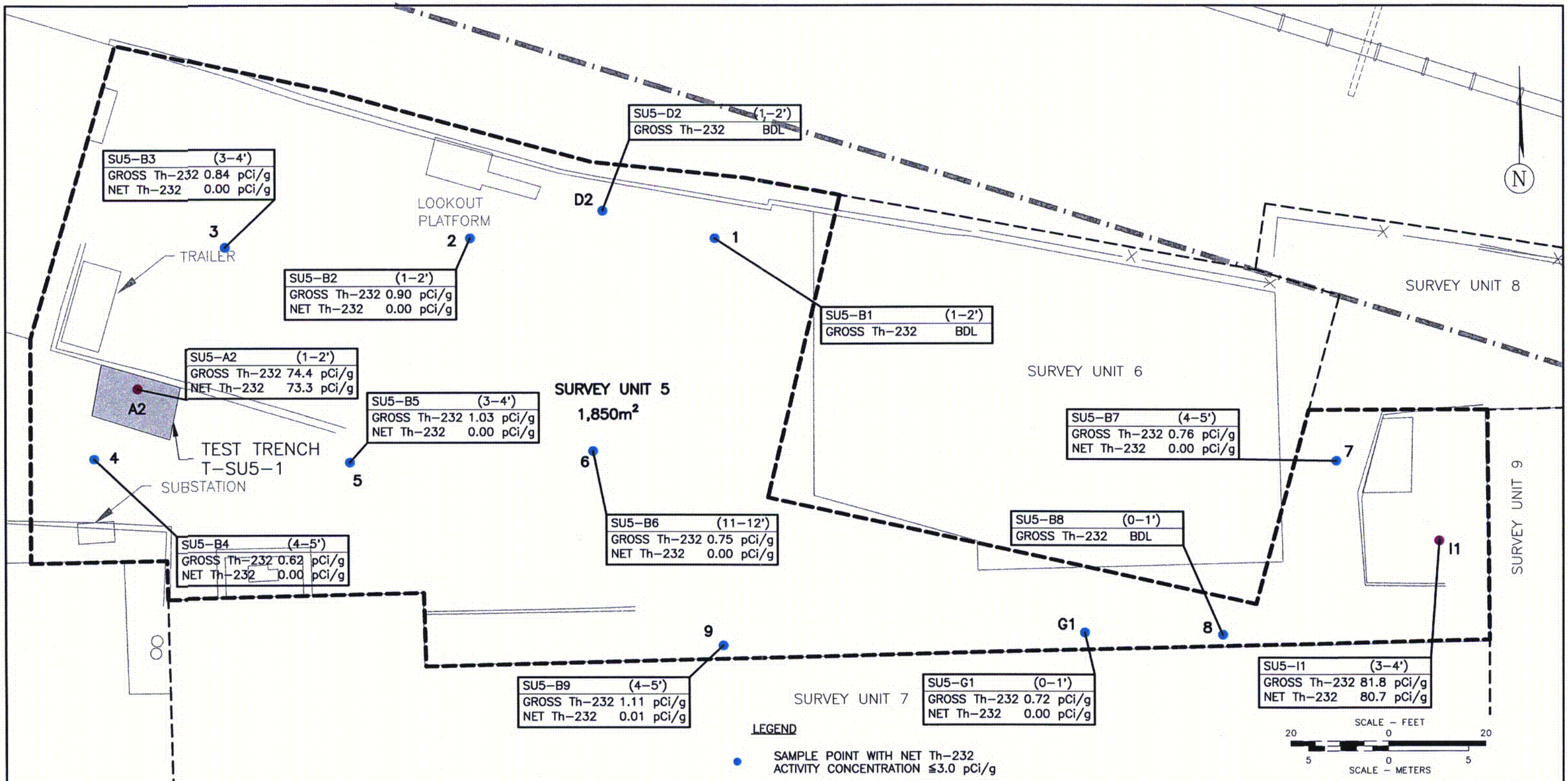

LEGEND

- SAMPLE POINT WITH NET Th-232 ACTIVITY CONCENTRATION ≤3.0 pCi/g
- SAMPLE POINT WITH NET Th-232 ACTIVITY CONCENTRATION >3.0 pCi/g
- APPROXIMATE SIZE AND LOCATION OF OF TEST TRENCH (4/4/02)
- SURVEY UNIT BOUNDARY
- APPROXIMATE RIGHT-OF-WAY

SAMPLE ID	(DEPTH)
GROSS Th-232	
NET Th-232	

ANALYTICAL RESULTS

NOTE
BACKGROUND VALUE OF 1.1 pCi/g Th-232 SUBTRACTED FROM GROSS Th-232 ANALYTICAL RESULT.

REFERENCES

DIGITAL MAPPING ASSOCIATES, INC.; AUG. 16, 2001

THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM A PLAT PREPARED BY DENTON AND WHITE SURVEYING COMPANY ON FEBRUARY 14, 1964.

FIGURE 4A-13
Th-232 ANALYTICAL RESULTS SOIL CORE SAMPLES
SURVEY UNIT 5
FORMER KAISER ALUMINUM
SPECIALTY PRODUCTS FACILITY
TULSA, OKLAHOMA

PREPARED FOR
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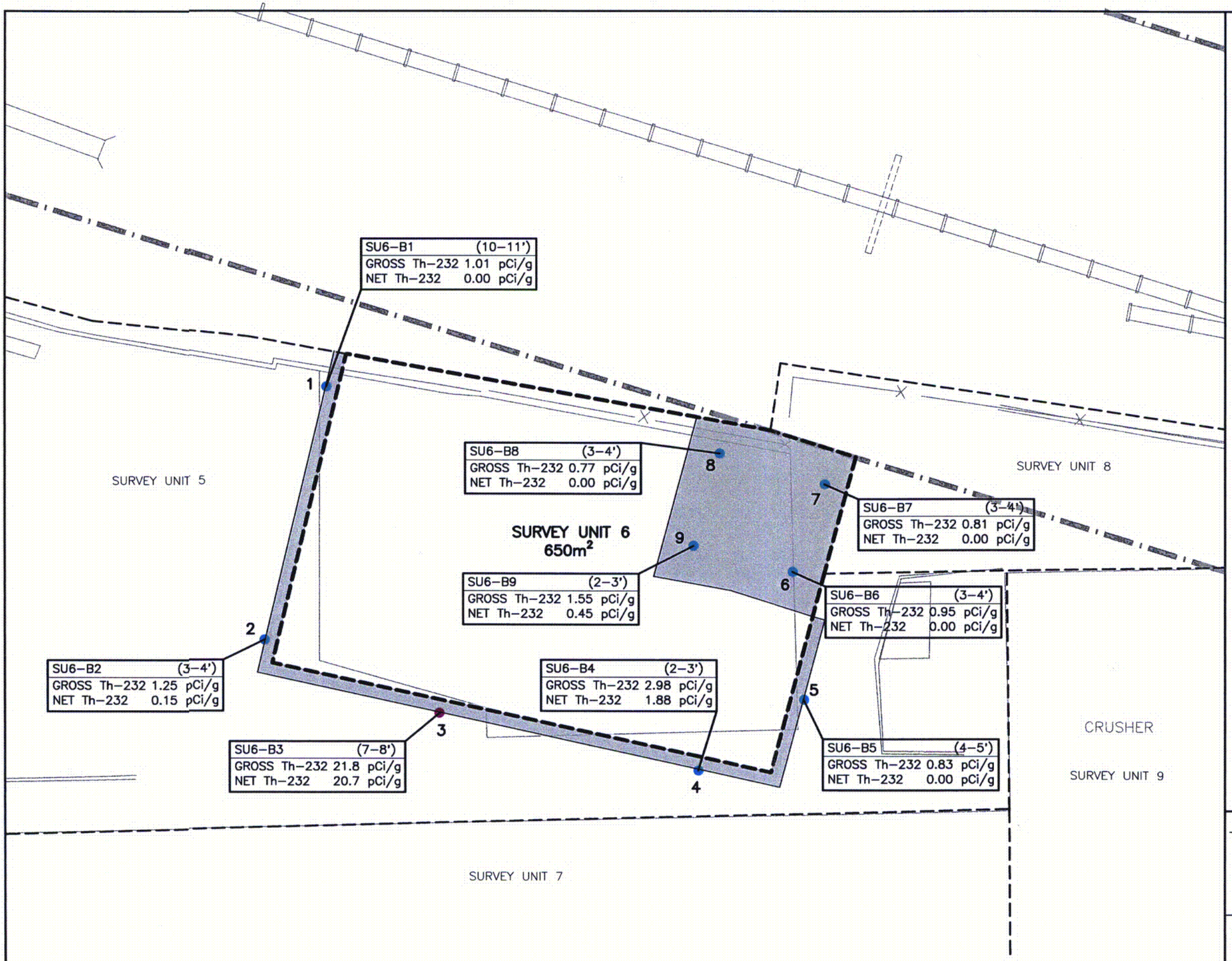

NOTE
BACKGROUND VALUE OF 1.1 pCi/g Th-232 SUBTRACTED FROM GROSS Th-232 ANALYTICAL RESULT.

N

LEGEND

- SAMPLE POINT WITH NET Th-232 ACTIVITY CONCENTRATION ≤3.0 pCi/g
- SAMPLE POINT WITH NET Th-232 ACTIVITY CONCENTRATION >3.0 pCi/g
- SURVEY UNIT BOUNDARY
- APPROXIMATE RIGHT-OF-WAY
- AREA SAMPLED AND SURVEYED

SAMPLE ID (DEPTH)
GROSS Th-232
NET Th-232

ANALYTICAL RESULTS

SCALE – FEET
20 0 20
5 0 5
SCALE – METERS

REFERENCES

DIGITAL MAPPING ASSOCIATES, INC.; AUG. 16, 2001

THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM A PLAT PREPARED BY DENTON AND WHITE SURVEYING COMPANY ON FEBRUARY 14, 1964.

FIGURE 4A-14
Th-232 ANALYTICAL RESULTS SOIL CORE SAMPLES
SURVEY UNIT 6
FORMER KAISER ALUMINUM
SPECIALTY PRODUCTS FACILITY
TULSA, OKLAHOMA

PREPARED FOR
KAISER ALUMINUM & CHEMICAL CORPORATION
BATON ROUGE, LOUISIANA

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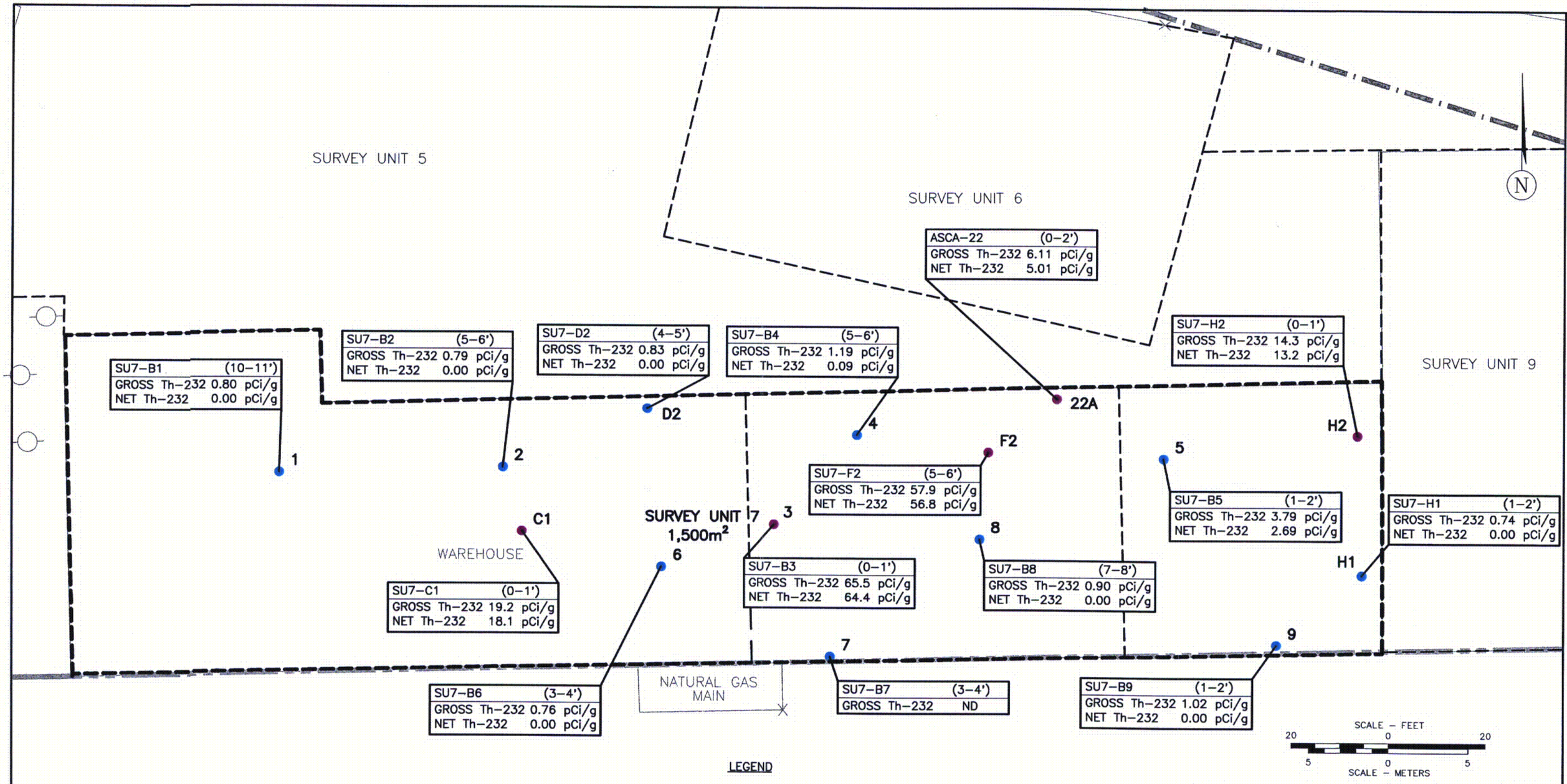

LEGEND

- SAMPLE POINT WITH NET Th-232 ACTIVITY CONCENTRATION ≤3.0 pCi/g
- SAMPLE POINT WITH NET Th-232 ACTIVITY CONCENTRATION >3.0 pCi/g
- SURVEY UNIT BOUNDARY
- APPROXIMATE RIGHT-OF-WAY
- SAMPLE ID (DEPTH) / GROSS Th-232 / NET Th-232 — ANALYTICAL RESULTS

NOTE
BACKGROUND VALUE OF 1.1 pCi/g Th-232 SUBTRACTED FROM GROSS Th-232 ANALYTICAL RESULT.

REFERENCES

DIGITAL MAPPING ASSOCIATES, INC.; AUG. 16, 2001

THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM A PLAT PREPARED BY DENTON AND WHITE SURVEYING COMPANY ON FEBRUARY 14, 1964.

FIGURE 4A-15
Th-232 ANALYTICAL RESULTS SOIL CORE SAMPLES
SURVEY UNIT 7
FORMER KAISER ALUMINUM
SPECIALTY PRODUCTS FACILITY
TULSA, OKLAHOMA

PREPARED FOR
KAISER ALUMINUM & CHEMICAL CORPORATION
BATON ROUGE, LOUISIANA

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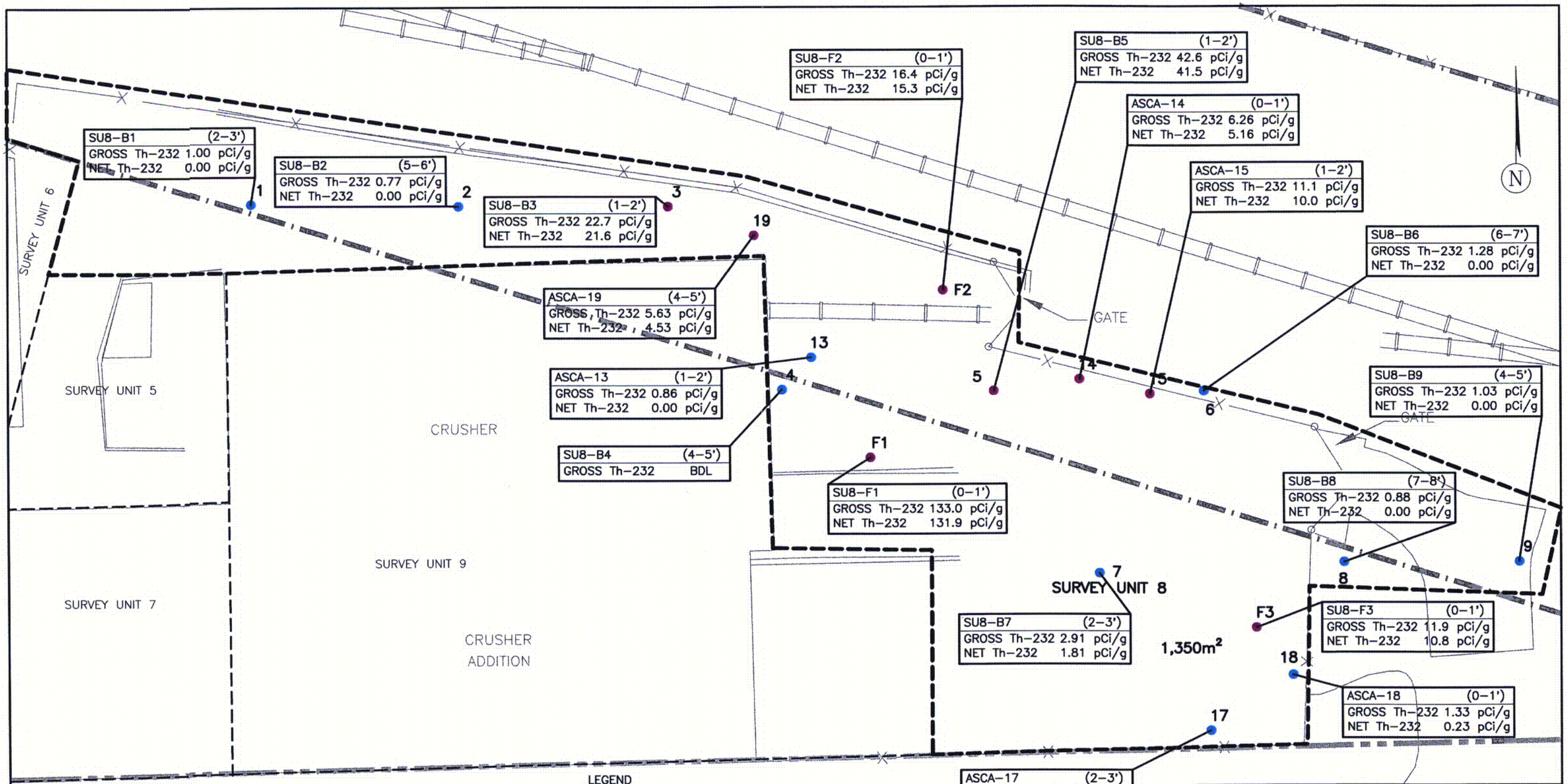

LEGEND

- SAMPLE POINT WITH NET Th-232 ACTIVITY CONCENTRATION ≤3.0 pCi/g
- SAMPLE POINT WITH NET Th-232 ACTIVITY CONCENTRATION >3.0 pCi/g
- SURVEY UNIT BOUNDARY
- APPROXIMATE RIGHT-OF-WAY

SAMPLE ID (DEPTH)
GROSS Th-232
NET Th-232

ANALYTICAL RESULTS

SCALE – FEET: 20 0 20

SCALE – METERS: 5 0 5

NOTE
BACKGROUND VALUE OF 1.1 pCi/g Th-232 SUBTRACTED FROM GROSS Th-232 ANALYTICAL RESULT.

REFERENCES

DIGITAL MAPPING ASSOCIATES, INC.; AUG. 16, 2001

THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM A PLAT PREPARED BY DENTON AND WHITE SURVEYING COMPANY ON FEBRUARY 14, 1964.

FIGURE 4A-16
Th-232 ANALYTICAL RESULTS SOIL CORE SAMPLES
SURVEY UNIT 8
FORMER KAISER ALUMINUM
SPECIALTY PRODUCTS FACILITY
TULSA, OKLAHOMA

PREPARED FOR
KAISER ALUMINUM & CHEMICAL CORPORATION
BATON ROUGE, LOUISIANA

APPROVED	DFD 5/02
CHECKED	ABL 5/02
DRAWN	DEB 2/25/02
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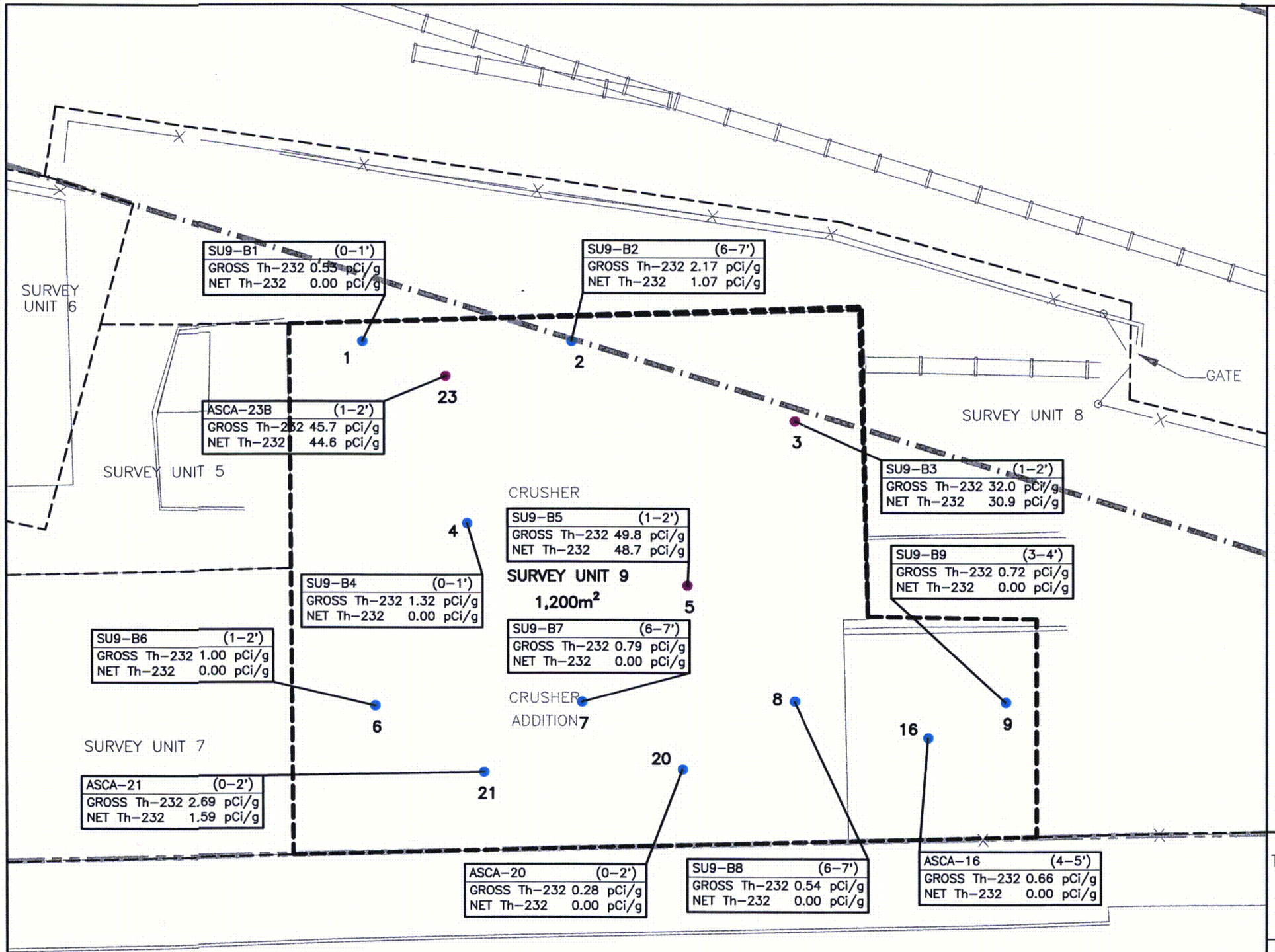

N

NOTE
BACKGROUND VALUE OF 1.1 pCi/g Th-232 SUBTRACTED FROM GROSS Th-232 ANALYTICAL RESULT.

LEGEND

- SAMPLE POINT WITH NET Th-232 ACTIVITY CONCENTRATION ≤3.0 pCi/g
- SAMPLE POINT WITH NET Th-232 ACTIVITY CONCENTRATION >3.0 pCi/g
- SURVEY UNIT BOUNDARY
- APPROXIMATE RIGHT-OF-WAY

SAMPLE ID (DEPTH)
GROSS Th-232
NET Th-232

ANALYTICAL RESULTS

SCALE – FEET
20 0 20
5 0 5
SCALE – METERS

REFERENCES

DIGITAL MAPPING ASSOCIATES, INC.; AUG. 16, 2001

THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM A PLAT PREPARED BY DENTON AND WHITE SURVEYING COMPANY ON FEBRUARY 14, 1964.

FIGURE 4A-17
Th-232 ANALYTICAL RESULTS SOIL CORE SAMPLES
SURVEY UNIT 9
FORMER KAISER ALUMINUM
SPECIALTY PRODUCTS FACILITY
TULSA, OKLAHOMA

PREPARED FOR
KAISER ALUMINUM & CHEMICAL CORPORATION
BATON ROUGE, LOUISIANA

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Table of Contents

	Page
5.0 Dose Modeling Evaluations	5-1
5.1 Introduction	5-1
5.2 Unrestricted Release Using Site-Specific Information	5-1
5.2.1 Source Term	5-1
5.2.1.1 Principal Radionuclides	5-1
5.2.1.2 Geochemistry	5-1
5.2.1.3 Spatial Distribution and Volume Estimates	5-1
5.2.1.4 Chosen Remedial Action: Off-Site Disposal/Site Restoration	5-1
5.2.2 Critical Groups Scenarios and Pathway Identification and Selection	5-1
5.2.2.1 Scenario Identification	5-2
5.2.2.2 Critical Group Determination	5-2
5.2.2.3 Exposure Pathways	5-2
5.2.3 Conceptual Model	5-2
5.2.3.1 Affected Zone	5-2
5.2.3.2 Saturated Zone	5-2
5.2.3.3 Conceptual Model for a Dual Simulation Approach to Dose Modeling	5-2
5.2.4 Calculations and Input Parameters	5-2
5.2.5 Uncertainty Analysis	5-2
5.2.6 Compliance with Radiological Criteria for License Termination	5-2
References	5-3

5.0 Dose Modeling Evaluations

5.1 Introduction

As, defined in the June 2001 Decommissioning Plan for the Kaiser Tulsa facility, the RESRAD model was used to calculate a preliminary $DCGL_w$ for the facility based on site-specific knowledge. The $DCGL_W$ (3.0 pCi/g) was calculated to correspond with the basic dose limit criterion of 25 mrem/yr. Derivation of the $DCGL_W$ incorporated the Unity Rule which assures that cumulative doses from Th-232, Th-230, and their daughter products do not result in a total dose that exceeds the basic dose limit. The $DCGL_W$ was used to develop a conservative estimate of the volume of impacted soil potentially requiring remediation in the former operational area. This small quantity, 60,000 ft^3, represents approximately 1 percent of the quantity modeled in the June 2001 Decommissioning Plan for the Tulsa facility. This amount is considered insignificant and, therefore, additional dose modeling is not necessary for this DPA. Additional information regarding the dose modeling evaluations for the Tulsa facility is provided in Chapter 5.0 of the June 2001 Decommissioning Plan.

5.2 Unrestricted Release Using Site-Specific Information

5.2.1 Source Term

Refer to Section 5.2.1 of the June 2001 Decommissioning Plan for the Tulsa facility.

5.2.1.1 Principal Radionuclides

Refer to Section 5.2.1.1 of the June 2001 Decommissioning Plan for the Tulsa facility.

5.2.1.2 Geochemistry

Refer to Section 5.2.1.2 of the June 2001 Decommissioning Plan for the Tulsa facility.

5.2.1.3 Spatial Distribution and Volume Estimates

Refer to Section 5.2.1.3 of the June 2001 Decommissioning Plan for the Tulsa facility.

5.2.1.4 Chosen Remedial Action: Off-Site Disposal/Site Restoration

Refer to Section 5.2.1.4 of the June 2001 Decommissioning Plan for the Tulsa facility.

5.2.2 Critical Groups Scenarios and Pathway Identification and Selection

Refer to Section 5.2.2 of the June 2001 Decommissioning Plan for the Tulsa facility.

5.2.2.1 Scenario Identification

Refer to Section 5.2.2.1 of the June 2001 Decommissioning Plan for the Tulsa facility.

5.2.2.2 Critical Group Determination

Refer to Section 5.2.2.2 of the June 2001 Decommissioning Plan for the Tulsa facility.

5.2.2.3 Exposure Pathways

Refer to Section 5.2.2.3 of the June 2001 Decommissioning Plan for the Tulsa facility.

5.2.3 Conceptual Model

Refer to Section 5.2.3 of the June 2001 Decommissioning Plan for the Tulsa facility.

5.2.3.1 Affected Zone

Refer to Section 5.2.3.1 of the June 2001 Decommissioning Plan for the Tulsa facility.

5.2.3.2 Saturated Zone

Refer to Section 5.2.3.2 of the June 2001 Decommissioning Plan for the Tulsa facility.

5.2.3.3 Conceptual Model for a Dual Simulation Approach to Dose Modeling

Refer to Section 5.2.3.3 of the June 2001 Decommissioning Plan for the Tulsa facility.

5.2.4 Calculations and Input Parameters

Refer to Section 5.2.4 of the June 2001 Decommissioning Plan for the Tulsa facility.

5.2.5 Uncertainty Analysis

Refer to Section 5.2.5 of the June 2001 Decommissioning Plan for the Tulsa facility.

5.2.6 Compliance with Radiological Criteria for License Termination

Refer to Section 5.2.6 of the June 2001 Decommissioning Plan for the Tulsa facility.

References

1. U.S. Department of Energy, September 1999, RESRAD for Windows, Version 5.95, Environmental Assessment Division of Argonne National Laboratory.

2. Earth Sciences, June 2001, Decommissioning Plan, Tulsa Facility, Tulsa, Oklahoma, Kaiser Aluminum & Chemical Corporation, Baton Rouge, Louisiana.

Table of Contents

	Page
6.0 Alternatives Considered and Rationale for Chosen Alternative	6-1
6.1 Chosen Alternative	6-1
6.2 No-Action Alternative	6-1
Reference	6-2

6.0 Alternatives Considered and Rationale for Chosen Alternative

A description of the decommissioning alternatives considered and the rationale for the chosen alternative for the Kaiser Tulsa facility was provided in the June 2001 Decommissioning Plan. Appropriate sections of the June 2001 Decommissioning Plan are referenced below.

6.1 Chosen Alternative

The decommissioning alternative chosen for implementation closely mirrors that presented in the June 2001 Decommissioning Plan. The planned remediation for the former operational area requires excavating material with a net Th-232 activity concentration greater than the established $DCGL_w$ of 3.0 pCi/g based on a dose limit criterion of 25 mrem/yr. The excavated material will be transported to the pond parcel. Material with Th-232 activity concentrations greater than 31.1 pCi/g will be segregated and disposed off site either as exempt or nonexempt material at a permitted facility. Material with activity concentrations less than 31.1 pCi/g Th-232 will be placed in the pond parcel excavation as backfill. The former operational area excavation will be backfilled with clean off-site soil.

Additional information on the chosen alternative relative to the segregation of material for off-site disposal and on-site backfill for the pond parcel excavation is presented in Section 6.1 of the June 2001 Decommissioning Plan for the Tulsa facility.

6.2 No-Action Alternative

Refer to Section 6.2 of the June 2001 Decommissioning Plan for the Tulsa facility.

Reference

1. Earth Sciences, June 2001, Decommissioning Plan, Tulsa Facility, Tulsa, Oklahoma, Kaiser Aluminum & Chemical Corporation, Baton Rouge, Louisiana.

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Table of Contents

	Page
7.0 ALARA Analysis	7-1
7.1 Quantitative Cost-Benefit Analysis	7-1
7.1.1 Benefit Calculation	7-1
7.1.2 Cost of Remediation	7-1
7.1.3 Regulatory Costs	7-1
7.1.4 Land Values	7-1
7.1.5 Esthetics	7-1
7.1.6 Reduction in Public Opposition	7-2
7.2 Summary of ALARA Analysis	7-2
References	7-3

7.0 ALARA Analysis

The planned remediation method for the former operational area is described in Chapters 6.0 and 8.0 of this DPA. The implementation of this plan results in removal of material with a net Th-232 activity concentration greater than 3.0 pCi/g, based on a dose limit criterion of 25 mrem/yr. The removed material will be transported to the pond parcel area, where it will be segregated according to the June 2001 DP. Excavations in the former operational area as a result of remediation activities will be backfilled with clean off-site soil. The estimated excavation quantity (60,000 ft^3) for the former operational area decommissioning activities represents approximately 1 percent of the quantity modeled in the June 2001 Decommissioning Plan for the Tulsa facility. This amount is considered insignificant and therefore additional ALARA analysis is not necessary for this DPA.

An ALARA analysis of the chosen remediation alternative for the Kaiser Tulsa facility was provided in the June 2001 Decommissioning Plan. Appropriate sections of the June 2001 Decommissioning Plan are referenced below.

7.1 Quantitative Cost-Benefit Analysis

Refer to Section 7.1 of the June 2001 Decommissioning Plan for the Tulsa facility.

7.1.1 Benefit Calculation

Refer to Section 7.1.1 of the June 2001 Decommissioning Plan for the Tulsa facility.

7.1.2 Cost of Remediation

Refer to Section 7.1.2 of the June 2001 Decommissioning Plan for the Tulsa facility.

7.1.3 Regulatory Costs

Refer to Section 7.1.3 of the June 2001 Decommissioning Plan for the Tulsa facility.

7.1.4 Land Values

Refer to Section 7.1.4 of the June 2001 Decommissioning Plan for the Tulsa facility.

7.1.5 Esthetics

Refer to Section 7.1.5 of the June 2001 Decommissioning Plan for the Tulsa facility.

7.1.6 Reduction in Public Opposition

Refer to Section 7.1.6 of the June 2001 Decommissioning Plan for the Tulsa facility.

7.2 Summary of ALARA Analysis

Refer to Section 7.2 of the June 2001 Decommissioning Plan for the Tulsa facility.

References

1. NRC, August 1998, Draft Regulatory Guide DG-4006, Demonstrating Compliance with the Radiological Criteria for License Termination.

2. Earth Sciences, June 2001, Decommissioning Plan, Tulsa Facility, Tulsa, Oklahoma, Kaiser Aluminum & Chemical Corporation, Baton Rouge, Louisiana.

Table of Contents

	Page
8.0 Planned Decommissioning Activities	8-1
8.1 Predecommissioning Activities	8-1
8.2 Remediation Plan	8-1
8.2.1 Summary of Remediation/Removal Activities	8-2
8.2.2 Site Preparation	8-3
8.2.3 Excavation	8-3
8.2.3.1 Water Handling	8-3
8.2.3.2 Excavation Support	8-3
8.2.4 Backfilling	8-4
8.2.5 Off-Site Disposal	8-4
8.2.6 Site Restoration	8-4
8.3 Decontamination Methods	8-4
8.4 Procedures and Controls	8-4
8.5 Schedule	8-5
Reference	8-6

Table

Table 8-1 – Excavation Volume Estimate, Decommissioning Plan Addendum

Figures

Figure 8A-1 – Excavation Plan, Former Operational Area (Dwg 5427A446)
Figure 8A-2 – Conceptual Site Restoration Plan, Former Operational Area (Dwg 5427A447)

8.0 Planned Decommissioning Activities

A description of the planned decommissioning activities for the affected portions of the 14-acre pond parcel at the former Kaiser Aluminum Specialty Products facility was provided in the June 2001 Decommissioning Plan. Appropriate sections of the June 2001 Decommissioning Plan are referenced or summarized below. Supplemental information relative to the planned decommissioning activities for the former operational area of the facility is provided in the following sections, where appropriate.

8.1 Predecommissioning Activities

Kaiser anticipates completing select predecommissioning activities prior to undertaking the remediation project described in this DPA. The most significant predecommissioning activity relates to the deconstruction of several nonimpacted site structures to facilitate excavation of affected material beneath floor slabs. As shown in Figure 8A-1, the Warehouse, Crusher, and Crusher Addition buildings will likely be demolished.

8.2 Remediation Plan

Presently, none of the original buildings in which magnesium-thorium alloy processing occurred exist on site. With the exception of the Flux Building, there were no buildings in the former operational area of the facility classified as impacted in the HSA. The Flux Building was initially classified as an impacted structure due to past and current uses of the building to house and process soil core and surface samples. Upon completion of decommissioning activities at the site, the Flux Building will be addressed as a Class 1 survey unit.

The recent characterization survey of the impacted land areas, located within the former operational area of the facility, indicated the presence of residual radioactive material beneath several concrete-paved surfaces and structures and at relatively shallow depths. The presence of this material beneath the concrete paving and structures is most likely the result of historical grading activities. Accordingly, this DPA has been designed to address the remediation of select land areas within the former operational area of the facility where residual radioactive material was found to be present under paved areas and floor slabs. The land area beneath the Flux Building is addressed in the June 2001 Decommissioning Plan. A limited amount of subsurface piping and subsurface culverts exist within the former operational area of the facility. These systems are not expected to contain radiological contamination.

8.2.1 Summary of Remediation/Removal Activities

A conceptual engineering plan for site decommissioning activities, relative to the former operational area, is presented below. The conceptual engineering plan for the pond parcel is presented in the June 2001 Decommissioning Plan for the Tulsa facility. Subsequent to plan approval by the NRC, designs and specifications will be developed to better detail approaches to accomplish the objectives set forth in the approved plan. These detailed plans and specifications may differ somewhat from the conceptual engineering approach provided herein.

The decommissioning alternative chosen for implementation closely mirrors that presented in the June 2001 Decommissioning Plan. The planned remediation for the former operational area requires excavating material with a net Th-232 activity concentration greater than the established $DCGL_w$ of 3.0 pCi/g based on a dose limit criterion of 25 mrem/yr. The excavated material will be transported to the pond parcel. Material with Th-232 activity concentrations greater than 31.1 pCi/g will be segregated and disposed off site as either exempt or nonexempt material at a permitted facility. Material with activity concentrations less than 31.1 pCi/g Th-232 will be placed in the pond parcel excavation as backfill. An automated system such as the Segmented Gate System most likely will be used to segregate the material based on activity concentrations. Kaiser will complete the decommissioning with the assistance of contractors, subcontractors, and consultants.

Standard construction equipment will be used to perform decommissioning operations for the former operational area. This equipment will include, but not be limited to, the following:

- Backhoes
- Excavators
- Bulldozers
- Loaders
- Dump trucks
- Water trucks
- Pickup trucks

During remediation, select land areas of the former operational area will be excavated to depths up to 8 feet and an average depth estimated at 2 feet. Excavation activities probably will not be conducted during winter months. Although excavations are planned to be relatively shallow, some dewatering may be required (see Section 8.2.3.1).

Health Physics Technician (HPT) support will be used to monitor the excavated material, the material left in place, workers, equipment, and loaded cars/containers leaving the site. Radiation control procedures and protection methods are described in Chapters 10.0 through 14.0 of the June 2001 Decommissioning Plan.

Once the former operational area is remediated to acceptable levels, it will be cleared through a MARSSIM-directed final status survey. Most likely, this will be conducted in stages where certain survey units will be cleared and backfilled as excavation occurs in other areas.

Approximately 60,000 ft^3 of clean fill will be added to backfill the excavations. The site will be graded so that surface water discharge from the site is attenuated. The site also will be vegetated to minimize soil erosion. The final site configuration is shown (conceptually) in Figure 8A-2.

8.2.2 Site Preparation

Site preparation may include construction of drainage channels, berms, erosion and sedimentation controls, and access controls. Site preparation activities will be under the direction of an HPT and will be performed to limit personnel exposure and off-site migration.

8.2.3 Excavation

Decommissioning activities for the former operational area likely will be completed prior to excavation in the pond parcel. However, Kaiser will encourage contractor input regarding work sequencing. The excavation areas are shown on Figure 8A-1. Approximately 60,000 ft^3 of material is expected to be excavated during decommissioning activities for the former operational area.

8.2.3.1 Water Handling

Water will be managed in accordance with applicable federal, state, and local laws, regulations, and permit requirements. If water is encountered in excavations, it will likely be managed using pumps and frac-tanks. For further details regarding water management, refer to Section 8.2.3.5 of the June 2001 Decommissioning Plan.

8.2.3.2 Excavation Support

Excavation activities will be conducted in accordance with Occupational Safety and Health Administration (OSHA) safety guidelines. In general, excavation walls will be sloped back. However, in the areas where excavation abuts the property line, vertical support, such as sheeting, may be required to

separate the work from the previously completed adjacent land remediation. In addition, special support may be required where excavation is conducted adjacent to building or wall footings.

8.2.4 Backfilling

Off-site borrow material will be necessary to bring the site of the former operational area to the final grades shown (conceptually) in Figure 8A-2. Backfill will be placed in 8-inch loose lifts and suitably compacted. Backfilling activities will be under the direction of a qualified technician or engineer.

8.2.5 Off-Site Disposal

A discussion of the off-site disposal for above-criteria material (>31.1 pCi/g Th-232) is presented in the June 2001 Decommissioning Plan for the Tulsa facility.

8.2.6 Site Restoration

The site will be restored as each area is completed so that weathering is minimized. Restoration will include the following:

- placement of vegetative material,
- seeding and mulching,
- permanent surface water controls,
- permanent erosion and sedimentation controls, and
- possible repaving of select areas.

8.3 Decontamination Methods

Decontamination of equipment, tools, vehicles, and materials will be necessary prior to release. Specific decontamination methods will be developed by the future contractor, with approval by Kaiser.

8.4 Procedures and Controls

Kaiser is committed to maintaining occupational exposures ALARA during all operations involving the management of radioactive materials. Decommissioning activities will be conducted in accordance with written approved procedures, as outlined in the June 2001 Decommissioning Plan and this DPA for the Tulsa facility. Fugitive air emissions (dust) are not anticipated during remediation activities. However, were dusts to become an issue of concern, they would be lightly watered to control any fugitive emissions. HPT support will be used to monitor the material removed, the material left in place, as well as workers, equipment, and loaded cars/containers leaving the site. There are no safety or removal/remediation issues unique to this site.

8.5 Schedule

Upon approval of the June 2001 Decommissioning Plan and this DPA by the NRC, Kaiser will undertake preparation of designs and specifications. Subsequently, a construction contractor will be selected. Kaiser may choose to develop performance specifications and require the contractor to develop design details. Alternatively, Kaiser may opt to develop detailed designs/specifications. In either case, preconstruction activities are expected to take approximately 9 months.

It is likely that construction activities will not be conducted during the months of December through February. Therefore, remediation is anticipated to begin in March following completion of the design/contractor selection tasks and extend over a period of approximately 3 years. A detailed schedule will be prepared subsequent to NRC approval of the June 2001 Decommissioning Plan and DPA. This schedule will be updated as circumstances dictate.

The tentative schedule for decommissioning activities is outlined in Figures 8-7 and 8-8 of the June 2001 Decommissioning Plan for the Tulsa facility. Because of the relatively small excavation quantity presented in this DPA, the tentative schedule has not been revised.

Reference

1. Earth Sciences, June 2001, Decommissioning Plan, Tulsa Facility, Tulsa, Oklahoma, Kaiser Aluminum & Chemical Corporation, Baton Rouge, Louisiana.

Table

Table 8-1
Excavation Volume Estimate
Decommissioning Plan Addendum
Former Operational Area
Kaiser Aluminum Chemical Corporation
Tulsa, Oklahoma

Survey Unit	Excavation Depth (ft)	Area (sf)	Volume (cf)
2	2	1,210	2,420
	4	540	2,160
	6	470	2,820
Unit Total		*2,220*	*7,400*
3	4	810	3,240
Unit Total		*810*	*3,240*
5	2	740	1,480
	4	1,520	6,080
	8	270	2,160
Unit Total		*2,530*	*9,720*
7	2	5,320	10,640
	6	470	2,820
Unit Total		*5,790*	*13,460*
8	2	7,220	14,440
	6	440	2,640
Unit Total		*7,660*	*17,080*
9	2	4,390	8,780
Unit Total		*4,390*	*8,780*
Total		***23,400***	***59,680***

Figures

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FIGURE 8A-1

EXCAVATION PLAN FORMER OPERATIONAL AREA FORMER KAISER ALUMINUM SPECIALTY PRODUCTS FACILITY TULSA, OKLAHOMA

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FIGURE 8A-2

CONCEPTUAL SITE RESTORATION PLAN FORMER OPERATIONAL AREA FORMER KAISER ALUMINUM SPECIALTY PRODUCTS FACILITY TULSA, OKLAHOMA

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Table of Contents

	Page
9.0 Project Management and Organization	9-1
9.1 Decommissioning Management Organization	9-1
9.2 Decommissioning Task Management	9-1
9.3 Decommissioning Management Positions and Qualifications	9-1
9.4 Training	9-1
9.5 Contractor Support	9-2
Reference	9-3

9.0 Project Management and Organization

A description of the decommissioning project management and organization for the Kaiser Tulsa facility was provided in the June 2001 Decommissioning Plan. Appropriate sections of the June 2001 Decommissioning Plan are referenced below.

9.1 Decommissioning Management Organization

Refer to Section 9.1 of the June 2001 Decommissioning Plan for an outline of the decommissioning organization. Figure 9-1 of the June 2001 Decommissioning Plan depicts the Decommissioning Management Organization and reporting hierarchy.

9.2 Decommissioning Task Management

Refer to Section 9.2 of the June 2001 Decommissioning Plan for the Tulsa facility relative to written plans and procedures that will be established for the decommissioning.

9.3 Decommissioning Management Positions and Qualifications

Duties and reporting responsibilities of each person in the management organization are described in Section 9.1 of the June 2001 Decommissioning Plan. The minimum qualifications for each position are described in Section 9.3 of the June 2001 Decommissioning Plan.

9.4 Training

A training program will be established to meet the following goals:

- Meet or exceed the applicable training requirements specified by the NRC, OSHA, and USEPA.
- Ensure that all personnel are knowledgeable of job requirements and are competent in the operation of the equipment they use, are safe in their work practices, and understand the risks associated with their work environment.
- Ensure that personnel meet the requirements of Kaiser to work at the Tulsa site.
- Indoctrinate new employees to ensure that they understand all requirements they are expected to meet.

The training program will include general radiation safety training/monitoring, site orientation, site-specific training, and training verification and documentation. These aspects of the training program are discussed in Section 9.4 of the June 2001 Decommissioning Plan for the Tulsa facility.

9.5 Contractor Support

Kaiser will utilize qualified contractors and consultants to implement this DPA in accordance with the written plans and procedures.

Reference

1. Earth Sciences, June 2001, Decommissioning Plan, Tulsa Facility, Tulsa, Oklahoma, Kaiser Aluminum & Chemical Corporation, Baton Rouge, Louisiana.

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Table of Contents

	Page
10.0 Health and Safety Plan	10-1
10.1 Radiation Safety Controls and Monitoring for Workers	10-1
10.1.1 Air Sampling Program	10-1
10.1.2 Respiratory Protection Program	10-1
10.1.3 Internal Exposure Determination	10-1
10.1.4 External Exposure Determination	10-1
10.1.5 Summation of Internal and External Exposures	10-1
10.1.6 Contamination Control Program	10-1
10.1.7 Instrumentation Program	10-2
10.1.8 Health Physics Audits, Inspections, and Record Keeping Program	10-2
10.1.9 Air Sampling Plan	10-2
10.1.10 Airborne Radioactivity Monitoring Program	10-2
Reference	10-3

10.0 Health and Safety Plan

Information regarding the general framework for health and safety policies and practices is included in Chapter 10.0 of the June 2001 Decommissioning Plan for the Tulsa facility. Information in that health and safety plan supplements Kaiser's Environmental Health and Safety Plan (June 2000, Revision 2) and provides the basic policies, objectives, organizational structure, and guidelines governing remediation work at the site. Contractors engaged to perform work related to site remediation will be required to prepare and submit health and safety plans that will be specific to activities and services they are to provide.

10.1 Radiation Safety Controls and Monitoring for Workers

Airborne radioactivity monitoring will be conducted to confirm the effectiveness of radioactive material control practices during work activities. A process for assessing compliance that provides at least as much surveillance as Regulatory Guide 8.25 recommends is outlined in Section 10.1 of the June 2001 Decommissioning Plan for the Tulsa facility.

10.1.1 Air Sampling Program

Refer to Section 10.1.1 of the June 2001 Decommissioning Plan for the Tulsa facility.

10.1.2 Respiratory Protection Program

Refer to Section 10.1.2 of the June 2001 Decommissioning Plan for the Tulsa facility.

10.1.3 Internal Exposure Determination

Refer to Section 10.1.3 of the June 2001 Decommissioning Plan for the Tulsa facility.

10.1.4 External Exposure Determination

Refer to Section 10.1.4 of the June 2001 Decommissioning Plan for the Tulsa facility.

10.1.5 Summation of Internal and External Exposures

Refer to Section 10.1.5 of the June 2001 Decommissioning Plan for the Tulsa facility.

10.1.6 Contamination Control Program

Refer to Section 10.1.6 of the June 2001 Decommissioning Plan for the Tulsa facility.

10.1.7 Instrumentation Program

Refer to Section 10.1.7 of the June 2001 Decommissioning Plan for the Tulsa facility.

10.1.8 Health Physics Audits, Inspections, and Record Keeping Program

Refer to Section 10.1.8 of the June 2001 Decommissioning Plan for the Tulsa facility.

10.1.9 Air Sampling Plan

Refer to Section 10.1.9 of the June 2001 Decommissioning Plan for the Tulsa facility.

10.1.10 Airborne Radioactivity Monitoring Program

Refer to Section 10.1.10 of the June 2001 Decommissioning Plan for the Tulsa facility.

Reference

1. Earth Sciences, June 2001, Decommissioning Plan, Tulsa Facility, Tulsa, Oklahoma, Kaiser Aluminum & Chemical Corporation, Baton Rouge, Louisiana.

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Table of Contents

	Page
11.0 Environmental Monitoring and Control Program	11-1
11.1 Environmental ALARA Evaluation Program	11-1
11.2 Effluent Monitoring Program	11-1
11.3 Effluent Control Program	11-2
Reference	11-3

11.0 Environmental Monitoring and Control Program

Kaiser will implement an Environmental Monitoring Program during site decommissioning activities for the specific purpose of evaluating whether the decommissioning activities comply with the regulatory requirements in 10 Code of Federal Regulations Part 20 and are adequate to protect workers, the public, and the environment from radiation during decommissioning activities.

The following items must be addressed prior to excavation of affected material:

- Management of water encountered in excavations.
- Management of surface water to minimize contact of water with contaminants and minimize erosion.
- Construction of safe stable excavations, particularly deep excavations where water may be encountered.
- Preparation and implementation of a Dust Control Plan to prevent migration of wind-borne contaminants.
- Identification and protection of existing underground and overhead utilities.
- Implementation of site access controls.
- Implementation of internal traffic controls.
- Management of wastewater as a result of remediation activities.

ALARA reviews will be included in regularly scheduled job meetings. The minutes of these meetings will be distributed to the attendees, the Project Manager, and the Radiation Safety Officer. A description of the environmental monitoring and control program for the Kaiser Tulsa facility was provided in the June 2001 Decommissioning Plan. Appropriate sections of the June 2001 Decommissioning Plan are referenced below

11.1 Environmental ALARA Evaluation Program

Refer to Section 11.1 of the June 2001 Decommissioning Plan for the Tulsa facility.

11.2 Effluent Monitoring Program

Refer to Section 11.2 of the June 2001 Decommissioning Plan for the Tulsa facility.

11.3 Effluent Control Program

Refer to Sections 11.2 and 11.3 of the June 2001 Decommissioning Plan for the Tulsa facility.

Reference

1. Earth Sciences, June 2001, Decommissioning Plan, Tulsa Facility, Tulsa, Oklahoma, Kaiser Aluminum & Chemical Corporation, Baton Rouge, Louisiana.

Table of Contents

	Page
12.0 Radioactive Waste Management	12-1
12.1 Solid Material	12-1
12.1.1 Volume Estimate of Thorium-Containing Soil/Dross – Former Operational Area	12-1
12.1.2 Th-232 Activity Concentrations	12-1
12.1.3 Management of Thorium-Containing Soil/Dross	12-1
12.1.4 Management of Other Dry Active Waste	12-2
12.2 Liquid Material Management	12-2
12.3 Radioactive Waste Disposal	12-2
12.3.1 Waste Classification	12-2
12.3.2 Waste Packaging, Transfer, and Storage	12-2
12.3.3 Waste Transportation	12-2
12.3.4 Waste Disposal	12-2
12.4 Mixed Waste	12-2
Reference	12-4

12.0 Radioactive Waste Management

A description of the radioactive waste management approach for the Kaiser Tulsa facility was provided in the June 2001 Decommissioning Plan. Appropriate sections of the June 2001 Decommissioning Plan are referenced below.

Solid and liquid materials will be generated during the implementation of the planned decommissioning activities in the former operational area of the facility. Kaiser will manage the solid and liquid materials generated from the decommissioning effort in a controlled manner in accordance with applicable NRC, Department of Transportation, and state regulatory requirements. The management approach is based upon minimizing secondary wastes and radiation exposure.

12.1 Solid Material

Two types of solid materials are expected to be generated during the implementation of the DPA: Dry Active Waste (DAW) – Thorium-Containing Soil/Dross and Other Incidental DAW.

12.1.1 Volume Estimate of Thorium-Containing Soil/Dross – Former Operational Area

As discussed in Chapter 8.0 of this DPA, approximately 60,000 ft^3 of solid material (soil/dross), with a Th-232 activity concentration of greater than 3.0 pCi/g, will be handled during the decommissioning of the former operational area of the facility.

12.1.2 Th-232 Activity Concentrations

Th-232 activity concentrations for the soil/dross materials relative to the former operational area are discussed in Chapter 4.0 of this DPA. Recent soil characterization activities indicated gross Th-232 activity concentrations in soils ranging from approximately 0.128 to 145 pCi/g. One characterization sample, representing an isolated pocket of an unique dross material collected from a test trench excavation, exhibited a Th-232 activity concentration of 6,430 pCi/g

12.1.3 Management of Thorium-Containing Soil/Dross

Soil/dross materials with net Th-232 activity concentrations of greater than the $DCGL_w$ (3.0 pCi/g) will be excavated during remediation efforts for the former operational area of the facility. During the site preparation phase of the decommissioning, a controlled stockpile and material handling/ processing/storage area will be constructed in the northwestern part of the property (freshwater pond area). Excavated materials will be transported to the stockpile area for segregation into above- and

below-criteria materials. Refer to Section 12.1.3 of the June 2001 Decommissioning Plan for additional information regarding the management of the excavated materials once they reach the stockpile area.

12.1.4 Management of Other Dry Active Waste

Refer to Section 12.1.4 of the June 2001 Decommissioning Plan for the Tulsa facility.

12.2 Liquid Material Management

Refer to Section 12.2 of the June 2001 Decommissioning Plan for the Tulsa facility.

12.3 Radioactive Waste Disposal

12.3.1 Waste Classification

All radioactive waste materials are expected to be exempt quantities and will be disposed using procedures that follow the requirements of federal regulations and the receiving disposal facility. Refer to Section 12.3.1 of the June 2001 Decommissioning Plan for the basic methods that may be used to ensure accurate profiling of the waste materials.

The volume of the solid material (soil/dross) to be removed during remediation of the former operational area soils was estimated to be 60,000 ft^3. Approximately 50 percent of the volume of soil/dross material may require off-site disposal. It is anticipated that this material will be exempt, based on the available characterization survey data for the former operational area land areas (see Chapter 4.0).

12.3.2 Waste Packaging, Transfer, and Storage

Refer to Section 12.3.2 of the June 2001 Decommissioning Plan for the Tulsa facility.

12.3.3 Waste Transportation

Refer to Section 12.3.3 of the June 2001 Decommissioning Plan for the Tulsa facility.

12.3.4 Waste Disposal

Refer to Section 12.3.4 of the June 2001 Decommissioning Plan for the Tulsa facility.

12.4 Mixed Waste

Based on recent ASCA efforts, solid and liquid mixed waste are not expected to be generated during decommissioning operations. However, should mixed waste be identified during remediation activities,

Kaiser will notify the NRC and provide a characterization of such wastes, identify alternate disposal methods to accommodate such wastes, and assess all additional treatment and disposal costs, as needed.

References

1. Earth Sciences, October 2001, Additional Site Characterization Activities, Former Kaiser Aluminum Specialty Products Facility, Tulsa, Oklahoma, Kaiser Aluminum & Chemical Corporation, Baton Rouge, Louisiana.

2. Earth Sciences, June 2001, Decommissioning Plan, Tulsa Facility, Tulsa, Oklahoma, Kaiser Aluminum & Chemical Corporation, Baton Rouge, Louisiana.

Table of Contents

	Page
13.0 QA Program	13-1
13.1 Organization	13-1
13.2 QA Program	13-1
13.3 Document Control	13-1
13.4 Control of Measuring and Testing Equipment	13-1
13.5 Corrective Action	13-1
13.6 QA Records	13-1
13.7 Audits and Surveillance	13-1
Reference	13-2

13.0 QA Program

A description of the QA program for the decommissioning of the former Kaiser Tulsa facility was provided in the June 2001 Decommissioning Plan. Appropriate sections of the June 2001 Decommissioning Plan are referenced below.

13.1 Organization

Refer to Section 13.1 of the June 2001 Decommissioning Plan for the Tulsa facility.

13.2 QA Program

Refer to Section 13.2 of the June 2001 Decommissioning Plan for the Tulsa facility.

13.3 Document Control

Refer to Section 13.3 of the June 2001 Decommissioning Plan for a description of the document control procedures.

13.4 Control of Measuring and Testing Equipment

Refer to Section 13.4 of the June 2001 Decommissioning Plan for a description of the QA/QC principals to be applied for counting systems and analytical instruments.

13.5 Corrective Action

Refer to Section 13.5 of the June 2001 Decommissioning Plan for the Tulsa facility.

13.6 QA Records

Refer to Section 13.6 of the June 2001 Decommissioning Plan for the Tulsa facility.

13.7 Audits and Surveillance

Refer to Section 13.7 of the June 2001 Decommissioning Plan for the Tulsa facility.

Reference

1. Earth Sciences, June 2001, Decommissioning Plan, Tulsa Facility, Tulsa, Oklahoma, Kaiser Aluminum & Chemical Corporation, Baton Rouge, Louisiana.

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Table of Contents

	Page
14.0 Facility Radiation Surveys	14-1
14.1 Release Criteria	14-1
14.1.1 Land Areas	14-2
14.1.2 Structures	14-3
14.2 Characterization Surveys	14-3
14.3 Remedial Action Support Surveys	14-4
14.4 Final Status Survey Design	14-4
14.5 Final Status Survey Report	14-4
References	14-5

14.0 Facility Radiation Surveys

Information regarding the general framework for facility radiation surveys was provided in the June 2001 Decommissioning Plan for the Tulsa facility. This framework is applicable to the former operational area of the facility with the exception of the threshold land area concentration criteria. The land area release criterion for the former operational area of the facility is the adjusted $DCGL_w$ value of 3.0 pCi/g net Th-232. The derivation of this threshold concentration criterion was presented in Chapter 5.0 of the June 2001 Decommissioning Plan.

The planned remediation for the former operational area requires excavating material with a net Th-232 activity concentration greater than the $DCGL_w$. The excavated material will be transported to the pond parcel. Material with Th-232 activity concentrations greater than 31.1 pCi/g will be segregated on site and disposed off site as either exempt or nonexempt material at a permitted facility. Material with activity concentrations less than 31.1 pCi/g Th-232 will be placed in the pond parcel excavation as backfill. An automated system such as the Segmented Gate System most likely will be used to segregate the material based on activity concentrations. The former operational area excavations will be backfilled with clean off-site borrow material.

Appropriate sections of the June 2001 Decommissioning Plan are referenced or summarized below. Supplemental information relative to facility radiation surveys for the former operational area of the facility is provided in the following sections, where appropriate.

14.1 Release Criteria

Extensive characterization activities conducted since 1994 have established that Th-228, Th-230, and Th-232 are present in dross/soil residues on the Kaiser property. No elevated uranium has been detected. In 1999, 24 samples were selected (on site) to confirm the Th-232 to Th-230 ratio in the dross. The samples were selected based on geographical distribution and included both the retention and reserve ponds and a range of depths. Th-228 and Th-232 have been determined to be in secular equilibrium. In addition, a ratio of Th-230 to (Th228 + Th232)/2 of 3.5 has been calculated from characterization data. Supporting documentation for the ratio determination is provided in an appendix to the June 2001 Decommissioning Plan.

The acceptance criteria for land areas are the average activity concentration in soil (pCi/g) that correspond to the dose-based radiological criteria of 10 CFR 20 Subpart E. The acceptance criteria for structures are

the average total surface contamination and the average removable surface contamination levels that correspond to the dose-based radiological criteria of 10 CFR 20 Subpart E. The limits are radionuclide specific and the sum of fractions (unity rule) must be applied to show compliance with the acceptance criteria.

Table 14-1
Radionuclide-Specific Acceptance Criteria

Radionuclide	Land Areas Single Radionuclide $DCGL_W$ (pCi/g)	Structures Total Contamination ($dpm/100cm^2$)	Structures Removable Contamination ($dpm/100cm^2$)
Th-228	3.4	41.1	4.11
Th-230	102	36.9	3.69
Th-232	3.4	7.31	0.731

14.1.1 Land Areas

Radionuclide-specific $DCGL_W$ values corresponding to the radiological criteria of 10 CFR 20 Subpart E have been derived for soil using the computer code RESRAD. The derivation is documented in the June 2001 Decommissioning Plan for the Tulsa facility. From the radionuclide specific values and the established activity ratios for the site, a value for Th-232 as a surrogate was also calculated and documented in the June 2001 Decommissioning Plan. The value is 3 pCi/g.

Table 14-2 presents area factors (based on MARSSIM guidance) to be used for elevated measurement comparisons (EMC) and to determine sampling requirements in situations where the scan instrument's MDC is greater than the appropriate $DCGL_w$. The appropriate $DCGL_{EMC}$ values are calculated by multiplying the appropriate $DCGL_w$ by the area factors in Table 14-2. Those for the former operational area and the processing area (area where material will be separated into above- and below-criteria material) were estimated on the $DCGL_w$ and are presented in Table 14-3.

$$DCGL_{EMC} = \text{Area Factor} * DCGL_W$$

Table 14-2
Area Factors

Area Factors									
Radio-nuclide	1 m^2 (11 ft^2)	3 m^2 (32 ft^2)	10 m^2 (108 ft^2)	30 m^2 (323 ft^2)	100 m^2 (1,076 ft^2)	300 m^2 (3,229 ft^2)	1,000 m^2 (10,764 ft^2)	3,000 m^2 (32,292 ft^2)	10,000 m^2 (107,639 ft^2)
Th-232	12.5	6.2	3.2	2.3	1.8	1.5	1.1	1.0	1.0

Table 14-3
$DCGL_{EMC}$ Values for Processing Area/Former Operational Area

$DCGL_{EMC}$ (pCi/g)									
Radio-nuclide	1 m^2 (11 ft^2)	3 m^2 (32 ft^2)	10 m^2 (108 ft^2)	30 m^2 (323 ft^2)	100 m^2 (1,076 ft^2)	300 m^2 (3,229 ft^2)	1,000 m^2 (10,764 ft^2)	3,000 m^2 (32,292 ft^2)	10,000 m^2 (107,639 ft^2)
Th-232	37.5	18.6	9.6	6.9	5.4	4.5	3.3	3.0	3.0

14.1.2 Structures

The radionuclide-specific average total contamination acceptance criteria were derived using the DandD code and default parameters. Values calculated using DandD and default parameters are referred to as screening values by the NRC. The NRC allows use of these screening values in lieu of site-specific DCGL values that must be submitted to the NRC for approval. (Refer to Federal Register Volume 63, Number 222, Page 64132-64134, November 18, 1998). The NRC screening values assume that removable contamination is not more than 10 percent of the total contamination screening value.

From the radionuclide-specific values and the activity ratios of the radionuclides established for the site, a Gross Activity DCGL (GA-DCGL) was calculated using formula Number 4-4 provided in MARSSIM. The calculated GA-DCGL value is 21.5 dpm/100 cm^2 for average total surface contamination and 2.15 dpm/100cm^2 for removable contamination. Refer to the calculation brief contained in Appendix D for a derivation of these GA-DCGL values. The calculation brief also presents area factors (based upon default DandD code) to be used for EMC and to determine sampling requirements in situations where the scan instruments' MDC is greater than the GA-DCGL.

Additional information regarding the release of criteria for the Tulsa facility is provided in Section 14.1 of the June 2001 Decommissioning Plan for the Tulsa facility.

14.2 Characterization Surveys

Results of the characterization surveys performed for the impacted land areas of the former operational area of the facility are presented in Chapter 4.0 of this DPA.

14.3 Remedial Action Support Surveys

Remedial action support surveys will be performed while remediation is being conducted and will guide the remedial action in a real-time mode. These surveys will be used to determine when a survey unit is ready for the final status survey. The remedial action surveys will rely principally on direct radiation measurement using gamma-sensitive instrumentation. The determination of a survey unit's readiness for a final status survey will rely on the results from the survey instrumentation.

Instrumentation will consist of portable survey rate meters equipped with sodium iodide (NaI) detectors. This detection method has the sensitivity to detect Th-232 (surrogate radionuclide) below the $DCGL_w$ threshold value of 3.0 pCi/g above background. Table 14-6 of the June 2001 Decommissioning Plan provides MDC values calculated using the guidance provided in NUREG-1575, MARSSIM, for increasing background values relative to a 2-inch-by-2-inch NaI detector.

14.4 Final Status Survey Design

The final status survey design for the impacted land areas and structures of the Kaiser Tulsa facility is presented in Section 14.4 of the June 2001 Decommissioning Plan. The impacted land areas and structure (Flux Building) located within the former operational area of the facility were depicted as Class 1 for purposes of classification and survey.

14.5 Final Status Survey Report

Refer to Section 14.14 of the June 2001 Decommissioning Plan for the Tulsa facility.

References

1. Earth Sciences, December 2001, Historical Site Assessment, Operational Area, Former Kaiser Aluminum Specialty Products Facility, Tulsa, Oklahoma, Kaiser Aluminum & Chemical Corporation, Baton Rouge Louisiana.

2. Earth Sciences, December 2001, Work Plan, Characterization Survey of the Operational Area, Former Kaiser Aluminum Specialty Products Facility, Tulsa, Oklahoma, Kaiser Aluminum & Chemical Corporation, Baton Rouge, Louisiana.

3. Earth Sciences, October 2001, Additional Site Characterization Activities, Former Kaiser Aluminum Specialty Products Facility, Tulsa, Oklahoma, Kaiser Aluminum & Chemical Corporation, Baton Rouge, Louisiana.

4. Earth Sciences, June 2001, Decommissioning Plan, Tulsa Facility, Tulsa, Oklahoma, Kaiser Aluminum & Chemical Corporation, Baton Rouge, Louisiana.

5. NUREG/CR-1575, August 2000, MARSSIM, Rev. 1.

Table of Contents

	Page
15.0 Budgetary Cost Estimate	15-1
15.1 Mobilization	15-1
15.2 Concrete Slab Demolition	15-1
15.3 Excavation and Backfill	15-1
15.3.1 Contractor Daily Cost	15-1
15.3.2 Backfill Material	15-2
15.4 Transportation and Disposal	15-2
15.5 Vegetative Cover and Seeding	15-2
15.6 Demobilization	15-2
15.7 Engineering Oversight	15-3
15.8 Final Status Survey	15-3
15.9 Analytical	15-3
References	15-4

Table

Table 15-1 – Preliminary Cost Estimate, Decommissioning Plan Addendum

15.0 Budgetary Cost Estimate

A budgetary cost estimate of $590,000 has been developed for the conceptual design/remediation activity relative to the former operational area, as presented in Chapter 8.0 of this DPA. This cost estimate is based on documented and reasonable assumptions. However, the estimate is subject to further refinement as the design details for the project are completed.

Major elements of the cost estimate are provided in Table 15A-1. Specific cost items outlined below are identified as the basis for this budgetary cost estimate. Allocation of equipment and labor ultimately will be determined by Kaiser's contractor.

15.1 Mobilization

It is assumed that the excavation activities presented in this addendum will be completed in conjunction with Phase I as outlined in the June 2001 Decommissioning Plan for the Tulsa facility. Therefore, an additional mobilization cost for the main excavation contractor is not included. However, a $10,000 mobilization cost for concrete slab demolition equipment and personnel is estimated.

15.2 Concrete Slab Demolition

Demolition and removal of concrete slabs will be necessary. For this estimate, it is assumed that the concrete slabs are 6-inches thick with mesh reinforcement. Production will be limited to 200 square yards (yd^2) per day, because of radiological scanning requirements for the underside of the slabs. A cost of $\$10.20/yd^2$ is based on Reference 1.

15.3 Excavation and Backfill

Based on experience with this type of project, a daily rate has been used in the estimates.

15.3.1 Contractor Daily Cost

Excavation activities in the former operational area will be in close quarters and conducted in conjunction with concrete slab removal. Therefore, it is assumed that production will be limited to 100 cubic yards (cy) per day (cy/dy). For estimating purposes, equipment and labor may consist of:

Former Operational Land Area				
Equipment and Labor	**Quantity**	**Daily Cost ($)**	**Subtotal ($)**	**Reference**
Foreman	1	305	305	RS Means, 2002
Track hoe, 2 cy bucket, one operator, one oiler	1	1,772	1,772	RS Means, 2002, Crew B-12C
12-ton dump truck, one truck driver	1	693	693	RS Means, 2002, Crew B-34A
Vibratory drum roller, one operator, 0.5 laborer	1	857	857	RS Means, 2002, Crew B-10Y
Water truck *(assumes truck driver from above will be used for water truck)*	1	180	180	RS Means, 2002, Crew B-9A
Front-end loader, 1 cy, one operator, 0.5 laborer	1	759	759	RS Means, 2002, Crew B-10R
Miscellaneous pumps and hose	1	200	200	Estimated
Total, per day			**4,766**	

15.3.2 Backfill Material

Off-site borrow will be required to bring the site up to final grade. The $6.75-per-cy cost is based on information developed during other similar projects in the area.

15.4 Transportation and Disposal

A $7.00-per-ft^3 cost for transportation and disposal is based upon discussion with disposal site operators. Based on existing characterization survey data, it is estimated that 50 percent of the excavation volume will be less than the criteria (31.1 pCi/g) for off-site disposal presented in the June 2001 Decommissioning Plan for the Tulsa facility.

15.5 Vegetative Cover and Seeding

The $5,000-per-acre cost for fine grading, placement of 6 inches of vegetative material, and seeding is based on experience.

15.6 Demobilization

It is assumed that the decommissioning activities presented in this addendum will be completed in conjunction with Phase I, as outlined in the June 2001 Decommissioning Plan for the Tulsa facility. Therefore, an additional demobilization cost is not included.

15.7 Engineering Oversight

The $25,000-per-day cost for engineering oversight includes labor, equipment, and expenses for HPT oversight and office support. This cost is based on experience.

15.8 Final Status Survey

The $25,000 estimated cost for the final status survey is based on experience.

15.9 Analytical

Based on experience, $190 per sample has been included for analytical costs for the final status survey soil samples. The analytical cost is based on a turnaround time of 2 days for gamma spectroscopy. A 2-day turnaround time was requested frequently during the ALRP and is anticipated to be requested for decommissioning activities in the former operational area. A faster turnaround time helps to minimize water handling and ensure a safe working environment by reducing the number of open excavations. The approximate number of final status survey samples (72) is based on a minimum of nine samples per survey unit for eight impacted land area survey units (no survey unit is greater than 2,000 m^2). In addition, analytical sample cost for liquid wastewater testing is included. This cost is based on the assumption that the maximum quantity of water generated would be 10,000 gallons (one frac tank). It is estimated that one grab sample will be required. Costs obtained for similar analysis during the ALRP equaled $390.

Additional samples that may be taken with their associated costs are included in the following table:

Additional Sample Costs				
Type of sample	**Analysis**	**Cost Per Sample ($)**	**Estimated Number of Samples**	**Total Estimated Cost ($)**
Waste Characterization Samples	TCLP (Metals and VOCs)	275.00	3	825.00
QA/QC Samples	Gamma Spec.	90.00	10	900.00
QA/QC Samples	Alpha Spec.	75.00	2	150.00
Environmental Air Samples	Gross Alpha	25.00	8	200.00
H&S Air Samples	Gross Alpha	25.00	4	100.00
Instrument Calibration	Gamma Detection	60.00	3	90.00

References

1. R. S. Means Co. Inc., 2002 Heavy Construction Cost Data.

2. Earth Sciences, June 2001, Decommissioning Plan, Tulsa Facility, Tulsa, Oklahoma, Kaiser Aluminum & Chemical Corporation, Baton Rouge, Louisiana.

Table

Table 15-1
Preliminary Cost Estimate
Decommissioning Plan Addendum
Former Operational Area
Kaiser Aluminum Chemical Corporation
Tulsa, Oklahoma

Contractor Costs

Description	Quantity	Unit		Unit Cost		Subtotal
Mobilization	1	lump sum	$	10,000.00	$	10,000
Operational area excavation[1]	22	days	$	4,766.00	$	104,852
Concrete slab demolition	2,500	yd^2	$	10.20	$	25,500
Backfill material	2,200	cy	$	6.75	$	14,850
Seeding, vegetative cover	1	acres	$	5,000.00	$	5,000
Transportation and off-site disposal	30,000	ft^3	$	7.00	$	210,000
				Contractor Total:	*$*	*370,202*

Support Costs

Description	Quantity	Unit		Unit Cost		Subtotal
Design, permitting, NRC interaction (7% of Contractor)	1	estimated	$	25,914.14	$	25,914
Engineering oversight[2]	47	days	$	2,000.00	$	94,000
Final status survey and report	1	lump sum	$	25,000.00	$	25,000
Final status survey samples (gamma spec. with two day turn time)	81	samples	$	190.00	$	15,390
Waste characterization samples (estimate)	3	samples	$	275.00	$	825
Liquid rad waste samples	1	samples	$	390.00	$	390
				Support Total:	***$***	***161,519***

10% Contingency			53,172
		Total for Project: $	584,893

Notes:
[1]Operational area excavation volume is estimated to be approximately 2,200 cy. The number of workdays is based on a production rate of 100 cy per day.
[2] Time for engineering oversight is based on the excavation workdays plus time on site during concrete slab demolition.

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