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U. S. Nuclear Regulatory Commission  
Washington, DC 20555  
Attn: Document Control Desk

Technical Report  
Additional Site Characterization Activities  
Former Kaiser Aluminum Specialty Products Facility  
Tulsa, Oklahoma

Dear Sir or Madam:

Kaiser Aluminum & Chemical Corporation is submitting one copy of the above-referenced technical report which describes the additional site characterization effort performed at Kaiser's former Specialty Products facility located in Tulsa, Oklahoma. If you have any questions concerning the enclosure, please do not hesitate to call me at (225) 231-5116.

Sincerely,

*J.W. Bill Vinzant*

J.W. (Bill) Vinzant, P.E.  
Manager, Corporate Environmental Affairs

JWV:tls

Enclosure

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# **Additional Site Characterization Activities**

**Former Kaiser Aluminum Specialty Products Facility  
Tulsa, Oklahoma**

**Kaiser Aluminum & Chemical Corporation  
Tulsa, Oklahoma**

**Project No. 5427G  
November 2001**

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**Technical Report**  
**Additional Site Characterization Activities**  
**Former Kaiser Aluminum Specialty Products Facility**  
**Tulsa, Oklahoma**  
**Kaiser Aluminum & Chemical Corporation**

**1.0 Introduction**

This report was prepared by Earth Sciences Consultants, Inc. (Earth Sciences) on behalf of the Kaiser Aluminum & Chemical Corporation (Kaiser) to present the results of an additional site characterization effort performed for Kaiser's former Specialty Products facility located in Tulsa, Oklahoma (Figure 1). Historical operations at the facility included the smelting and manufacture of magnesium anodes. The additional site characterization was completed in support of the June 2000 Decommissioning Plan (DP) submittal for the facility. The DP addresses the remediation of areas on site contaminated with radioactive material. The radioactive material previously identified on site is thorium-bearing dross containing the isotopes Thorium-232 (Th-232), Thorium-230 (Th-230), and Thorium-228 (Th-228). Implementation of the DP will make the site suitable for unrestricted release. Extensive site characterization activities have been conducted since 1994 within a 14-acre land area of the facility known as the "pond parcel". These characterization activities have indicated the presence of residual radioactive material within a 10-acre portion of the "pond parcel". The affected portion of the parcel contains the retention pond and former reserve pond area. The unaffected portion of the "pond parcel" contains a freshwater pond. Previous surveys of potentially affected structures at the facility have shown no radioactive material above background levels. However, the DP identified the potential for radioactive material beneath several currently paved areas and building floor surfaces based upon an interpretation of historical data and/or observations made during the recent Adjacent Land Remediation Project (ALRP). The additional site characterization effort described within this report was designed primarily to identify additional radioactive material located beneath these structures located on the property. Secondary considerations of the additional site characterization included a hazardous waste determination for the thorium-bearing dross to be excavated at the site during remediation and an assessment of an area of the site historically identified as the "trash pile."

The remainder of this document provides background information on the aforementioned areas of concern, details the additional site characterization approach, and presents the results of characterization efforts. Conclusions based upon the results of the additional characterization activities are also provided.

The structure of the report is as follows:

- Chapter 2.0 – Areas of Concern, Aerial Photograph Review, and Site Characterization Approach
- Chapter 3.0 – Characterization Activities and Results
- Chapter 4.0 – Summary of Findings and Conclusions

Supporting documentation is provided in appendices.

## 2.0 Areas of Concern, Aerial Photograph Review, and Site Characterization Approach

As discussed in Section 4.0 (Radiological Status of Facility) of the DP, modifications to site facilities (buildings, parking lots, etc.) during its operating life may have resulted in the covering of thorium-bearing dross beneath several currently paved surface and building floor areas. These areas of concern include the Slag Storage Building and adjacent paved area, the original Crusher Building and adjacent paved area, the Crusher Addition Building, the Flux Building and adjacent paved area, the Warehouse Building, and the concrete paved area located to the west of the Maintenance Building. Another area of concern identified through a review of historical information on plant operations and aerial photographs is the "trash pile." These areas of concern are depicted in Figure 2. Background information and aerial photograph reviews for these areas of concern as well as a characterization approach for each area are provided in the following sections.

### 2.1 Trash Pile

Reportedly, an on-site "trash pile" existed at the facility during plant operations. However, the location, nature (physical and chemical composition), and period of use for this historical waste area are not well defined. Previous subsurface exploratory activities conducted at the site revealed the presence of building debris at several locations near the Freshwater Pond embankment at the edge of the Retention Pond. These locations were near the buried Freshwater Pond spillway. This was confirmed in more recent excavations made during the ALRP. Soil samples collected near the spillway, both inside and outside the Retention Pond parcel, exhibited Th-232 concentrations above the site derived guideline level of 3.0 pCi/g (June 2001 Decommissioning Plan).

Available aerial photographs of the site were reviewed and evaluated for the presence, and if found, the aerial extent of the "trash pile." A discussion of the aerial photograph review findings is provided below.

#### 2.1.1 Aerial Photograph Review

Available aerial photographs for the site cover a time period from 1943 to 2001 (Appendix A). A review of aerial photographs dated prior to 1964 did not indicate the presence of a debris pile. However, the 1964 image of the site (Appendix A, Figure A-3) showed the presence of a considerable debris area extending from the then-existing south bank of the retention pond, to within 20 to 25 feet of the railroad right-of-way, and from the Freshwater Pond embankment to the Flux Building. A comparison of the 1964 photograph with later aerial photographs indicated that the debris pile extended beyond the current pond perimeter by approximately 30 to 60 feet. Aerial photographs for the years 1967 through 2001 did

not show the presence of the previously identified debris pile but indicated physical changes on the ground surface in the subject area and the limits of the pond.

The emergence of this debris pile sometime before 1964 may relate to an explosion and fire at the original magnesium smelter building in 1961. This smelter building was located midway between the current Maintenance Building and the original Crusher Building, and was adjacent to the west wall of a new smelter which was nearing completion in 1961. The scale of the fire is unknown, but one available photograph looking east from the Office Building shows a partially collapsed Warehouse Building, the (slightly damaged) new Smelter Building, and the damaged old Smelter Building. In addition, large sheets of metal siding appear scattered about the yard area between the buildings. As the Crusher Building is not clearly evident in the aerial photograph, it is impossible to evaluate damage from the fire. Similarly, the two smelters block the view toward the Flux Building location.

Significant changes are apparent to most of the structures on site between the 1958 and 1964 aerial photographs. The structures identified as the Maintenance Building, Warehouse Building, and Crusher Building appear significantly different in roof configurations and all have been enlarged. Whether changes are a result of expansion, or of the fire, is unknown. Regardless of the extent of fire damage, debris cleared for building modifications or reconstruction appears to have been transported to the retention pond area for management.

#### 2.1.2 Characterization Approach

The site characterization objective for this area of concern was to define the physical, chemical (organic compounds), and radiological nature of subsurface materials in the former “trash pile” area as they relate to the proposed DP remediation activities for the area. Characterization activities for this area of concern consisted of the following:

- Examination of aerial photograph stereo pairs (pre- and post-facility construction and operation) for changes in site topography
- Excavation of test trenches to evaluate the physical nature of subsurface materials (biased locations)
- Examination of exhumed subsurface materials for the presence of organic compounds and elevated radioactivity through field screening methodologies

A discussion of the characterization activities and findings is presented in Chapter 3.0.

## 2.2 Structures and Paved Areas

Changes in the plant footprint over the last 40 years may have resulted in the covering of thorium-bearing dross and scrap metal residuum by plant buildings and/or paved areas. The most likely on-site locations for this condition include the immediate areas of the Flux, Slag Storage, Crusher, Crusher Addition, Warehouse, and Maintenance Buildings (Figure 3).

An example is the Flux Building. The Flux Building is suspected of having been built on top of thorium-bearing material. This condition is suggested by the presence of radioactive material on all four sides of the structure, both on- and off-site. Radioactive material was found along the east fence line within ALRP Characterization Grids 33 and 35 to depths of 5 to 6 feet (Figure 2). The remedial excavations for these characterization grids ended within approximately 3 feet of the structure's wall. Radioactive material was detected in the west wall of the excavation, extending under Kaiser property. Data collected during the ALRP from Characterization Grids 22 through 24 (directly south of the Flux Building) indicated the presence of thorium-bearing dross to depths of 8 to 9 feet below ground surface (bgs). In 1995, radioactive material also was identified at Borehole 30, located on the north side of the concrete paved area, to a depth of 10 feet bgs.

The following review of available aerial photograph stereo pairs was conducted to aid in understanding where:

- potentially affected material may have been used as fill in site grading; and
- potentially affected material may have been covered by concrete pavement or building floor slabs.

### 2.2.1 Aerial Photograph/Map Reviews

The Flux Building reportedly was constructed around 1961 to test and develop an etching process for magnesium metal. The process proved unsuccessful, and activities ceased by 1963. A 1989 site drawing identified the structure as an aluminum packaging facility, a function that is assumed to have started in the late 1970s. The facility consists of an approximate 80-foot-by-120-foot-by-20-foot tall concrete block structure with a flat roof. At the time of the 1964 photograph, several corrugated metal outbuildings with a combined footprint of approximately 40 feet by 70 feet were attached to the northern part of the Flux Building's west wall. Three vertical cylindrical tanks, each estimated at 12 to 15 feet in diameter and 25 to 30 feet high, were adjacent to the west side of the outbuildings. A concrete paved area located between

the Flux Building and the vertical cylindrical tanks, as well as to the west, completed this approximately 0.75-acre facility complex. The outbuildings and tanks were removed sometime between 1972 and 1979 based on the aerial photographs.

The Slag Storage Building is visible at the southeast corner of the Crusher Building in the 1964 through 1972 aerial photographs. It was approximately 90 feet by 40 feet in plan dimension and was constructed of galvanized steel walls. It apparently served as a holding facility, receiving dross fines from the Crusher. The 1964 aerial photograph showed the presence of drums, stacks, or piles of material within fenced areas east, north, and west of the building. That area appears to have been cleaned up by 1967. However, radioactive material was reported during the ALRP in several of the characterization grids (175 through 165) along East 41st Street, which are located directly south of the Slag Storage Building's footprint. Also, thorium-bearing dross material was reported present south of Characterization Grids 129 through 132 during the ALRP (Figure 2).

The yard area west of the Slag Storage Building was reportedly the site of a large shearing machine that was apparently used to chop metal into more manageable sizes. Around 1977, this area was covered by the Crusher Addition Building. The addition's concrete deck is approximately 4 feet above the original surface grade. This suggests that fill was placed to support the deck.

The Crusher Building has been expanded significantly, at least once between 1958 and 1964 and again around 1977. Less obvious changes are visible in other aerial photographs, possibly reflecting process changes in plant operations. The current structure features a concrete deck elevated at least 4 feet above the surrounding grade and equal to the level of the addition's deck. The expansion built in 1958 and 1961 may have covered residual radioactive material beneath the expanded decking.

Most of the surface area around the current plant layout is paved with concrete, including the areas between the offices, maintenance, new smelter, warehouse, crusher, and north extrusion buildings. Surface areas north and east of the Crusher Building consist of concrete driveways. The date(s) when paving was completed is not known. The 1958 aerial photograph appears to show bare soil for much of the surface area around plant buildings, but by 1964 most of the surface area appears to be paved. Areas of concern were identified near the maintenance building and the warehouse during the ALRP.

Historical aerial photographs for the years 1958 and 1964 suggest that the North Extrusion Building may also have been built over fill. Extensive changes in the site topography for the building area were noted

on these aerial photographs. The footprint of the North Extrusion Building falls within an area that was once inundated with surface water. The site topography of this particular low area appears to have been significantly elevated by late 1958. Figure 4 compares the extent of the North Extrusion Building in 1958 and 1964. The physical characteristics of the fill material observed in the aerial photographs also appear to be similar to that found in areas excavated during the ALRP.

### 2.2.2 Characterization Approach

The goal for this phase of characterization was to define the physical and radiological nature of materials beneath certain concrete building slabs and pavement areas as they relate to the proposed decommissioning of the site. Characterization activities consisted of the following:

- Advancement of soil core holes through concrete floor slabs and the concrete paved areas to evaluate the physical nature and radiological characteristics of subsurface materials present in each area of concern.
- Analytical testing of soil core samples for the presence of thorium.

The site areas characterized include the Slag Storage Building and adjacent paved area, the original Crusher Building and adjacent paved area, the Crusher Addition Building, the Flux Building and adjacent paved area, the Warehouse Building, and the concrete paved area located to the west of the Maintenance Building. A discussion of the specific characterization activities and findings for each of these areas of concern is presented in Chapter 3.0.

### 3.0 Characterization Activities and Results

This chapter provides a discussion of the characterization activities completed for each area of concern and presents the results of the additional site characterization effort. As previously mentioned, one of the secondary goals of the additional characterization event was to determine the chemical toxicity characteristics (U.S. Environmental Protection Agency [USEPA], Hazardous Waste Determination) of the thorium-bearing dross materials to be excavated at the site during implementation of the DP. An overview of this determination is also provided below.

#### 3.1 USEPA Hazardous Waste Determination for the Thorium-Bearing Dross

In order to establish a baseline chemical toxicity characteristics profile of the thorium-bearing dross for material management purposes, 10 grab samples of subsurface dross materials were collected for laboratory analysis. Samples were obtained from test pit excavations advanced in the Retention Pond area (five samples), the Reserve Pond area (two samples), and the suspected area of the “trash pile” (three samples) (Figure 5). Test pits were excavated with a rubber-tired backhoe operated by A&M Engineering under the supervision of Earth Sciences’ personnel. Subsurface materials encountered were screened in the field with a photoionization detector (PID) for the presence of organic compounds. No above-background organic vapor readings were detected with the field survey instrument during the intrusive subsurface characterization activities.

Samples for laboratory analyses were placed in appropriate containers, properly labeled, and packaged for shipment to the analytical laboratory in shuttles. Samples were chilled from the time of collection until their arrival at the analytical laboratory. Earth Sciences’ standard chain-of-custody protocol was strictly adhered to during all phases of sample collection, transport, and delivery to the laboratory.

Samples were analyzed by Outreach Laboratory (Outreach) of Broken Arrow, Oklahoma for leachable concentrations of metals and volatile organic compounds (VOCs) via the Toxicity Characteristic Leaching Procedure (TCLP). Results of the TCLP testing of the 10 samples indicated that the thorium-bearing dross is nonhazardous (Table 1). No VOCs were detected above laboratory reporting limits. The metals arsenic, barium, chromium, selenium, and silver were detected at concentrations below their respective USEPA toxicity characteristic regulatory levels (Appendix B). A copy of the analytical data report is contained in Appendix C.



### 3.2 Trash Pile Area

Seven exploratory test trench excavations were advanced at biased locations (based on aerial photograph interpretations and field observations during the ALRP) to evaluate the physical nature and examine the radiological and chemical (organic compounds) characteristics of subsurface materials present in this area of concern. The placement of the test trench excavations was as follows (Figure 5):

- Two test trench excavations (Nos. 3 and 7) were advanced within the structural limits of the buried spillway, one between the south fence and the stockpile (No. 3), and one between the stockpile and the Retention Pond (No. 7).
- Two test trench excavations (Nos. 1 and 2) were advanced in the area of the small trash pile identifiable in the 1967 aerial photograph of the site (Appendix A).
- Three test trench excavations (Nos. 4, 5, and 6) were advanced along the southwestern perimeter of the Retention Pond in the area of the trash pile identifiable in the 1964 aerial photograph of the site (Appendix A).

Test trench excavations were advanced using a rubber-tired backhoe operated by A&M Engineering under the supervision of Earth Sciences' personnel. Earth Sciences' field representative prepared a descriptive log of the subsurface materials encountered in each test trench excavation. Subsurface materials encountered were also screened in the field with gamma detectors for radioactivity and a PID for the presence of organic compounds.

A descriptive summary of the subsurface materials encountered during trenching and the results of the field screening activities are presented by test trench location in Table 2. Test Trench Excavation Nos. 2 through 6 exhibited a combination of soil, dross, and buried debris. Debris materials typically consisted of concrete, scrap steel, rebar, wood, plastic, wire, cables, and rubber belts. Depths associated with these debris materials ranged from the ground surface to over 15 feet bgs. Metal drums containing dross were also encountered during the excavation of Test Trench No. 3.

Field screening activities indicated the presence of above-background radioactivity (Table 2). Gross gamma exposure rate survey measurements obtained with a Ludlum Model 19 instrument ranged from 11  $\mu\text{R/hr}$  (Test Trench No. 1) to 160  $\mu\text{R/hr}$  (Test Trench No. 3). Gross gamma survey measurements obtained with a Ludlum 2221 ratemeter coupled with a 2-inch-by-2-inch NaI detector ranged from 19,500 counts per minute (cpm) (Test Trench No. 1) to 260,000 cpm (Test Trench No. 3). No organic vapor readings were detected with the field survey instrument during the intrusive subsurface characterization activities.

### 3.3 Subsurface Characterization Beneath Structures and Paved Areas

As previously mentioned, modifications to on-site buildings/structures during the operating life of the facility may have resulted in the covering of residual radioactive material beneath concrete paved surfaces and building floor areas. The areas where radioactive material may exist beneath structures and paved areas were based upon an interpretation of historical data and/or observations made during the ALRP. These areas include the Flux Building and adjacent paved area, Slag Storage Building and adjacent paved area, the original Crusher Building and adjacent paved area, the Crusher Addition Building, the Warehouse Building, and the concrete paved area located to the west of the Maintenance Building (Figure 2).

An on-contact gamma exposure rate survey of each building concrete floor surface or concrete-paved surface was initially conducted to identify areas of elevated surface radioactivity. A total of 24 core sample holes were then advanced through the concrete surfaces of the areas of concern at locations biased towards the results of the gamma survey, previous characterization activities, and/or the ALRP (Figure 5). A Geoprobe<sup>TM</sup> sampler was used to collect soil cores (typically 4 feet in length) of the subsurface materials for characterization purposes. Gross gamma exposure rate readings were obtained directly above each core hole location during the core sampling activity. The results provided immediate feedback of potential radioactivity. The gross gamma exposure rate survey readings were obtained at each core hole location prior to the removal of the concrete core, following the removal of the concrete core, and following the removal of each Geoprobe<sup>TM</sup> sample core (Table 3).

The soil cores were surveyed on-site for gross gamma activity and sampled for laboratory analysis in accordance with Procedure ESC/HPM3-6 (Appendix D). Soil cores were scanned with a sodium iodide detector in a controlled environment (i.e., lead cave). The maximum net count rate observed for each 1-foot segment of the core sample was recorded (Table 4). The most elevated 1-foot segment of soil core for each core hole location was sampled for laboratory analysis. Sample collection consisted of separating the most elevated 1-foot segment using an appropriate tool, placing the segment into a clean bucket, mixing the core segment with a trowel, and placing the material in an appropriate laboratory supplied container.

Samples for laboratory analyses were properly labeled and packaged for shipment to the analytical laboratory in shuttles. Earth Sciences' standard chain-of-custody protocol was strictly adhered to during all phases of sample collection, transport, and delivery to the laboratory. Samples were analyzed by Outreach via gamma spectroscopy. A copy of the analytical data report is contained in Appendix E.

Specific characterization activities conducted for each area of concern and the results thereof are presented in the following sections.

### 3.3.1 Background Values

Background values used in the interpretation of field and analytical results were established at the start of field activities. Background concentrations for Th-232 occurring naturally in soil were derived for the ALRP. The established value for the site is 1.1 picocuries per gram (pCi/g) Th-232. The derivation of this value is presented in the Adjacent Land Remediation Plan (Reference 3).

Background values for field instruments were calculated by averaging several ambient measurements taken in nonimpacted areas. Background exposure rates were obtained in the front grounds of the office building. Background for the Ludlum Model 19 was determined to be 9  $\mu$ R/hr. Background gross gamma rates were obtained in the lead cave that was utilized for the surveying of the soil cores. Background for the Ludlum Model 2221 with a 44-10 (2-inch-by-2-inch NaI) detector was determined to be 6,400 cpm.

### 3.3.2 Thorium Comparison Value

In order for the analytical results acquired during the additional characterization to be meaningful, a comparison value for the Th-232 reported results was needed. The value that was used for comparison was the Modeled Derived Concentration Guideline Level (DCGL) valued calculated for the DP (Reference 1, Section 5). This value, 3.0 pCi/g, was determined by taking the calculated DCGL value of 3.45 pCi/g Th-232 (which would result in a resident farmers dose of 25 mrem/yr.) and adjusting for the presence of other principal radionuclides and their ratios to Th-232. The following table illustrates the radionuclides of interest, their ratio to Th-232 and the adjusted DCGL with respect to the Unity Rule.

Radionuclide	Single Radionuclide DCGL <sub>w</sub> (pCi/g)	Ratio to Th-232 Assuming Equilibrium	Average Concentration with Respect to Th-232 Ratio (pCi/g)	Adjusted DCGL <sub>w</sub> to Meet Unity Rule (pCi/g)
Pb-210	1.751	0.043	0.15	0.12
Ra-226	5.9	0.082	0.28	0.24
Ra-228	4.317	1	3.42	2.91
Th-228	3.366	1	3.42	2.91
Th-230	102.3	3.5	11.96	10.19
Th-232	3.418	1	3.42	2.91

### 3.3.3 Flux Building and Adjacent Paved Area

#### **Characterization Activities**

A total of 12 core holes was advanced through the concrete slab within the Flux Building and the concrete paved area located to the west of the building to evaluate the physical nature and examine the radiological characteristics of subsurface materials present in this area of concern (Figure 5). The placement of the core sample holes was as follows:

- Eight core holes were advanced through the Flux Building concrete slab. Core Hole Nos. 1 through 4 were placed along the eastern and southern interior walls of the building to confirm the presence or absence of radioactive material that was found outside of the building during site characterization and ALRP activities. Core Hole Nos. 5 through 8 were placed at biased locations as determined through a gamma exposure rate survey of the building floor surface.
- Four core holes (Nos. 9 through 12) were advanced through the concrete paving located to the west of the Flux Building. Core Hole Nos. 9 and 10 were biased to the area of the former vertical storage tanks.

#### **Characterization Results**

##### Physical Information

- Soils consisted mainly of a brown to gray clayey debris zone overlying a brown to dark brown clay. General profiles of the subsurface materials encountered beneath the Flux Building and Paved Area are presented in Figure 7 (Sections A and B).

##### Radiological Information

The soil cores net gamma activity survey and soil sample gross gamma spectroscopy analysis results for Th-232 are summarized in Tables 4 and 5 respectively. Figure 6 shows the spatial positioning of the core holes color-coded according to Th-232 activity concentrations.

##### *Flux Building (Core Hole Nos. 1 through 8)*

- Net gamma activity survey results for the soil cores ranged from 143 cpm to 10,097 cpm.
- Th-232 activity concentrations (gross) ranged from 1.82 pCi/g (Sample Location No. 2) to 89.0 pCi/g (Sample Location No. 7). Sample locations and corresponding depths with

activity concentrations above the DP Modeled DCGL of 3.0 pCi/g included Location No. 1, 8 to 9 feet (4.21 pCi/g); Location No. 3, 3 to 4 feet (11.1 pCi/g); Location No. 5, 5 to 6 feet (30.7 pCi/g); Location No. 6, 3 to 4 feet (71.4 pCi/g); and Location No. 7, 3 to 4 feet (89.0 pCi/g); and Location No. 8, 0 to 1 foot (3.33 pCi/g).

*Paved Surface Area (Core Hole Nos. 9 through 12)*

- Net gamma activity survey results for the soil cores ranged from 284 cpm to 1,249 cpm.
- Th-232 activity concentrations (gross) ranged from 0.641 pCi/g (Sample Location No. 11) to 0.954 pCi/g (Sample Location No. 9). No sample locations for this area exceeded the DP Modeled DCGL of 3.0 pCi/g.

3.3.4 Slag Storage Building and Adjacent Paved Area

**Characterization Activities**

A total of six core holes was advanced through the concrete slab of the former Slag Storage Building and the concrete paved area located to the north of the building footprint to evaluate the physical nature and examine the radiological characteristics of subsurface materials present in this area of concern (Figure 5). The placement of the core sample holes was as follows:

- Three core holes (Nos. 16 through 18) were advanced through the former Slag Storage Building concrete slab.
- Three core holes (Nos. 13 through 15) were advanced through the concrete paving located to the north of the building footprint.

Core holes were placed at biased locations as determined through a gamma exposure rate survey of the concrete surfaces, previous characterization activities, and/or the ALRP activities.

**Characterization Results**

Physical Information

Several layers of concrete and base material were encountered at Location Nos. 14 and 15. Underlying soils at these two locations consisted mainly of a thin dark brown to gray clayey debris zone overlying a brown to dark brown clay. Core Hole Location Nos. 13, 16, and 18 exhibited a single layer of concrete and base materials overlying a brown to dark brown clay. General profiles of the subsurface materials encountered in the area of the former Slag Storage Building are presented in Figure 7 (Sections B and C).

### Radiological Information

The soil cores net gamma activity survey and soil sample gross gamma spectroscopy analysis results for Th-232 are summarized in Tables 4 and 5 respectively. Figure 6 shows the spatial positioning of the core holes color-coded according to Th-232 activity concentrations.

#### *Building Footprint (Core Hole Nos. 16 through 18)*

- Net gamma activity survey results for the soil cores ranged from 247 cpm to 1,364 cpm.
- Th-232 activity concentrations (gross) were reported as 0.659 pCi/g (Sample Location No. 16, 4 to 5 feet); 0.674 pCi/g (Location No. 17, 2 to 3 feet); and 1.33 pCi/g (Sample Location No. 18, 0 to 1 foot). No sample locations for this area exceeded the DP Modeled DCGL of 3.0 pCi/g.

#### *Paved Surface Area North of Building Footprint (Core Hole Nos. 13 through 15)*

- Net gamma activity survey results for the soil cores ranged from 437 cpm to 2,948 cpm.
- Th-232 activity concentrations (gross) were reported as 0.863 pCi/g (Sample Location No. 13, 1 to 2 feet); 6.26 pCi/g (Location No. 14, 0 to 1 foot); and 11.1 pCi/g (Sample Location No. 15, 1 to 2 feet). Sample locations exhibiting activity concentrations above the DP Modeled DCGL of 3.0 pCi/g included Location Nos. 14 and 15.

### 3.3.5 Crusher Building and Adjacent Paved Area

#### **Characterization Activities**

A total of two core holes was advanced through the concrete slab of the Crusher Building and the concrete paved area located to the north of the building to evaluate the physical nature and examine the radiological characteristics of subsurface materials present in this area of concern (Figure 5). The placement of the core sample holes was as follows:

- One core hole (No. 23b) was advanced through the Crusher Building concrete decking.
- One core hole (No. 19) was advanced through the concrete paving located to the north of the Crusher Building.

Core holes were placed at biased locations as determined through a gamma exposure rate survey of the concrete surfaces.

## **Characterization Results**

### Physical Information

A sand, dross, and brown clay mixture was encountered at Core Hole Location No. 19. Soils consisted mainly of a brown to gray clayey debris zone overlying a brown to dark brown clay at Corehole No. 23. General profiles of the subsurface materials encountered beneath the Crusher Building and Paved Area are presented in Figure 7 (Sections A and B).

### Radiological Information

The soil cores net gamma activity survey and soil sample gross gamma spectroscopy analysis results for Th-232 are summarized in Tables 4 and 5 respectively. Figure 6 shows the spatial positioning of the core holes color-coded according to Th-232 activity concentrations.

#### *Crusher Building (Corehole No. 23b)*

- Net gamma activity survey results for the soil cores ranged from 449 cpm to 5,067 cpm.
- The Th-232 activity concentration (gross) reported for Sample Location No. 23b, 1 to 2 feet was 45.7 pCi/g. This activity concentration exceeded the DP Modeled DCGL of 3.0 pCi/g.

#### *Paved Surface Area North of Crusher Building (Corehole No. 19)*

- Net gamma activity survey results for the soil cores ranged from 624 cpm to 2,221 cpm.
- The Th-232 activity concentration (gross) reported for Sample Location No. 19, 4 to 5 feet was 5.63 pCi/g. This activity concentration exceeded the DP Modeled DCGL of 3.0 pCi/g.

### 3.3.6 Crusher Addition Building

#### **Characterization Activities**

A total of two core holes was advanced through the concrete slab of the Crusher Addition Building to evaluate the physical nature and examine the radiological characteristics of subsurface materials present in this area of concern (Figure 5). The two core holes (Nos. 20 and 21) were placed along the east-west centerline of the addition.

#### **Characterization Results**

##### Physical Information

A subsurface concrete layer encountered in Core Hole Location Nos. 20 and 21 prevented the adequate subsurface characterization of this area. A general profile of the subsurface materials encountered beneath the Crusher Addition Building is presented in Figure 7 (Section D).

##### Radiological Information

The soil cores net gamma activity survey and soil sample gross gamma spectroscopy analysis results for Th-232 are summarized in Tables 4 and 5 respectively. Figure 6 shows the spatial positioning of the core holes color-coded according to Th-232 activity concentrations.

- Net gamma activity survey results for the soil cores ranged from 389 cpm to 919 cpm.
- Th-232 activity concentrations (gross) reported for Sample Location Nos. 20 and 21 were 0.283 pCi/g and 2.69 pCi/g respectively. These activity concentrations do not exceed the DP Modeled DCGL of 3.0 pCi/g.

### 3.3.7 Maintenance Building Area

#### **Characterization Activities**

One core hole was advanced through the concrete paving located to the west of the Maintenance Building to evaluate the physical nature and examine the radiological characteristics of subsurface materials present in this area of concern (Figure 5). The positioning of this core hole (No. 24) was based on a gamma exposure rate survey of the concrete surface. A second sample for this area (Sample No. 25) was not collected during the Additional Characterization event. It was collected during the ALRP.



## Characterization Results

### Physical Information

A general profile of the subsurface materials encountered in the vicinity of the Maintenance Building is presented in Figure 7 (Section D).

### Radiological Information

The soil cores net gamma activity survey and soil sample gross gamma spectroscopy analysis results for Th-232 are summarized in Tables 4 and 5 respectively. Figure 6 shows the spatial positioning of the core holes color-coded according to Th-232 activity concentrations.

- Net gamma activity survey results for the soil core ranged from 6,097 to 9,097 cpm.
- Th-232 activity concentrations (gross) reported for Sample Location Nos. 24 and 25 were 9.57 pCi/g and 8.47 pCi/g respectively. These activity concentrations exceeded the DP Modeled DCGL of 3.0 pCi/g.

#### 3.3.8 Warehouse Building

### Characterization Activities

One core hole was advanced through the concrete slab of the Warehouse Building to evaluate the physical nature and examine the radiological characteristics of subsurface materials present in this area of concern (Figure 5). The core hole (No. 22) was placed along the north wall outside of the warehouse office. The positioning of this core hole was based on a gamma exposure rate survey of the concrete surface.

### Characterization Results Summary

#### Physical Information

A subsurface concrete layer encountered in Corehole Location No. 22 prevented adequate subsurface characterization of this area. A general profile of the subsurface materials encountered beneath the Warehouse Building is presented in Figure 7 (Section D).

### Radiological Information

The soil cores net gamma activity survey and soil sample gross gamma spectroscopy analysis results for Th-232 are summarized in Tables 4 and 5 respectively. Figure 6 shows the spatial positioning of the core holes color-coded according to Th-232 activity concentrations.

- Net gamma activity survey results for the soil core ranged from 849 to 1,068 cpm.
- The Th-232 activity concentration (gross) reported for Sample Location No. 22 was 6.11 pCi/g. This activity concentration exceeded the DP Modeled DCGL of 3.0 pCi/g.

## 4.0 Summary of Findings and Conclusions

This chapter presents a summary of findings for the additional site characterization effort. Conclusions based on these findings relative to future characterization activities in support of the facility decommissioning are also contained in this section of the report.

### 4.1 USEPA Hazardous Waste Determination for the Thorium-Bearing Dross

The objective of this additional site characterization task was to establish a baseline chemical toxicity characteristics profile of the thorium-bearing dross materials to be excavated at the site during implementation of the DP for material management purposes. Ten grab samples of subsurface dross materials were collected from test pit excavations advanced in the Retention Pond area (five samples), the Reserve Pond area (two samples), and the suspected area of the "trash pile" (three samples). Samples were analyzed for leachable concentrations of metals and VOCs via the TCLP. No VOCs were detected above laboratory reporting limits. The metals arsenic, barium, chromium, selenium, and silver were detected at concentrations below their respective USEPA toxicity characteristics regulatory levels. Results of the TCLP testing of the 10 samples indicated that the thorium-bearing dross is a nonhazardous material.

### 4.2 "Trash Pile" Area Subsurface Characterization

Historical aerial photographs of the site indicated that a "trash pile" at one time existed within the 14-acre land parcel area prescribed in the DP for remediation. The objective of this additional site characterization task was to determine the physical, radiological, and chemical (organic compounds) characteristics of the subsurface materials within this area of concern relative to materials management planning.

Seven exploratory test trench excavations were advanced at biased locations based on aerial photograph interpretations and field observations. Five of the seven test trench excavations revealed the presence of a significant amount of debris material (concrete, scrap steel, rebar, wood, plastic, wire, cables, and rubber belts) intermixed with soil and dross. Planned DP activities may need to be modified to address the presence of debris materials in the excavation areas.

As mentioned in Section 4.2, three grab samples of subsurface materials were collected from test pit excavations advanced in the "trash pile" area. Results of TCLP testing of the samples indicated that the materials were nonhazardous material. Furthermore, subsurface materials encountered during test pitting

were also screened in the field with a PID for the presence of organic compounds. No organic vapor readings were detected with the field survey instrument during the intrusive subsurface characterization activities.

#### 4.3 Subsurface Characterization Beneath Structures and Paved Areas

Modifications to on-site buildings/structures during the operating life of the facility may have resulted in the covering of residual radioactive material beneath concrete paved surfaces and building floor areas. The areas where radioactive material may exist beneath structures was based upon an interpretation of historical data and/or observations made during the ALRP. These areas included the Flux Building and adjacent paved area, Slag Storage Building and adjacent paved area, the original Crusher Building and adjacent paved area, the Crusher Addition Building, the Warehouse Building, and the concrete paved area located to the west of the Maintenance Building. The objective of this additional site characterization task was to determine if thorium-bearing dross/radioactive material was present beneath these areas of concern.

##### 4.3.1 Flux Building and Adjacent Paved Area

A total of 12 core holes was advanced through the concrete slab within the Flux Building and the concrete paved area located to the west of the building to evaluate the physical nature and examine the radiological characteristics of subsurface materials present in this area of concern. Data obtained during the characterization effort in conjunction with observations made during the ALRP indicate the presence of radioactive material beneath a significant portion of the Flux Building structure. The presence of this material beneath the structure is most likely the result of grading activities prior to the building's construction. The limited subsurface characterization effort conducted for the concrete paved area located to the west of the Flux Building did not reveal the presence of radioactive material.

##### 4.3.2 Slag Storage Building and Adjacent Paved Area

A total of six core holes was advanced through the concrete slab of the former Slag Storage Building and the concrete paved area located to the north of the building footprint to evaluate the physical nature and examine the radiological characteristics of subsurface materials present in this area of concern. Data obtained during the characterization effort in conjunction with observations made during the ALRP indicate the presence of radioactive material beneath the northern portion of the concrete pad which once utilized as a slag storage area. The limited subsurface characterization effort conducted within the footprint of the former building did not reveal the presence of radioactive material.

#### 4.3.3 Crusher Addition Building

A total of two core holes was advanced through the concrete slab of the Crusher Addition Building to evaluate the physical nature and examine the radiological characteristics of subsurface materials present in this area of concern. The two core holes (Nos. 20 and 21) were placed along the east-west centerline of the addition. Data obtained during the characterization did not indicate the presence of radioactive material. However, a subsurface concrete layer prevented the adequate subsurface characterization of this area.

#### 4.3.4 Crusher Building and Adjacent Paved Area

One core hole was advanced through the concrete slab of the Crusher Building and one in the concrete paved area located to the north of the building to evaluate the physical nature and examine the radiological characteristics of subsurface materials present in this area of concern. Data obtained during the characterization effort in conjunction with observations made during the ALRP indicate the presence of radioactive material beneath the north portion of the Crusher Building structure and beneath the paved area north/northeast of the building.

#### 4.3.5 Maintenance Building Area

One core hole was advanced through the concrete paving located to the west of the Maintenance Building to evaluate the physical nature and examine the radiological characteristics of subsurface materials present in this area of concern. Data obtained during the characterization effort in conjunction with observations made during the ALRP indicate the presence of radioactive material beneath the concrete paving area located west of the Maintenance Building. The location of the elevated measurements identified in this area appears to correlate to an area that underwent several grading activities between 1950 and 1964.

#### 4.3.6 Warehouse Building

One core hole was advanced through the concrete slab of the Warehouse Building to evaluate the physical nature and examine the radiological characteristics of subsurface materials present in this area of concern. The core hole was placed along the north wall outside of the warehouse office. Data obtained during the characterization effort indicate the presence of radioactive material beneath a portion of the concrete area inside of the Warehouse Building. The location of the elevated measurements identified in this area appears to correlate to an area which underwent several grading activities between 1958 and 1964.

## References

## References

Decommissioning Plan, Tulsa Facility, Tulsa, Oklahoma, Kaiser Aluminum and Chemical Corporation, Baton Rouge, Louisiana, Project No. 5427E, Earth Sciences Consultants, Inc. (June 2001).

Final Status Survey Report, Adjacent Land Area, Tulsa, Oklahoma Facility, Kaiser Aluminum & Chemical Corporation, Baton Rouge, Louisiana, Project No. 5427F, Earth Sciences Consultants, Inc. (July 2001).

Adjacent Land Remediation Plan for Kaiser Aluminum & Chemical Corporation, Tulsa, Oklahoma (July 1999, Revision 1).

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## Tables



Table 1  
USEPA Hazardous Waste Determination - TCLP Analytical Results  
Thorium-Bearing Dross  
Additional Site Characterization  
Former Kaiser Aluminum Specialty Products Facility  
Tulsa, Oklahoma  
Kaiser Aluminum & Chemical Corporation

Sample No.	Analysis	Arsenic (mg/l)	Barium (mg/l)	Cadmium (mg/l)	Chromium (mg/l)	Lead (mg/l)	Mercury (mg/l)	Selenium (mg/l)	Silver (mg/l)
<i>Reg. Level</i>		<i>5.0</i>	<i>100.0</i>	<i>1.0</i>	<i>5.0</i>	<i>5.0</i>	<i>0.2</i>	<i>1.0</i>	<i>5.0</i>
1	Metals	< 0.005	14	< 0.011	< 0.010	< 0.005	< 0.0005	< 0.005	< 0.009
2	Metals	< 0.010	13.4	< 0.011	< 0.010	< 0.005	< 0.0005	< 0.105	0.047
3	Metals	0.01	7.85	< 0.011	0.015	< 0.005	< 0.0005	< 0.005	< 0.009
4	Metals	< 0.005	3.7	< 0.011	0.013	< 0.005	< 0.0005	0.007	0.014
5	Metals	< 0.005	13.9	< 0.011	< 0.010	< 0.005	< 0.0005	< 0.005	0.01
6	Metals	< 0.005	6.19	< 0.011	< 0.010	< 0.005	< 0.0005	0.007	< 0.009
7	Metals	< 0.005	3.61	< 0.011	< 0.010	< 0.005	< 0.0005	< 0.005	0.01
8	Metals	< 0.005	6.14	< 0.011	< 0.010	< 0.005	< 0.0005	0.008	< 0.009
9	Metals	< 0.005	5.16	< 0.011	< 0.010	< 0.005	< 0.0005	0.006	0.034
10	Metals	0.01	8.71	< 0.011	0.011	< 0.005	< 0.0005	< 0.005	0.013

Sample No.	Analysis	1,1-Dichloroethene (mg/l)	1,2-Dichloroethane (mg/l)	2-Butanone (mg/l)	Benzene (mg/l)	Carbon tetrachloride (mg/l)	Chloroform (mg/l)	Tetrachloroethene (mg/l)	Trichloroethene (mg/l)	Vinyl Chloride (mg/l)	Chlorobenzene (mg/l)
<i>Reg. Level</i>		<i>0.7</i>	<i>0.5</i>	<i>200.0</i>	<i>0.5</i>	<i>0.5</i>	<i>6.0</i>	<i>0.7</i>	<i>0.5</i>	<i>0.2</i>	<i>100.0</i>
1	VOCs	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
2	VOCs	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
3	VOCs	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
4	VOCs	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
5	VOCs	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
6	VOCs	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
7	VOCs	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
8	VOCs	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
9	VOCs	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
10	VOCs	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005

ND = None Detected

**Table 2**  
**Summary of Test Trench Excavation Results**  
**Trash Pile Area**  
**Additional Site Characterization**  
**Former Kaiser Aluminum Specialty Products Facility**  
**Tulsa, Oklahoma**  
**Kaiser Aluminum & Chemical Corporation**

Test Trench No.	Physical Description of Subsurface Materials Encountered	Net Gamma Screening Result <sup>(1)</sup> (Average CPM)	Net Exposure Rate Screening Result <sup>(1)</sup> (Average $\mu$ R/hr)	Organic Vapor Reading (ppm)
1	Bluish-gray to gray dross (0-0.25') and brown clay (0.25-10'). No debris encountered.	9,500	2	0.0
2	Dark brown silt loam (0-6') and brown clay (6'-10'). Elevated radioactivity appeared to be limited to the initial 6' of material. An abandoned electrical conduit (8") was found at a depth of 5'.	10,000 70,000 on pipe	11	0.0
3	Bluish-gray to gray dross (0-15') containing debris (sheet metal, rebar, wood, plastic, various cables, wire, bricks, 55-gallon drums of dross material, and rubber belts). Dross became wet at a depth of 9' with a significant amount of water inflow at a depth of 11'. Total depth of excavation was 19'. Buried concrete spillway was not encountered during excavation.	250,000	81 @ 3' 91 @ 4' 151 @ 11'	0.0
4	Brown silt loam (0-1.5'), bluish-gray to gray compacted dross (1.5'-3'), and a bluish-gray to gray dross comingled with a brown silt loam and debris (3-10'). Debris consisted of rebar, plastic, and steel conduits.	18,000 Max 70,000	71	0.0
5	Debris consisting of concrete blocks, large rocks, and lumber (0-1'), bluish-gray to gray dross (1-2'), and brown clay (2-10').	16,000 Max 90,000	21	0.0
6	Debris consisting of concrete, belts, scrap steel, and wood (0-2'), dark brown silt loam (2-8'), and clay (8-10'). Water inflow was noted at a depth of 9'.	10,000	11	0.0
7	Brown clay (0-1'), bluish-gray to gray dross (1-2'), and light brown silt loam (2-10'). No debris encountered.	10,000	11	0.0

<sup>(1)</sup>Site established background values are 9  $\mu$ R/hr and 10,000 cpm.

**Table 3**  
**Net Gamma Exposure Rate Readings During Coring Activities**  
**Additional Site Characterization**  
**Former Kaiser Aluminum Specialty Products Facility**  
**Tulsa, Oklahoma**  
**Kaiser Aluminum & Chemical Corporation**

Building Location	Sample No.	Before Concrete Core Removal ( $\mu\text{R/hr}$ )	Following Concrete Core Removal ( $\mu\text{R/hr}$ )	Following First Soil Core Removal ( $\mu\text{R/hr}$ )	Following Second Soil Core Removal ( $\mu\text{R/hr}$ )	Following Third Soil Core Removal ( $\mu\text{R/hr}$ )
Flux Building	1	1	3	4	4	2
	2	0	2	-1	-1	N/A
	3	1	2	0	1	N/A
	4	0	2	-1	0	N/A
	5	3	9	7	7	N/A
	6	4	11	18	21	N/A
	7	6	21	23	23	N/A
	8	5	9	10	8	N/A
Paved Area Adjacent to Flux Building	9	13	13	5	4	N/A
	10	9	11	10	9	N/A
	11	11	4	4	4	N/A
	12	6	4	1	0	N/A
Slag Storage Building Area	13	1	3	4	4	N/A
	14	2	6	5	4	N/A
	15	6	6	6	6	N/A
	16	2	-3	-1	-2	N/A
	17	5	2	0	0	N/A
	18	8	20	14	14	N/A
North of Crusher Building	19	6	1	0	0	N/A
Crusher Addition Building	20	-2	0	-3	N/A	N/A
	21	1	1	-2	N/A	N/A
Warehouse Building	22	1	4	4	N/A	N/A
Crusher Building	<sup>(1)</sup> 23a	5	16	N/A	N/A	N/A
	23b	2	11	9	N/A	N/A
Maintenance Building	24	-2	51	61	N/A	N/A

<sup>(1)</sup> Sample location was moved to 23b because Geoprobe™ sampler could not reach original sample location.  
Background Gamma Exposure Rate ( $\mu\text{R/hr}$ ): 9

Table 4  
Gamma Survey Results - Soil Cores  
Additional Site Characterization  
Former Kaiser Aluminum Specialty Products Facility  
Tulsa, Oklahoma  
Kaiser Aluminum & Chemical Corporation

Building Location	Core Hole No.	Notes	Section 0-1' Net Gamma (cpm)	Section 1-2' Net Gamma (cpm)	Section 2-3' Net Gamma (cpm)	Section 3-4' Net Gamma (cpm)	Section 4-5' Net Gamma (cpm)	Section 5-6' Net Gamma (cpm)	Section 6-7' Net Gamma (cpm)	Section 7-8' Net Gamma (cpm)	Section 8-9' Net Gamma (cpm)	Section 9-10' Net Gamma (cpm)
Flux Building	1	1	286	149	447	548	475	492	577	1051	2164	1615
	2	1	545	<b>1099</b>	916	578	991	1011	819	611		
	3	1	648	1288	1948	<b>3339</b>	1548	1058	698	449		
	4	1	587	<b>1349</b>	927	1099	645	722	709	618		
	5	1	545	849	1038	1399	3318	<b>3615</b>	1289	513		
	6	1	1345	3465	4141	<b>7584</b>	4147	3057	1548	1145		
	7	1	954	4067	6646	<b>10097</b>	1399	1096	197	449		
	8	1	<b>1649</b>	699	548	483	349	143	351	340		
Paved Area Adjacent to Flux Building	9	1	964	449	<b>1249</b>	612	619	479	593	477		
	10	1	587	284	429	<b>658</b>	491	544	479	533		
	11	1	587	664	<b>1139</b>	437	611	449	577	437		
	12	1	<b>1092</b>	946	494	512	615	646	494	1013		
Slag Storage Building Area	13	1	668	<b>1146</b>	449	496	749	449	479	548		
	14	1	<b>1149</b>	1039	449	573	437	449	946	1002		
	15	1	1849	<b>2948</b>	948	618	457	619	988	449		
	16	1	389	449	247	615	<b>854</b>	548	810	745		
	17	1	349	494	<b>966</b>	848	856	446	534	477		
	18	1	<b>1364</b>	1068	619	445	848	553	437	429		
North of Crusher Building	19	1	749	1086	949	899	<b>2221</b>	624	1058	1031		
Crusher Addition Building	20	1, 2	<b>389</b>	<b>668</b>								
	21	1, 2	<b>919</b>	<b>706</b>								
Warehouse Building	22	1, 2	<b>849</b>	<b>1068</b>								
Crusher Building	23	1	4284	<b>5067</b>	3245	597	649	449	537	688		
Maintenance Building	24	1, 2	<b>9097</b>	<b>6097</b>								

Bolded numbers indicate core segment analyzed by the laboratory.

Concrete or similar subsurface obstructions were encountered. Entire soil core volume was required for laboratory analysis.

Counting Cave Background (cpm): 6400

**Table 5**  
**Analytical Results for Th-232**  
**Additional Site Characterization**  
**Former Kaiser Aluminum Specialty Products Facility**  
**Tulsa, Oklahoma**  
**Kaiser Aluminum & Chemical Corporation**

Building Location	Sample No.	Core Sample Depth (ft)	Net Gamma Count (cpm)	Analytical Results Gross Th-232 (pCi/g)
Flux Building	1	8-9	2164	4.21
	2	1-2	1099	1.82
	3	3-4	3339	11.1
	4	1-2	1349	2.83
	5	5-6	3615	30.7
	6	3-4	7584	71.4
	7	3-4	10097	89.0
	8	0-1	1649	3.33
Paved Area Adjacent to Flux Building	9	2-3	1249	0.954
	10	3-4	658	0.792
	11	2-3	1139	0.641
	12	0-1	1092	0.725
Slag Storage Building Area	13	1-2	1146	0.863
	14	0-1	1149	6.26
	15	1-2	2948	11.1
	16	4-5	854	0.659
	17	2-3	966	0.674
	18	0-1	1364	1.33
North of Crusher Building	19	4-5	2221	5.63
Crusher Addition Building	20	0-2	668	0.283
	21	0-2	919	2.69
Crusher Building	23a <sup>(1)</sup>	N/A	N/A	N/A
	23b	1-2	5067	45.7
Maintenance Building	24	0-2	9097	9.57
	25 <sup>(2)</sup>	0-0.5	N/A	8.47
Warehouse Building	22	0-2	1068	6.11

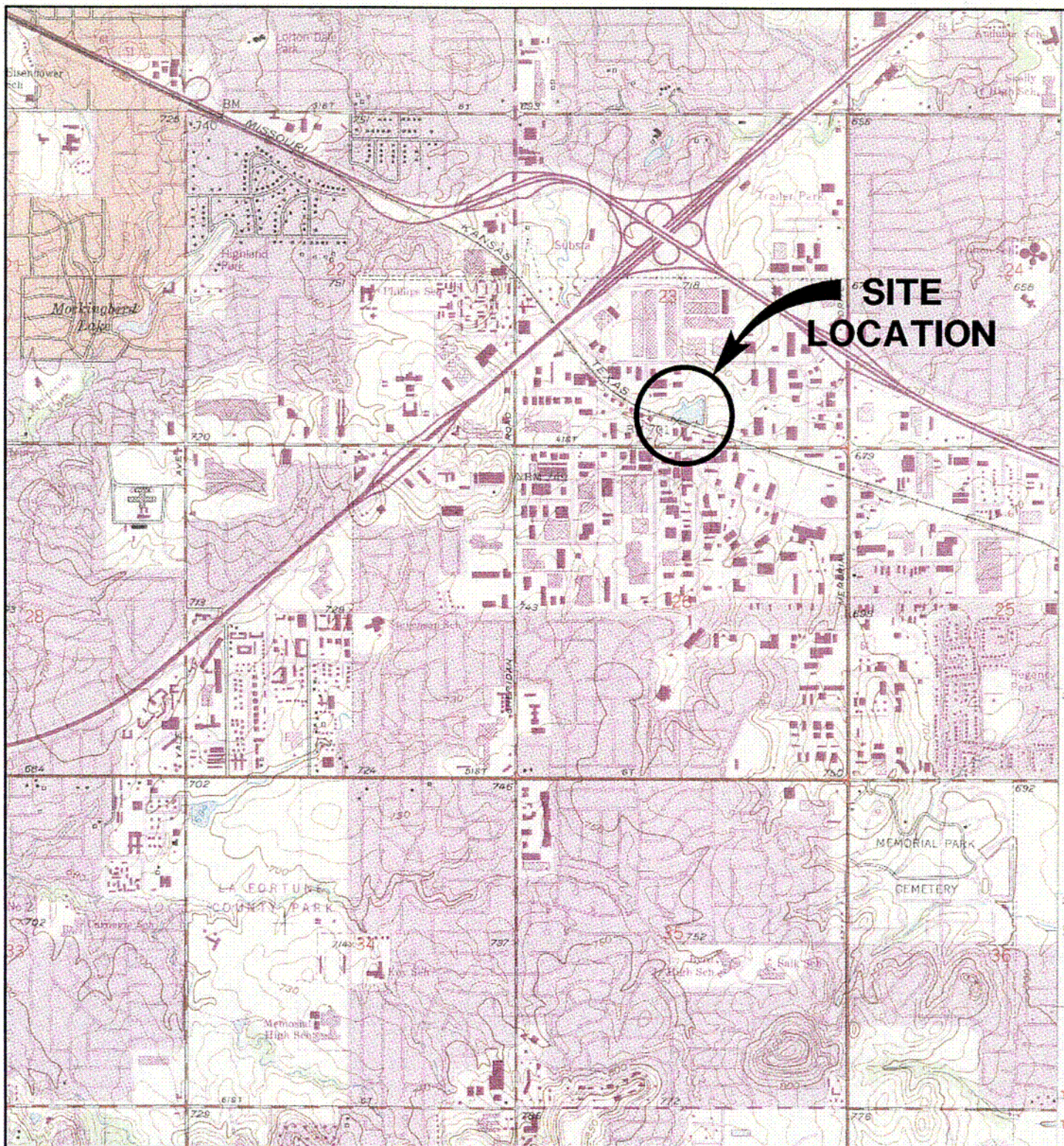
<sup>(1)</sup>Sample location was moved to 23b because Geoprobe™ sampler could not reach original sample location.

<sup>(2)</sup>Surface sample taken west of the Maintenance Building.

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## Figures





SCALE - FEET  
0 2000



**REFERENCE**

USGS 7.5-MIN TOPOGRAPHIC QUADRANGLE  
JENKS, OKLAHOMA  
DATED 1952, PHOTOREVISED 1982

**FIGURE 1  
SITE LOCATION MAP  
FORMER KAISER ALUMINUM  
SPECIALTY PRODUCTS FACILITY  
TULSA, OKLAHOMA**

PREPARED FOR  
**KAISER ALUMINUM & CHEMICAL CORPORATION  
BATON ROUGE, LOUISIANA**

APPROVED *[Signature]* 11/2/01  
CHECKED *[Signature]* 11/2/01  
DRAWN *[Signature]* GWA 10/1/01

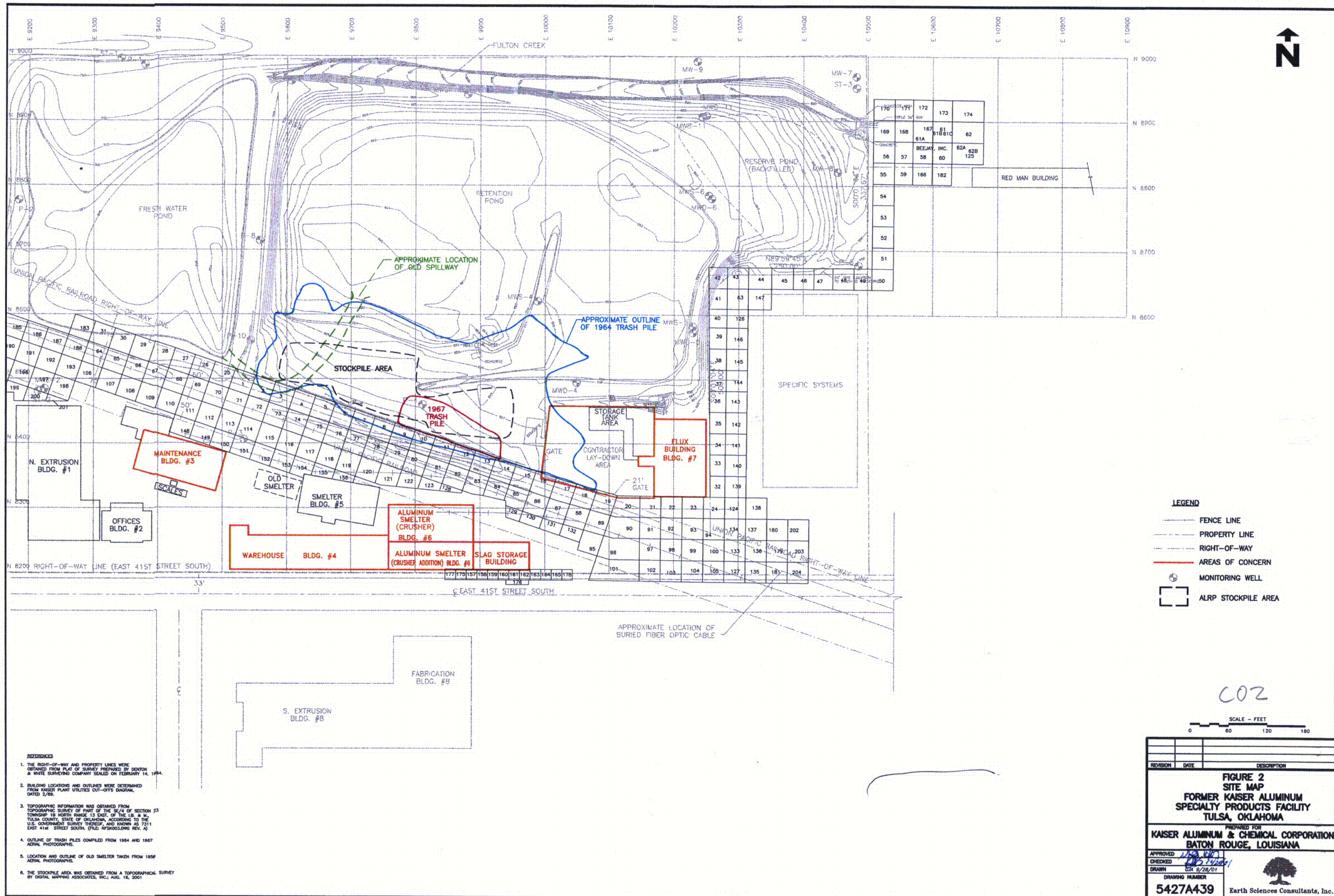
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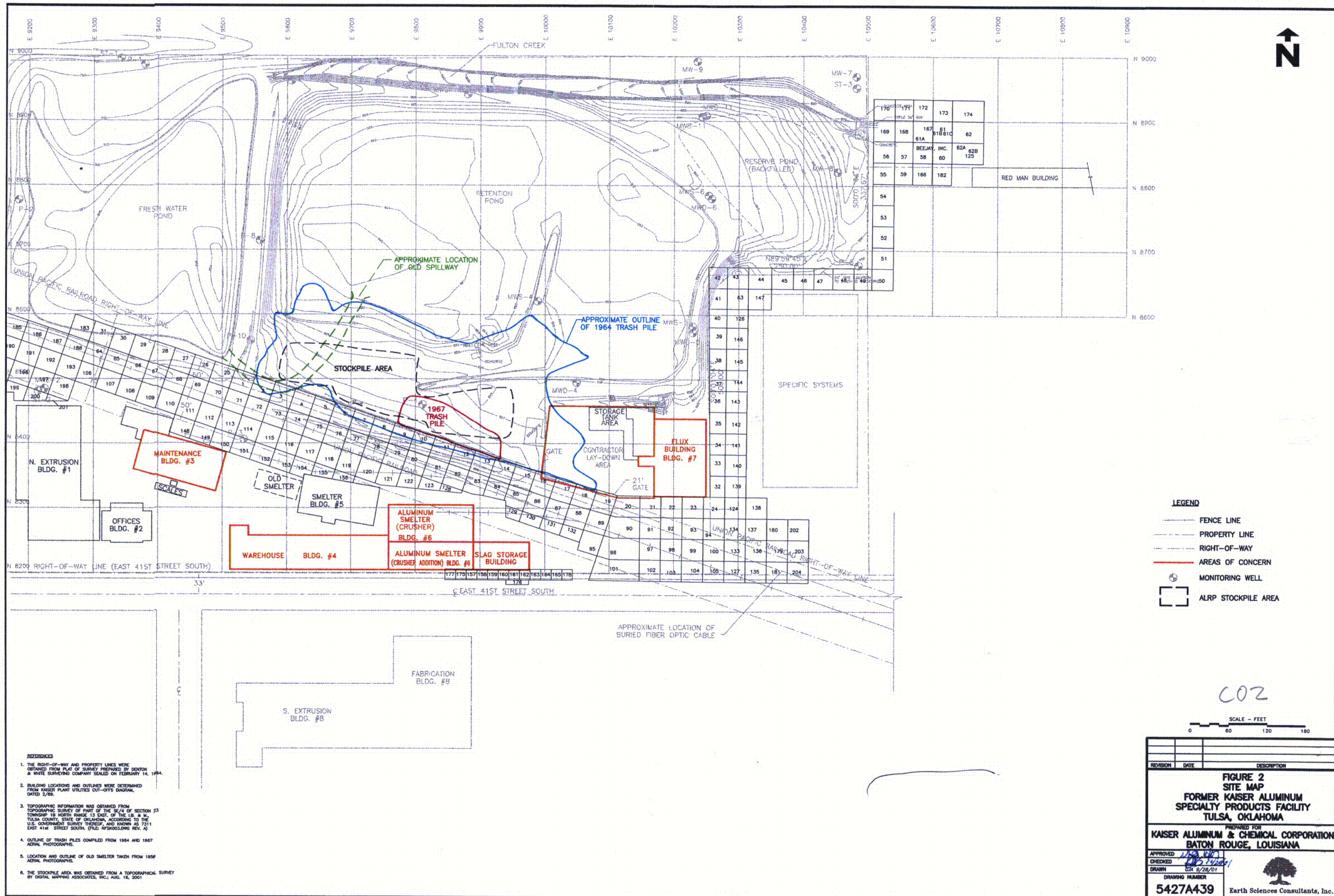
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**Earth Sciences Consultants, Inc.**

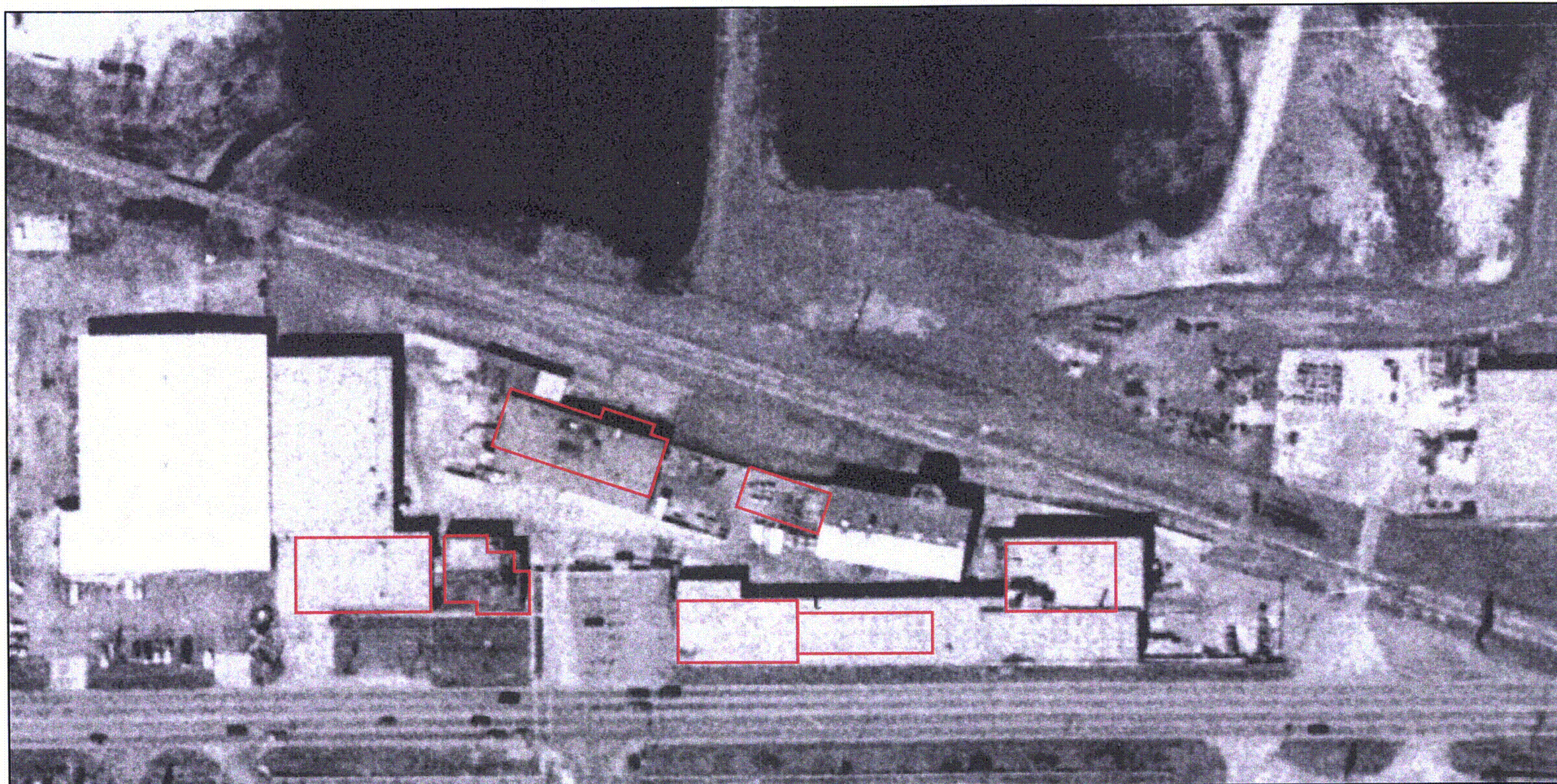












LEGEND

— 1958 BUILDING FOOTPRINT

NOTE

1. 1958 AND 1991 AERIAL PHOTOGRAPHS WHERE USED FOR COMPARISON.



SCALE - FEET  
0 80

FIGURE 3  
CHANGES TO BUILDINGS BETWEEN  
1958 AND 1991  
FORMER KAISER ALUMINUM  
SPECIALTY PRODUCTS FACILITY  
TULSA, OKLAHOMA

PREPARED FOR  
KAISER ALUMINUM & CHEMICAL CORPORATION  
BATON ROUGE, LOUISIANA

APPROVED *[Signature]* 10/26/01  
CHECKED *[Signature]* 11/09/01  
DRAWN GJA 10/26/01  
DRAWING NUMBER  
5427A258



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C03






1958 AERIAL PHOTOGRAPH

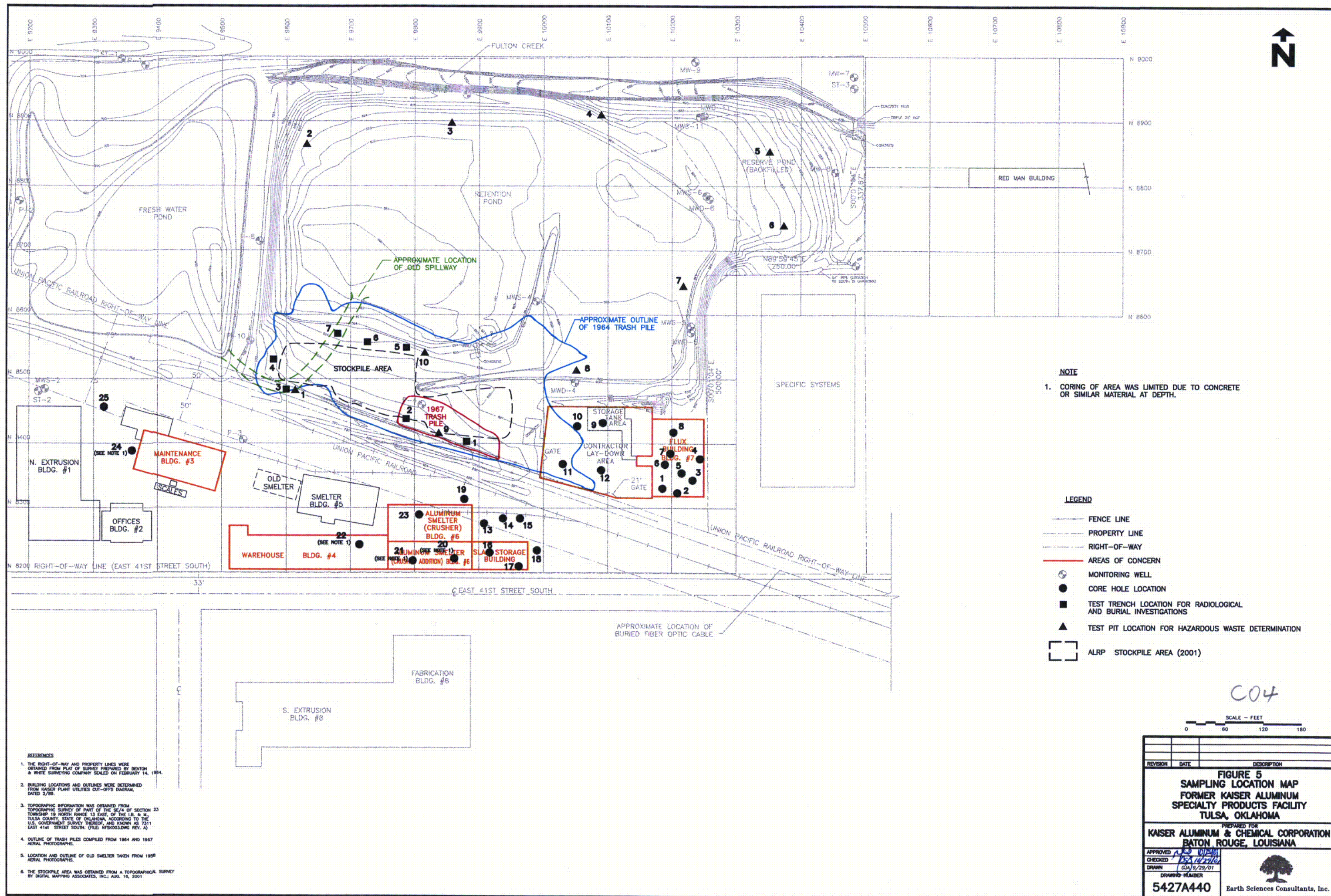


1964 AERIAL PHOTOGRAPH



<p>FIGURE 4  AERIAL COMPARISON OF N. EXTRUSION  BUILDING AREA 1958 AND 1964  FORMER KAISER ALUMINUM  SPECIALTY PRODUCTS FACILITY  TULSA, OKLAHOMA</p>	
<p>PREPARED FOR  KAISER ALUMINUM &amp; CHEMICAL CORPORATION  BATON ROUGE, LOUISIANA</p>	
<p>APPROVED <i>[Signature]</i> 10/29/01  CHECKED <i>[Signature]</i> 10/29/01  DRAWN GJA 10/26/01</p>	<p>DRAWING NUMBER  5427A259</p>
<p>  Earth Sciences Consultants, Inc.</p>	





**NOTE**

1. CORING OF AREA WAS LIMITED DUE TO CONCRETE OR SIMILAR MATERIAL AT DEPTH.

**LEGEND**

- FENCE LINE
- PROPERTY LINE
- RIGHT-OF-WAY
- AREAS OF CONCERN
- MONITORING WELL
- CORE HOLE LOCATION
- TEST TRENCH LOCATION FOR RADIOLOGICAL AND BURIAL INVESTIGATIONS
- ▲ TEST PIT LOCATION FOR HAZARDOUS WASTE DETERMINATION
- ALRP STOCKPILE AREA (2001)

**REFERENCES**

1. THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM PLAT OF SURVEY PREPARED BY DENTON & WHITE SURVEYING COMPANY SEALED ON FEBRUARY 14, 1984.
2. BUILDING LOCATIONS AND OUTLINES WERE DETERMINED FROM KAISER PLANT UTILITIES CUT-OFFS DIAGRAM, DATED 2/89.
3. TOPOGRAPHIC INFORMATION WAS OBTAINED FROM TOPOGRAPHIC SURVEY OF PART OF THE SE/4 OF SECTION 23 TOWNSHIP 19 NORTH RANGE 13 EAST, OF THE 18 & 14 TULSA COUNTY, STATE OF OKLAHOMA, ACCORDING TO THE U.S. GOVERNMENT SURVEY THEREOF, AND KNOWN AS 7311 EAST 41ST STREET SOUTH. (FILE: NPS0003.DWG REV. A)
4. OUTLINE OF TRASH PILES COMPILED FROM 1964 AND 1967 AERIAL PHOTOGRAPHS.
5. LOCATION AND OUTLINE OF OLD SMELTER TAKEN FROM 1958 AERIAL PHOTOGRAPHS.
6. THE STOCKPILE AREA WAS OBTAINED FROM A TOPOGRAPHICAL SURVEY BY DIGITAL MAPPING ASSOCIATES, INC.; AUG. 16, 2001.

REVISION	DATE	DESCRIPTION

**FIGURE 5  
SAMPLING LOCATION MAP  
FORMER KAISER ALUMINUM  
SPECIALTY PRODUCTS FACILITY  
TULSA, OKLAHOMA**

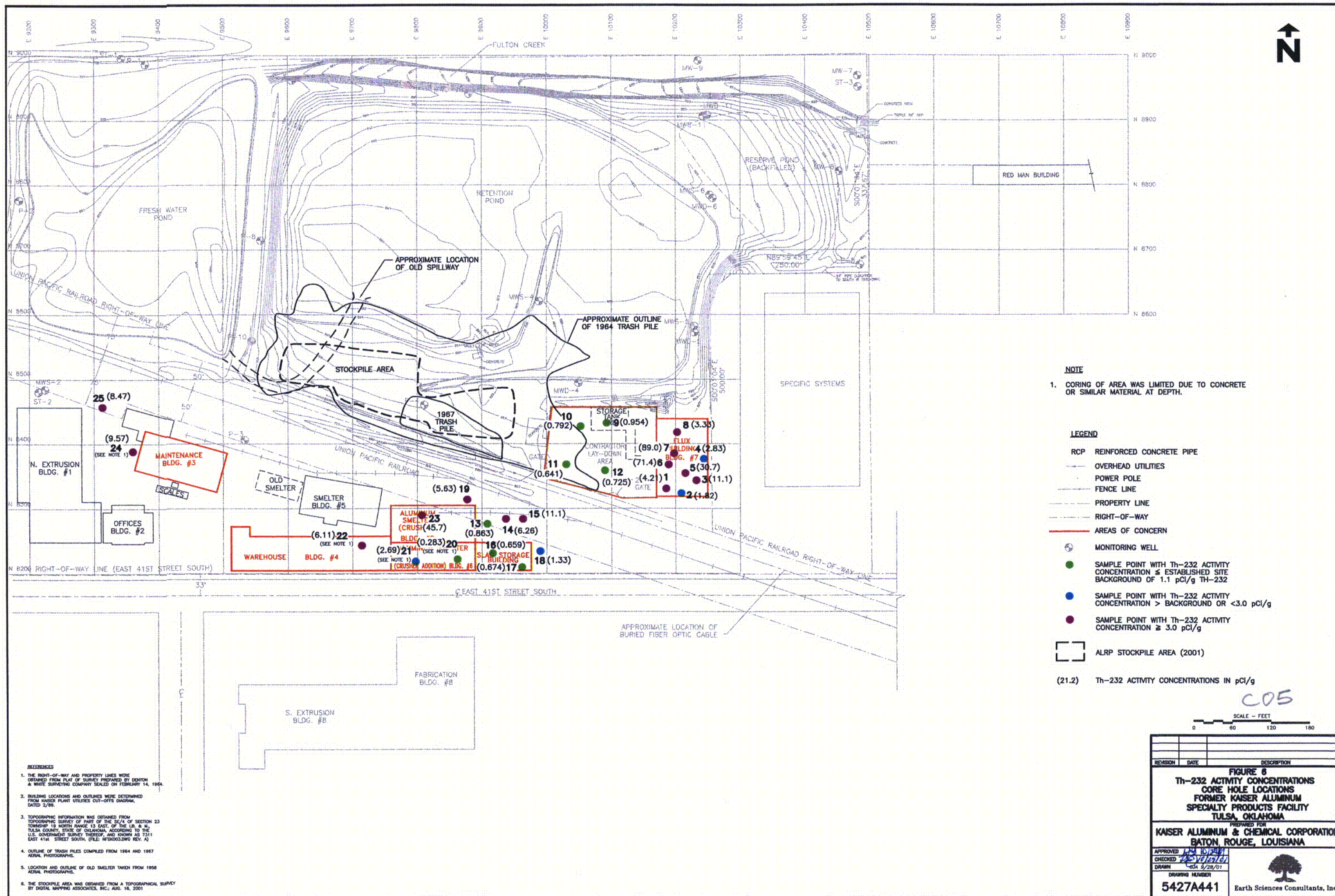
PREPARED FOR  
**KAISER ALUMINUM & CHEMICAL CORPORATION  
BATON ROUGE, LOUISIANA**

APPROVED [signature] DATE 9/29/01  
CHECKED [signature] DATE 9/29/01  
DRAWN [signature]

DRAWING NUMBER  
**5427A440**

Earth Sciences Consultants, Inc.





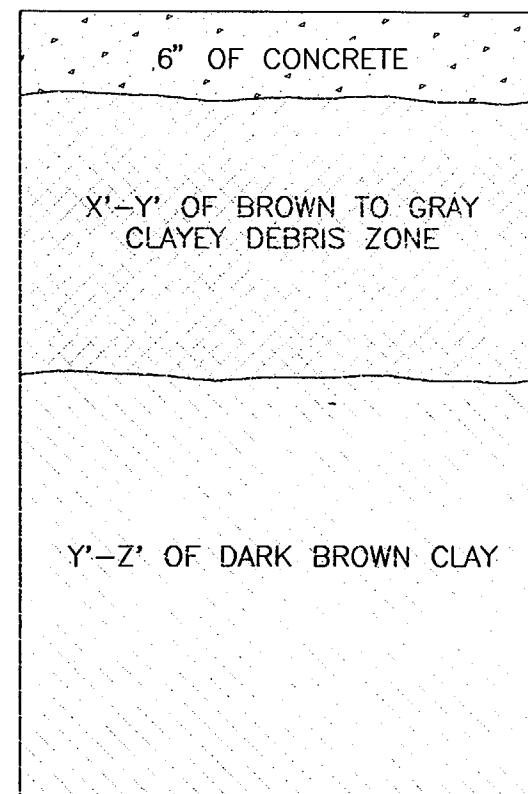
NOTE  
1. CORING OF AREA WAS LIMITED DUE TO CONCRETE OR SIMILAR MATERIAL AT DEPTH.

- LEGEND
- RCP REINFORCED CONCRETE PIPE
  - OVERHEAD UTILITIES
  - POWER POLE
  - FENCE LINE
  - PROPERTY LINE
  - RIGHT-OF-WAY
  - AREAS OF CONCERN
  - MONITORING WELL
  - SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $\leq$  ESTABLISHED SITE BACKGROUND OF 1.1 pCi/g TH-232
  - SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $>$  BACKGROUND OR  $< 3.0$  pCi/g
  - SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $\geq 3.0$  pCi/g
  - ALRP STOCKPILE AREA (2001)
- (21.2) Th-232 ACTIVITY CONCENTRATIONS IN pCi/g

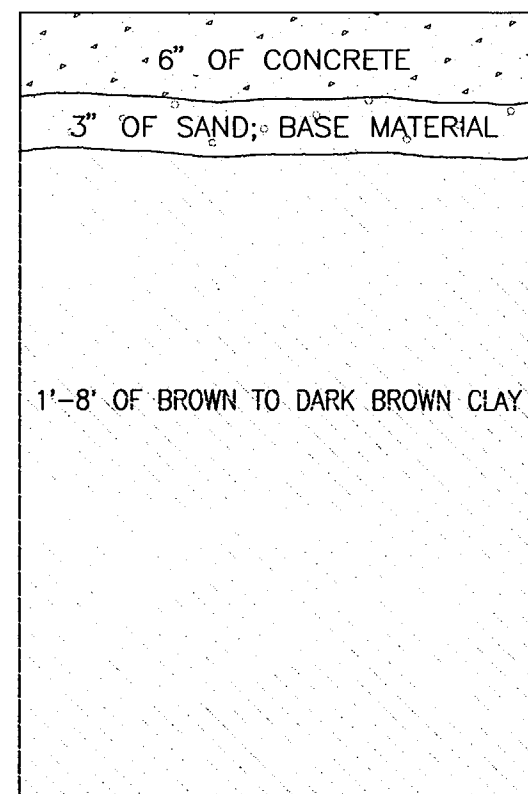
- REFERENCES
1. THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM PLAT OF SURVEY PREPARED BY DENTON & WHITE SURVEYING COMPANY SEALED ON FEBRUARY 14, 1964.
  2. BUILDING LOCATIONS AND OUTLINES WERE DETERMINED FROM KAISER PLANT UTILITIES OUT-OFFS DIAGRAM, DATED 2/89.
  3. TOPOGRAPHIC INFORMATION WAS OBTAINED FROM TOPOGRAPHIC SURVEY OF PART OF THE SE 1/4 OF SECTION 23 TOWNSHIP 13 NORTH RANGE 13 EAST OF THE U.S. & M. TULSA COUNTY, STATE OF OKLAHOMA, ACCORDING TO THE U.S. GOVERNMENT SURVEY THEREOF, AND KNOWN AS 7311 EAST 41ST STREET SOUTH. (FILE: NTSX003.DWG REV. A)
  4. OUTLINE OF TRASH PILES COMPILED FROM 1964 AND 1967 AERIAL PHOTOGRAPHS.
  5. LOCATION AND OUTLINE OF OLD SMELTER TAKEN FROM 1958 AERIAL PHOTOGRAPH.
  6. THE STOCKPILE AREA WAS OBTAINED FROM A TOPOGRAPHICAL SURVEY BY DIGITAL MAPPING ASSOCIATES, INC., AUG. 16, 2001.

REVISION	DATE	DESCRIPTION
FIGURE 6 Th-232 ACTIVITY CONCENTRATIONS CORE HOLE LOCATIONS FORMER KAISER ALUMINUM SPECIALTY PRODUCTS FACILITY TULSA, OKLAHOMA		
PREPARED FOR KAISER ALUMINUM & CHEMICAL CORPORATION BATON ROUGE, LOUISIANA		
APPROVED	DATE	
CHECKED	DATE	
DRAWN	DATE	
DRAWING NUMBER 5427A441		
Earth Sciences Consultants, Inc.		

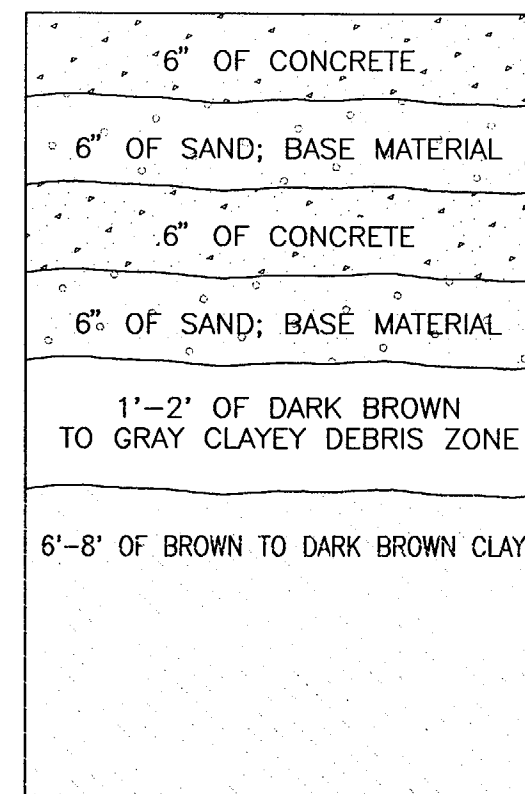




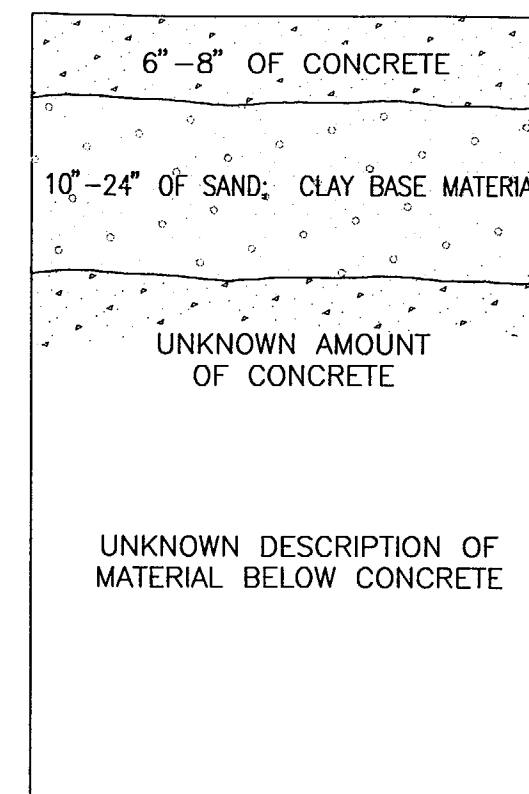
A  
CROSS SECTION  
FLUX BUILDING AND  
CRUSHER BUILDING



B  
CROSS SECTION  
SLAG STORAGE BUILDING AREA,  
AREA ADJACENT TO FLUX  
BUILDING, AND AREA NORTH  
OF CRUSHER BUILDING



C  
CROSS SECTION  
AREA NORTH OF SLAG  
STORAGE BUILDING




D  
CROSS SECTION  
CRUSHER ADDITION, WAREHOUSE  
BUILDING, AND AREA WEST OF  
THE MAINTENANCE BUILDING

DRAWING NOT TO SCALE

FIGURE 7  
CROSS SECTIONS OF  
INVESTIGATED AREAS  
FORMER KAISER ALUMINUM  
SPECIALTY PRODUCTS FACILITY  
TULSA, OKLAHOMA

PREPARED FOR  
KAISER ALUMINUM & CHEMICAL CORPORATION  
BATON ROUGE, LOUISIANA

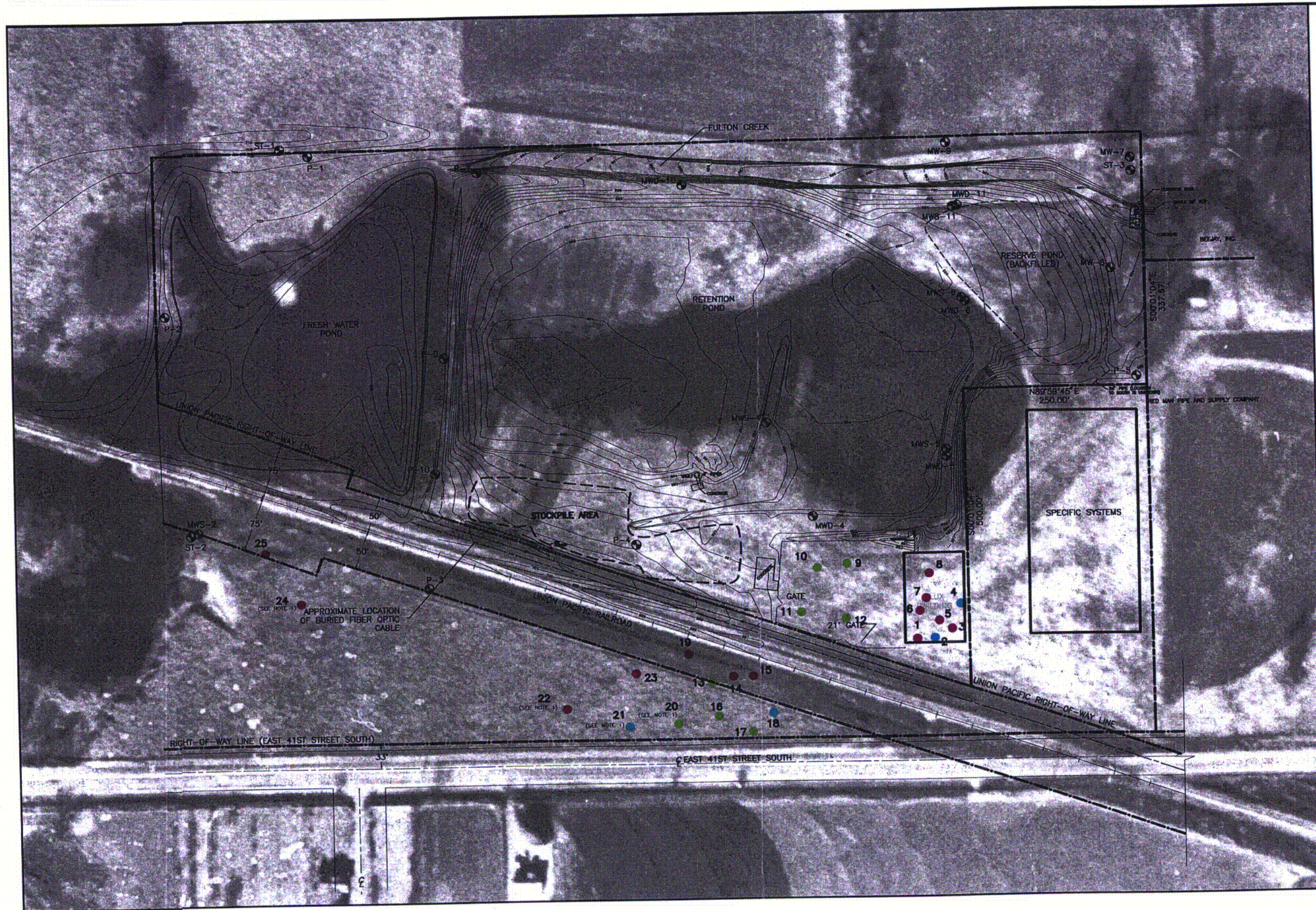
APPROVED	<i>[Signature]</i> 10/29/01
CHECKED	<i>[Signature]</i> 10/29/01
DRAWN	GJA 9/12/01
DRAWING NUMBER	
5427240	

  
Earth Sciences Consultants, Inc.

## **Appendix A**

### **Aerial Photographs with Overlay of Soil Core Hole Locations**





#### NOTE

1. CORING OF AREA WAS LIMITED DUE TO CONCRETE OR SIMILAR MATERIAL AT DEPTH.

#### LEGEND

- RCP REINFORCED CONCRETE PIPE
- OVERHEAD UTILITIES
- POWER POLE
- ⊙ MONITORING WELL
- FENCE LINE
- PROPERTY LINE
- RIGHT-OF-WAY
- SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $\leq$  ESTABLISHED SITE BACKGROUND OF 1.1 pCi/g Th-232
- SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $>$  BACKGROUND OR  $<$  3.0 pCi/g
- SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $\geq$  3.0 pCi/g

C06

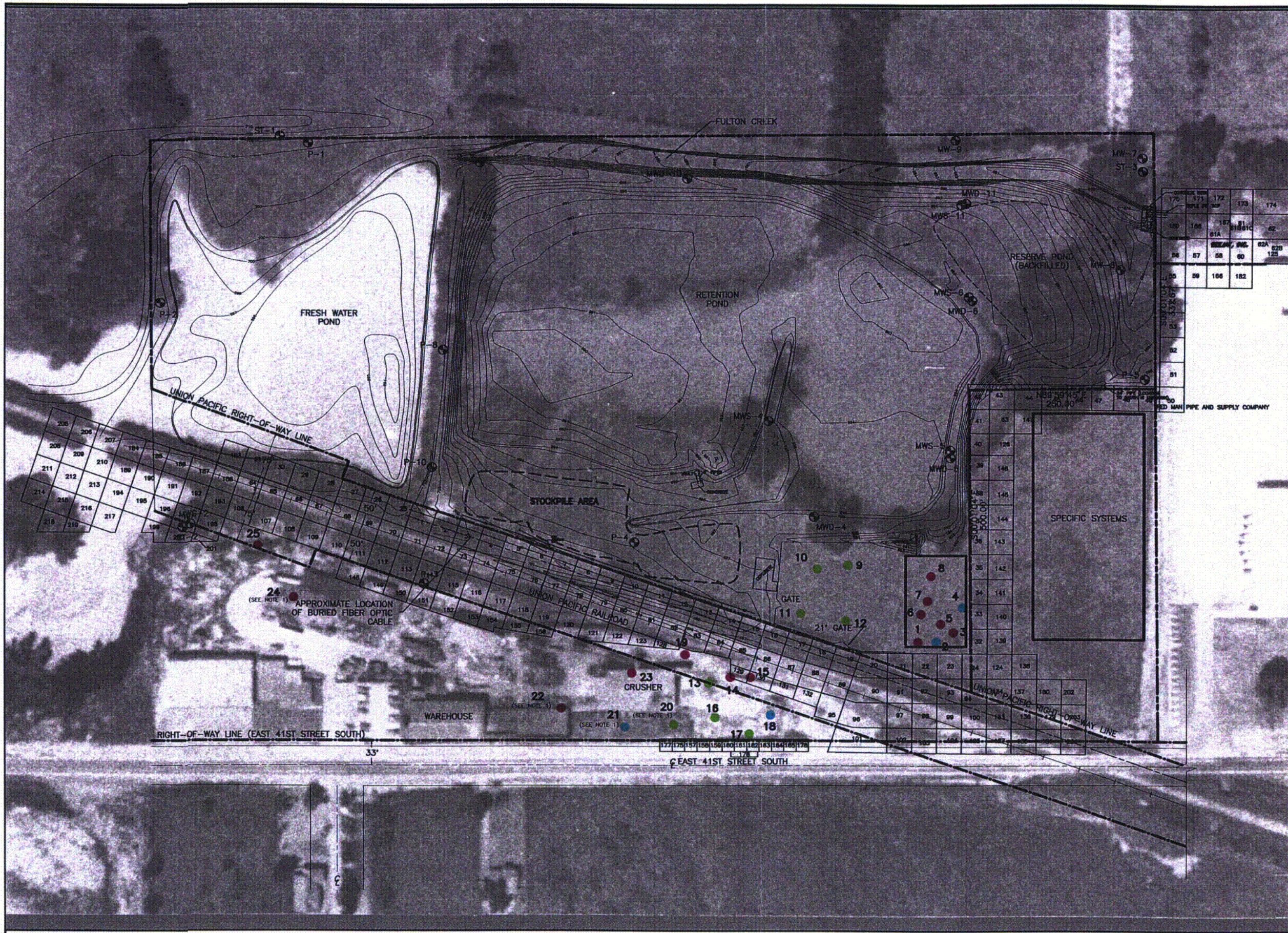
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REVISION	DATE	DESCRIPTION
<p><b>FIGURE A-1</b>  <b>PHOTO PROCESSION DATE 12/28/50</b>  <b>ADDITIONAL SITE CHARACTERIZATION</b>  <b>FORMER KAISER ALUMINUM</b>  <b>SPECIALTY PRODUCTS FACILITY</b>  <b>TULSA, OKLAHOMA</b></p>		
<p>PREPARED FOR  <b>KAISER ALUMINUM &amp; CHEMICAL CORPORATION</b>  <b>BATON ROUGE, LOUISIANA</b></p>		
APPROVED	DATE	
CHECKED	DATE	
DRAWN	DATE	
DRAWING NUMBER		
5427A426		
		Earth Sciences Consultants, Inc.

#### REFERENCES

1. THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM PLAT OF SURVEY PREPARED BY DENTON & WHITE SURVEYING COMPANY SEALED ON FEBRUARY 14, 1964.
2. TOPOGRAPHIC INFORMATION WAS OBTAINED FROM TOPOGRAPHIC SURVEY OF PART OF THE SE/4 OF SECTION 23 TOWNSHIP 19 NORTH RANGE 13 EAST OF THE 1B & M, TULSA COUNTY, STATE OF OKLAHOMA, ACCORDING TO THE U.S. GOVERNMENT SURVEY THEREOF, AND KNOWN AS 7311 EAST 41st STREET SOUTH. (FILE: HFSK003.DWG REV. A)
3. 1950 AERIAL PHOTOGRAPH USED TO ALIGN CULTURAL FEATURES WITH KAISER PROPERTY LINES.
4. THE STOCKPILE AREA WAS OBTAINED FROM A TOPOGRAPHICAL SURVEY BY DIGITAL MAPPING ASSOCIATES, INC.; AUG. 18, 2001.





**NOTE**

1. CORING OF AREA WAS LIMITED DUE TO CONCRETE OR SIMILAR MATERIAL AT DEPTH.

- LEGEND**
- RCP REINFORCED CONCRETE PIPE
  - OVERHEAD UTILITIES
  - POWER POLE
  - MONITORING WELL
  - FENCE LINE
  - PROPERTY LINE
  - RIGHT-OF-WAY
- SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $\leq$  ESTABLISHED SITE BACKGROUND OF 1.1 pCi/g TH-232
  - SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $>$  BACKGROUND OR  $< 3.0$  pCi/g
  - SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $\geq 3.0$  pCi/g

**REFERENCES**

1. THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM PLAT OF SURVEY PREPARED BY DENTON & WHITE SURVEYING COMPANY SEALED ON FEBRUARY 14, 1964.
2. TOPOGRAPHIC INFORMATION WAS OBTAINED FROM TOPOGRAPHIC SURVEY OF PART OF THE SE 1/4 OF SECTION 23 TOWNSHIP 19 NORTH RANGE 13 EAST OF THE 10<sup>TH</sup> E. TULSA COUNTY, STATE OF OKLAHOMA, ACCORDING TO THE U.S. GOVERNMENT SURVEY THEREOF, AND KNOWN AS 2311 EAST 41<sup>ST</sup> STREET SOUTH. (FILE: NFS0003.DWG REV. A)
3. 1968 AERIAL PHOTOGRAPH USED TO ALIGN CULTURAL FEATURES WITH KAISER PROPERTY LINES.
4. THE STOCKPILE AREA WAS OBTAINED FROM A TOPOGRAPHICAL SURVEY BY DIGITAL MAPPING ASSOCIATES, INC.; AUG. 10, 2001

C07

SCALE - FEET  
0 60 120 180

REVISION	DATE	DESCRIPTION

**FIGURE A-2**  
**PHOTO PROCESSION DATE 7/23/88**  
**ADDITIONAL SITE CHARACTERIZATION**  
**FORMER KAISER ALUMINUM**  
**SPECIALTY PRODUCTS FACILITY**  
**TULSA, OKLAHOMA**

PREPARED FOR  
**KAISER ALUMINUM & CHEMICAL CORPORATION**  
**BATON ROUGE, LOUISIANA**

APPROVED \_\_\_\_\_  
 CHECKED \_\_\_\_\_  
 DRAWN \_\_\_\_\_  
 DRAWING NUMBER  
**5427A430**

Earth Sciences Consultants, Inc.









BEEJAY INC.



#### NOTE

1. CORING OF AREA WAS LIMITED DUE TO CONCRETE OR SIMILAR MATERIAL AT DEPTH.

#### LEGEND

- RCP REINFORCED CONCRETE PIPE
- OVERHEAD UTILITIES
- POWER POLE
- MONITORING WELL
- FENCE LINE
- PROPERTY LINE
- RIGHT-OF-WAY
- SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $\leq$  ESTABLISHED SITE BACKGROUND OF 1.1 pCi/g TH-232
- SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $>$  BACKGROUND OR  $< 3.0$  pCi/g
- SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $\geq 3.0$  pCi/g

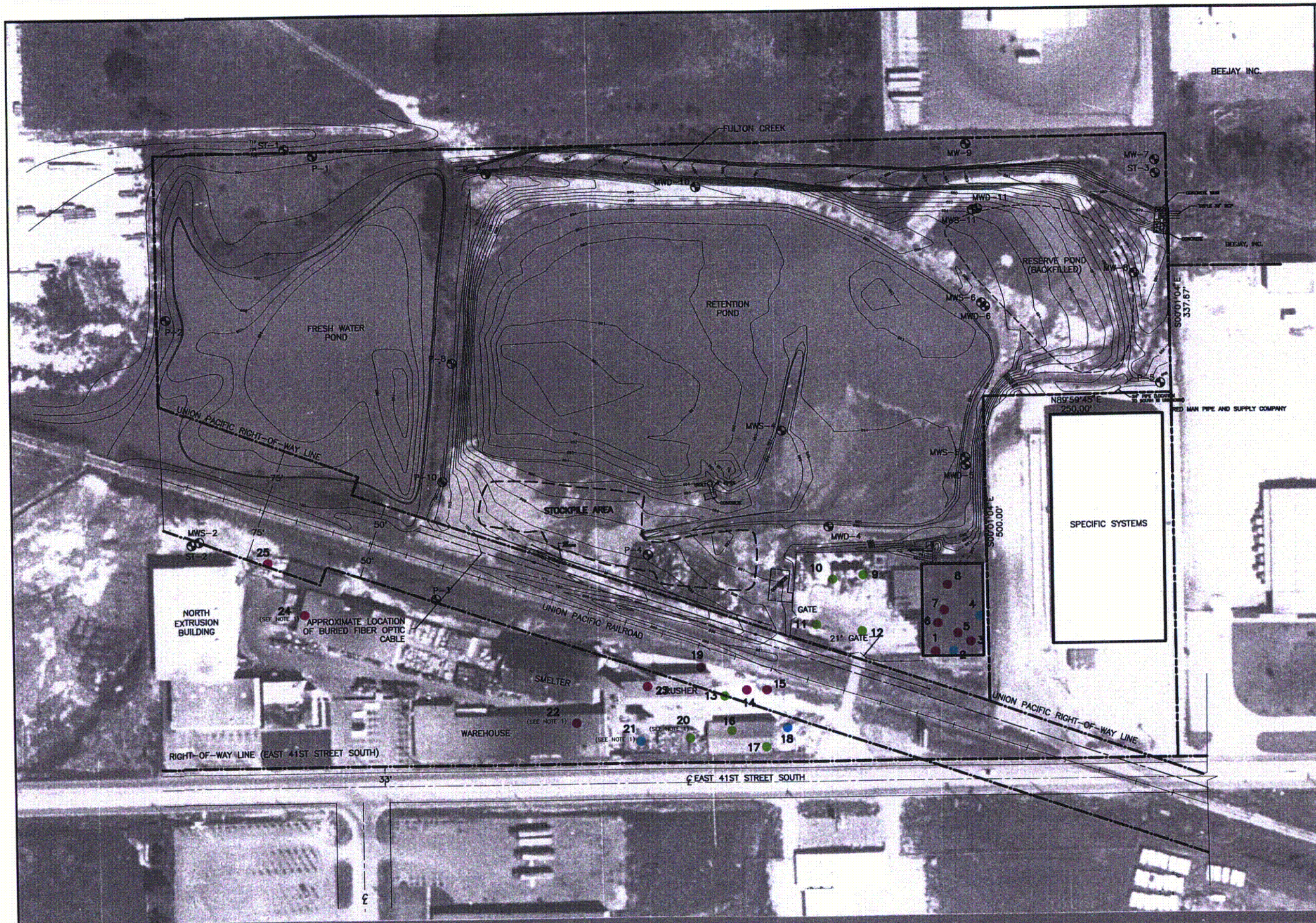
#### REFERENCES

1. THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM A SURVEY PREPARED BY DENTON & WHITE SURVEYING COMPANY SEALED ON FEBRUARY 14, 1964.
2. TOPOGRAPHIC INFORMATION WAS OBTAINED FROM A TOPOGRAPHIC SURVEY OF PART OF THE SE 1/4 OF SECTION 23 TOWNSHIP 19 NORTH RANGE 13 EAST, OF THE 18 & 14 TULSA COUNTY, STATE OF OKLAHOMA, ACCORDING TO THE U.S. GOVERNMENT SURVEY THEREOF, AND KNOWN AS 7311 EAST 41ST STREET SOUTH. (FILE: N55K003.DWG REV. A)
3. 1972 AERIAL PHOTOGRAPH USED TO ALIGN CULTURAL FEATURES WITH KAISER PROPERTY LINES.
4. THE STOCKPILE AREA WAS OBTAINED FROM A TOPOGRAPHICAL SURVEY BY DIGITAL MAPPING ASSOCIATES, INC., AUG. 16, 2001

SCALE - FEET  
0 60 120 180

REVISION	DATE	DESCRIPTION
<p><b>FIGURE A-4</b>  <b>PHOTO PROCESSION DATE 1/26/85</b>  <b>ADDITIONAL SITE CHARACTERIZATION</b>  <b>FORMER KAISER ALUMINUM</b>  <b>SPECIALTY PRODUCTS FACILITY</b>  <b>TULSA, OKLAHOMA</b></p>		
<p>PREPARED FOR  <b>KAISER ALUMINUM &amp; CHEMICAL CORPORATION</b>  <b>BATON ROUGE, LOUISIANA</b></p>		
APPROVED		
CHECKED		
DRAWN		
<p>DRAWING NUMBER  <b>5427A435</b></p>		
<p>Earth Sciences Consultants, Inc.</p>		





NOTE  
1. CORING OF AREA WAS LIMITED DUE TO CONCRETE OR SIMILAR MATERIAL AT DEPTH.

- LEGEND
- RCP REINFORCED CONCRETE PIPE
  - OVERHEAD UTILITIES
  - POWER POLE
  - MONITORING WELL
  - FENCE LINE
  - PROPERTY LINE
  - RIGHT-OF-WAY
- SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $\leq$  ESTABLISHED SITE BACKGROUND OF 1.1 pCi/g TH-232
  - SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $>$  BACKGROUND OR  $< 3.0$  pCi/g
  - SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $\geq 3.0$  pCi/g

C10  
SCALE - FEET  
0 60 120 180

REFERENCES  
1. THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM PLAT OF SURVEY PREPARED BY DENTON & WHITE SURVEYING COMPANY SEALED ON FEBRUARY 14, 1964.  
2. TOPOGRAPHIC INFORMATION WAS OBTAINED FROM TOPOGRAPHIC SURVEY OF PART OF THE SE 1/4 OF SECTION 23 TOWNSHIP 15 NORTH RANGE 13 EAST, OF THE 15 & M. TULSA COUNTY, STATE OF OKLAHOMA, ACCORDING TO THE U.S. GOVERNMENT SURVEY THEREOF, AND KNOWN AS 7311 EAST 41ST STREET SOUTH (FILE: NPS0001000 REV. A)  
3. 1987 AERIAL PHOTOGRAPH USED TO ALIGN CULTURAL FEATURES WITH KASPER PROPERTY LINES.  
4. THE STOCKPILE AREA WAS OBTAINED FROM A TOPOGRAPHICAL SURVEY BY DIGITAL MAPPING ASSOCIATES, INC., AUG. 16, 2001

REVISION	DATE	DESCRIPTION
FIGURE A-5		
PHOTO PROCESSION DATE 9/10/87		
ADDITIONAL SITE CHARACTERIZATION		
FORMER KAISER ALUMINUM		
SPECIALTY PRODUCTS FACILITY		
TULSA, OKLAHOMA		
PREPARED FOR		
KAISER ALUMINUM & CHEMICAL CORPORATION		
BATON ROUGE, LOUISIANA		
APPROVED	[Signature]	
CHECKED	[Signature]	
DRAWN	[Signature]	
DRAWING NUMBER		
5427A431		
Earth Sciences Consultants, Inc.		





BEEJAY INC.



#### NOTE

1. CORING OF AREA WAS LIMITED DUE TO CONCRETE OR SIMILAR MATERIAL AT DEPTH.

#### LEGEND

- RCP REINFORCED CONCRETE PIPE
- OVERHEAD UTILITIES
- POWER POLE
- MONITORING WELL
- FENCE LINE
- PROPERTY LINE
- RIGHT-OF-WAY

- SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $\leq$  ESTABLISHED SITE BACKGROUND OF 1.1 pCi/g TH-232
- SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $>$  BACKGROUND OR  $< 3.0$  pCi/g
- SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $\geq 3.0$  pCi/g

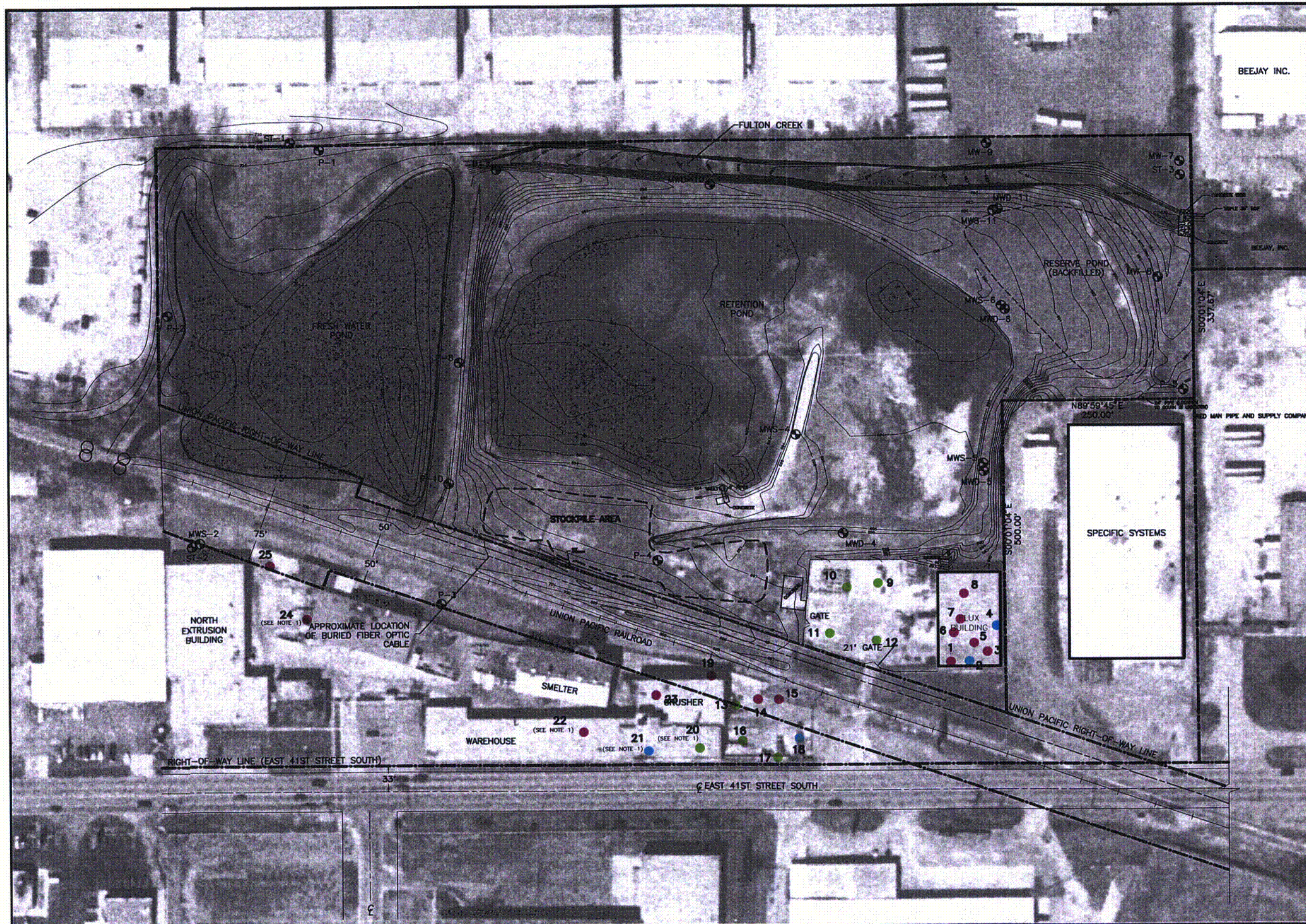
SCALE - FEET  
0 60 120 180

REVISION	DATE	DESCRIPTION
<p align="center"><b>FIGURE A-6</b>  <b>PHOTO PROCESSION DATE 4/18/72</b>  <b>ADDITIONAL SITE CHARACTERIZATION</b>  <b>FORMER KAISER ALUMINUM</b>  <b>SPECIALTY PRODUCTS FACILITY</b>  <b>TULSA, OKLAHOMA</b></p>		
<p align="center">PREPARED FOR  <b>KAISER ALUMINUM &amp; CHEMICAL CORPORATION</b>  <b>BATON ROUGE, LOUISIANA</b></p>		
APPROVED	<p align="right">[Signature]</p>	
CHECKED	<p align="right">[Signature]</p>	
DRAWN	<p align="right">[Signature]</p>	
<p align="center">DRAWING NUMBER  <b>5427A429</b></p>		
<p align="right">Earth Sciences Consultants, Inc.</p>		

#### REFERENCES

1. THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM PLAT OF SURVEY PREPARED BY DENTON & WHITE SURVEYING COMPANY SEALED ON FEBRUARY 14, 1964.
2. TOPOGRAPHIC INFORMATION WAS OBTAINED FROM TOPOGRAPHIC SURVEY OF PART OF THE SE/4 OF SECTION 23 TOWNSHIP 19 NORTH RANGE 13 EAST, OF THE 18 & 19 TULSA COUNTY, STATE OF OKLAHOMA, ACCORDING TO THE U.S. GOVERNMENT SURVEY THEODOLITE AND KNOWN AS 7311 EAST 41ST STREET SOUTH. (FILE: NPS1003.DWG REV. A)
3. 1972 AERIAL PHOTOGRAPH USED TO ALIGN CULTURAL FEATURES WITH KAISER PROPERTY LINES.
4. THE STOCKPILE AREA WAS OBTAINED FROM A TOPOGRAPHICAL SURVEY BY DIGITAL MAPPING ASSOCIATES, INC., AUG. 16, 2001





BEEJAY INC.



**NOTE**

1. CORING OF AREA WAS LIMITED DUE TO CONCRETE OR SIMILAR MATERIAL AT DEPTH.

**LEGEND**

- RCP REINFORCED CONCRETE PIPE
- OVERHEAD UTILITIES
- POWER POLE
- MONITORING WELL
- FENCE LINE
- PROPERTY LINE
- RIGHT-OF-WAY
- SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $\leq$  ESTABLISHED SITE BACKGROUND OF 1.1 pCi/g TH-232
- SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $>$  BACKGROUND OR  $<$  3.0 pCi/g
- SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $\geq$  3.0 pCi/g

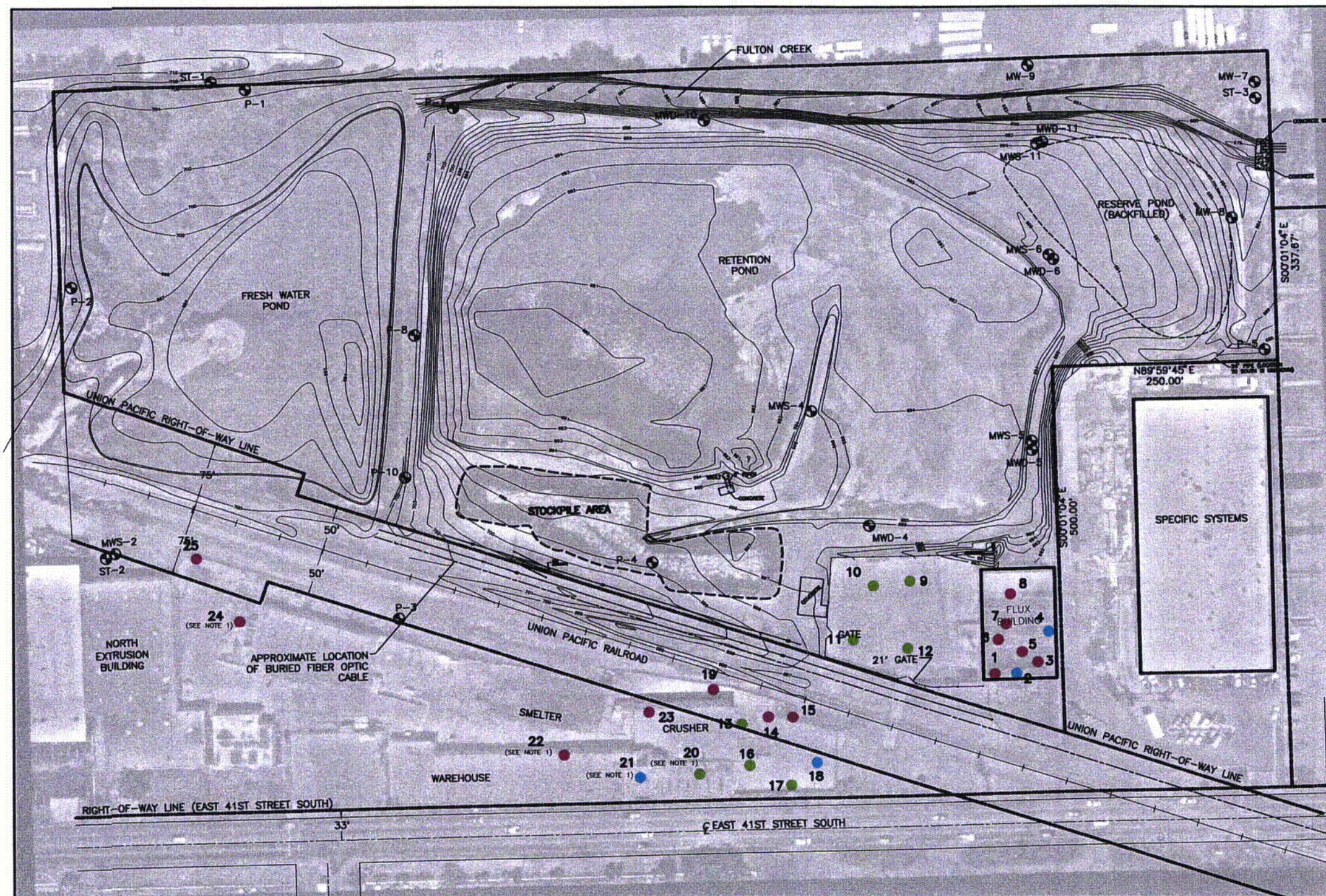
C12

SCALE - FEET  
0 60 120 180

REVISION	DATE	DESCRIPTION
<p><b>FIGURE A-7</b>  <b>PHOTO PROCESSION DATE 3/23/91</b>  <b>ADDITIONAL SITE CHARACTERIZATION</b>  <b>FORMER KAISER ALUMINUM</b>  <b>SPECIALTY PRODUCTS FACILITY</b>  <b>TULSA, OKLAHOMA</b></p>		
<p>PREPARED FOR  <b>KAISER ALUMINUM &amp; CHEMICAL CORPORATION</b>  <b>BATON ROUGE, LOUISIANA</b></p>		
APPROVED	<p><i>[Signature]</i>          DATE 3/31/91</p>	
CHECKED	<p><i>[Signature]</i>          DATE 3/31/91</p>	
DRAWN	<p><i>[Signature]</i>          DATE 3/31/91</p>	
<p>DRAWING NUMBER  <b>5427A428</b></p>		
<p>Earth Sciences Consultants, Inc.</p>		

- REFERENCES**
1. THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM PLAT OF SURVEY PREPARED BY DENTON & WHITE SURVEYING COMPANY SEALED ON FEBRUARY 14, 1964.
  2. TOPOGRAPHIC INFORMATION WAS OBTAINED FROM TOPOGRAPHIC SURVEY OF PART OF THE SE/4 OF SECTION 23 TOWNSHIP 18 NORTH RANGE 13 EAST, OF THE LB. & M. TULSA COUNTY, STATE OF OKLAHOMA, ACCORDING TO THE U.S. GOVERNMENT SURVEY THEREOF, AND KNOWN AS 7311 EAST 41st STREET SOUTH. (FILE: W30003.DWG REV. A)
  3. 1991 AERIAL PHOTOGRAPHY USED TO ALIGN CULTURAL FEATURES WITH KAISER PROPERTY LINES.
  4. THE STOCKPILE AREA WAS OBTAINED FROM A TOPOGRAPHICAL SURVEY BY DIGITAL MAPPING ASSOCIATES, INC.; AUG. 16, 2001





**NOTE**

1. CORING OF AREA WAS LIMITED DUE TO CONCRETE OR SIMILAR MATERIAL AT DEPTH.

**LEGEND**

- RCP REINFORCED CONCRETE PIPE
- OVERHEAD UTILITIES
- POWER POLE
- MONITORING WELL
- FENCE LINE
- PROPERTY LINE
- RIGHT-OF-WAY

- SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $\geq$  ESTABLISHED SITE BACKGROUND OF 1.1 pCi/g TH-232
- SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $>$  BACKGROUND OR  $< 3.0$  pCi/g
- SAMPLE POINT WITH Th-232 ACTIVITY CONCENTRATION  $\geq 3.0$  pCi/g

C13

SCALE - FEET  
0 60 120 180

**REFERENCES**

1. THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM PLAT OF SURVEY PREPARED BY DENTON & WHITE SURVEYING COMPANY SEALED ON FEBRUARY 14, 1984.
2. TOPOGRAPHIC INFORMATION WAS OBTAINED FROM TOPOGRAPHIC SURVEY OF PART OF THE SE 1/4 OF SECTION 23 TOWNSHIP 18 NORTH RANGE 13 EAST, OF THE U.S. & M. TULSA COUNTY, STATE OF OKLAHOMA, ACCORDING TO THE U.S. GOVERNMENT SURVEY THEREOF, AND KNOWN AS 7311 EAST 41st STREET SOUTH, (FILE: WFOKOLONG REV. A)
3. 1972 AERIAL PHOTOGRAPH USED TO ALIGN CULTURAL FEATURES WITH KAISER PROPERTY LINES.
4. THE STOCKPILE AREA WAS OBTAINED FROM A TOPOGRAPHICAL SURVEY BY DIGITAL MAPPING ASSOCIATES, INC., AUG. 16, 2001

REVISION	DATE	DESCRIPTION
FIGURE A-8		
PHOTO PROCESSION DATE 8/16/01		
ADDITIONAL SITE CHARACTERIZATION		
FORMER KAISER ALUMINUM		
SPECIALTY PRODUCTS FACILITY		
TULSA, OKLAHOMA		
PREPARED FOR		
KAISER ALUMINUM & CHEMICAL CORPORATION		
BATON ROUGE, LOUISIANA		
APPROVED	[Signature]	
CHECKED	[Signature]	
DRAWN	[Signature]	
DRAWING NUMBER		
5427A438		
Earth Sciences Consultants, Inc.		



## **Appendix B**

### **Toxicity Characteristic Leaching Procedure (TCLP) Regulatory Levels**



**Toxicity Characteristic Leaching Procedure (TCLP)  
Regulatory Levels**

<b>Contaminant</b>	<b>Regulatory Level (mg/l)</b>	<b>USEPA Hazardous Waste</b>
Arsenic	5.0	D004
Barium	100.0	D005
Cadmium	1.0	D006
Chromium	5.0	D007
Lead	5.0	D008
Mercury	0.2	D009
Selenium	1.0	D010
Silver	5.0	D011
Endrin	0.02	D012
Lindane	0.4	D013
Methoxychlor	10.0	D014
Toxaphene	0.5	D015
2,4-D	10.0	D016
2,4,5-TP (silvex)	1.0	D017
Benzene	0.5	D018
Carbon Tetrachloride	0.5	D019
Chlordane	0.03	D020
Chlorobenzene	100.0	D021
Chloroform	6.0	D022
o-Cresol	200.0	D023
m-Cresol	200.0	D024
p-Cresol	200.0	D025
Cresol	200.0	D026
1,4-Dichlorobenzene	7.5	D027
1,2-Dichloroethane	0.5	D028
1,1-Dichloroethene	0.7	D029
2,4-Dinitrotoluene	0.13	D030
Heptachlor (and its epoxide)	0.008	D031
Hexachlorobenzene	0.13	D032
Hexachlorobutadiene	0.5	D033
Hexachloroethane	3.0	D034
2-Butanone	200.0	D035
Nitrobenzene	2.0	D036
Pentachlorophenol	100.0	D037
Pyridine	5.0	D038
Tetrachloroethene	0.7	D039
Trichloroethene	0.5	D040
2,4,5-Trichlorophenol	400.0	D041
2,4,6-Trichlorophenol	2.0	D042
Vinyl Chloride	0.2	D043

Rev. 3/93



# OUTREACH LABORATORY

311 North Aspen  
Broken Arrow, OK 74012  
Phone: (918) 251-2515  
Fax: (918) 251-0008

## CHAIN OF CUSTODY

Results To: Company \_\_\_\_\_  
Name OUTREACH TECHNOLOGIES, INC.  
Address: 311 N. Aspen  
Broken Arrow, OK 74012  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
Phone \_\_\_\_\_ Fax # \_\_\_\_\_

Bill To: \_\_\_\_\_  
Company \_\_\_\_\_  
Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

## ANALYSIS REQUESTED

PO # \_\_\_\_\_  
PROJECT # \_\_\_\_\_  
PROJECT NAME \_\_\_\_\_  
REQUESTED TURNAROUND TIME ASAP  
(ADDITIONAL CHARGES MAY APPLY)  
SAMPLER \_\_\_\_\_  
Signature \_\_\_\_\_

# CONTAINERS

CONTAINER  
SIZE &  
TYPE  
  
PLASTIC  
OR  
GLASS

PRESERVATIVE  
#  
1. HNO<sub>3</sub> pH2  
2. Ice at 4°C  
3. HCl pH4.2  
4. H2SO4 pH4.2  
5. NaOH pH11

TCLP Volatiles

REMARKS  
(E.G. FILTERED, UNFILTERED,  
SILAR, COMPOSITE)

Extract Date 5/10/01

5/14/01  
5/14/01  
5/15/01  
5/14/01

RELINQUISHED BY Brian J. [Signature] DATE 5/17/01 TIME 1445 RECEIVED BY [Signature] DATE 5/17/01 TIME 1645

RELINQUISHED BY [Signature] DATE 5/18/01 TIME 1445 RECEIVED BY \_\_\_\_\_ DATE \_\_\_\_\_ TIME \_\_\_\_\_

My signature on this chain of custody form indicates that I am authorized by the above company to release samples for analysis. The company agrees to pay the entire balance upon receipt of sample data and it is understood and agreed that any balance carried over thirty (30) days is subject to a 1.5% per month (18% per annum) late charge. In the event of default, the company becomes legally liable for any reasonable attorney and/or collection fees and all related costs necessary to remit the entire balance to Outreach Technologies, Inc. (Outreach Laboratory).

SAMPLE RET. DISPOSAL: All non-hazardous aqueous samples shall be disposed of 30 days after issue of final report. All other samples shall be returned at client's expense.

### FOR LABORATORY USE ONLY:

Sample Condition Upon Receipt \_\_\_\_\_  
Custody Seals Intact Y N  
Cooler Temperature \_\_\_\_\_



# Outreach Laboratory

311 North Aspen  
Broken Arrow, OK 74012  
(918) 251-2515  
FAX (918) 251-0008

Client:

Kaiser Aluminum

Client Project:

Add Characterization Plan 5427f

Lab Number:

20010471

Date Reported:

5/23/01

Date Received:

5/9/01

Page Number:

1 of 8

## Analytical Report

Method	Result	Units	DL	Prep Date	Analysis Date	Analyst
<b>Lab ID: 20010471-01</b>						
<b>Client ID: 001</b>						
<b>Date Sampled: 5/9/01 2:16:00 PM</b>						
<b>Matrix: Soil</b>						
<b>Metals Analyses</b>						
TCLP-Arsenic	EPA 1311/6010B	BDL mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Barium	EPA 1311/6010B	14.0 mg/l	0.120	5/17/01	5/17/01	MG
TCLP-Cadmium	EPA 1311/6010B	BDL mg/l	0.011	5/17/01	5/17/01	MG
TCLP-Chromium	EPA 1311/6010B	BDL mg/l	0.010	5/17/01	5/17/01	MG
TCLP-Lead	EPA 1311/6010B	BDL mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Mercury	EPA 7470A/7471A	BDL mg/l	0.0005	5/18/01	5/22/01	MG
TCLP-Selenium	EPA 1311/6010B	BDL mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Silver	EPA 1311/6010B	BDL mg/l	0.009	5/17/01	5/17/01	MG
<b>Organics Analyses</b>						
1,1-Dichloroethene	EPA 1311/8240A	ND mg/l	0.0050	5/10/01	5/21/01	
1,2-Dichloroethane	EPA 1311/8240A	ND mg/l	0.0050	5/10/01	5/21/01	
2-Butanone (MEK)	EPA 1311/8240A	ND mg/l	0.0050	5/10/01	5/21/01	
Benzene	EPA 1311/8240A	ND mg/l	0.0050	5/10/01	5/21/01	
Carbon tetrachloride	EPA 1311/8240A	ND mg/l	0.0050	5/10/01	5/21/01	
Chloroform	EPA 1311/8240A	ND mg/l	0.0050	5/10/01	5/21/01	
Tetrachloroethene	EPA 1311/8240A	ND mg/l	0.0050	5/10/01	5/21/01	
Trichloroethene	EPA 1311/8240A	ND mg/l	0.0050	5/10/01	5/21/01	
Vinyl Chloride	EPA 1311/8240A	ND mg/l	0.0050	5/10/01	5/21/01	
Chlorobenzene	EPA 1311/8240A	ND mg/l	0.0050	5/10/01	5/21/01	

**Lab ID: 20010471-02**

**Client ID: 002**

**Date Sampled: 5/9/01 2:26:00 PM**

**Matrix: Soil**

<b>Metals Analyses</b>						
TCLP-Arsenic	EPA 1311/6010B	BDL mg/l	0.010	5/17/01	5/17/01	MG
TCLP-Barium	EPA 1311/6010B	13.4 mg/l	0.120	5/17/01	5/17/01	MG
TCLP-Cadmium	EPA 1311/6010B	BDL mg/l	0.011	5/17/01	5/17/01	MG
TCLP-Chromium	EPA 1311/6010B	BDL mg/l	0.010	5/17/01	5/17/01	MG
TCLP-Lead	EPA 1311/6010B	BDL mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Mercury	EPA 7470A/7471A	BDL mg/l	0.0005	5/18/01	5/22/01	MG

BDL = Below Detection Limit



# Outreach Laboratory

311 North Aspen  
Broken Arrow, OK 74012  
(918) 251-2515  
FAX (918) 251-0008

Client:

Kaiser Aluminum

Client Project:

Add Characterization Plan 5427f

Lab Number:

20010471

Date Reported:

5/23/01

Date Received:

5/9/01

Page Number:

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## Analytical Report

	Method	Result	Units	DL	Prep Date	Analysis Date	Analyst
TCLP-Selenium	EPA 1311/6010B	BDL	mg/l	0.105	5/17/01	5/17/01	MG
TCLP-Silver	EPA 1311/6010B	0.047	mg/l	0.009	5/17/01	5/17/01	MG
Organics Analyses							
1,1-Dichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
1,2-Dichloroethane	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
2-Butanone (MEK)	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Benzene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Carbon tetrachloride	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Chloroform	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Tetrachloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Trichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Vinyl Chloride	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Chlorobenzene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	

Lab ID: 20010471-03

Client ID: 003

Date Sampled: 5/9/01 2:36:00 PM

Matrix: Soil

### Metals Analyses

TCLP-Arsenic	EPA 1311/6010B	0.01	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Barium	EPA 1311/6010B	7.85	mg/l	0.120	5/17/01	5/17/01	MG
TCLP-Cadmium	EPA 1311/6010B	BDL	mg/l	0.011	5/17/01	5/17/01	MG
TCLP-Chromium	EPA 1311/6010B	0.015	mg/l	0.010	5/17/01	5/17/01	MG
TCLP-Lead	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Mercury	EPA 7470/7471A	BDL	mg/l	0.0005	5/18/01	5/22/01	MG
TCLP-Selenium	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Silver	EPA 1311/6010B	BDL	mg/l	0.009	5/17/01	5/17/01	MG

### Organics Analyses

1,1-Dichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
1,2-Dichloroethane	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
2-Butanone (MEK)	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Benzene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Carbon tetrachloride	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Chloroform	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Tetrachloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Trichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Vinyl Chloride	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	

BDL = Below Detection Limit



# Outreach Laboratory

311 North Aspen  
Broken Arrow, OK 74012  
(918) 251-2515  
FAX (918) 251-0008

Client:

Kaiser Aluminum

Client Project:

Add Characterization Plan 5427f

Lab Number:

20010471

Date Reported:

5/23/01

Date Received:

5/9/01

Page Number:

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## Analytical Report

	Method	Result	Units	DL	Prep Date	Analysis Date	Analyst
Chlorobenzene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	

Lab ID: 20010471-04

Client ID: 004

Date Sampled: 5/9/01 2:46:00 PM

Matrix: Soil

### Metals Analyses

TCLP-Arsenic	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Barium	EPA 1311/6010B	3.70	mg/l	0.120	5/17/01	5/17/01	MG
TCLP-Cadmium	EPA 1311/6010B	BDL	mg/l	0.011	5/17/01	5/17/01	MG
TCLP-Chromium	EPA 1311/6010B	0.013	mg/l	0.010	5/17/01	5/17/01	MG
TCLP-Lead	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Mercury	EPA 7470/7471A	BDL	mg/l	0.0005	5/18/01	5/22/01	MG
TCLP-Selenium	EPA 1311/6010B	0.007	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Silver	EPA 1311/6010B	0.014	mg/l	0.009	5/17/01	5/17/01	MG

### Organics Analyses

1,1-Dichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
1,2-Dichloroethane	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
2-Butanone (MEK)	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Benzene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Carbon tetrachloride	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Chloroform	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Tetrachloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Trichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Vinyl Chloride	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Chlorobenzene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	

Lab ID: 20010471-05

Client ID: 005

Date Sampled: 5/9/01 2:56:00 PM

Matrix: Soil

### Metals Analyses

TCLP-Arsenic	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Barium	EPA 1311/6010B	13.9	mg/l	0.120	5/17/01	5/17/01	MG
TCLP-Cadmium	EPA 1311/6010B	BDL	mg/l	0.011	5/17/01	5/17/01	MG
TCLP-Chromium	EPA 1311/6010B	BDL	mg/l	0.010	5/17/01	5/17/01	MG
TCLP-Lead	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG

BDL = Below Detection Limit



311 North Aspen  
Broken Arrow, OK 74012  
(918) 251-2515  
FAX (918) 251-0008

Client:

Client Project:

Lab Number:

Date Reported:

Date Received:

Page Number:

Kaiser Aluminum  
Add Characterization Plan 5427f

20010471

5/23/01

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## Analytical Report

	Method	Result	Units	DI	Prep Date	Analysis Date	Analyst
TCLP-Mercury	EPA 7470/7471A	BDL	mg/l	0.0005	5/18/01	5/22/01	MG
TCLP-Selenium	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Silver	EPA 1311/6010B	0.010	mg/l	0.009	5/17/01	5/17/01	MG
<b>Organics Analyses</b>							
1,1-Dichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
1,2-Dichloroethane	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
2-Butanone (MEK)	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Benzene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Carbon tetrachloride	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Chloroform	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Tetrachloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Trichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Vinyl Chloride	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Chlorobenzene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	

Lab ID: 20010471-06

Client ID: 006

Date Sampled: 5/9/01 3:06:00 PM

Matrix: Soil

### Metals Analyses

TCLP-Arsenic	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Barium	EPA 1311/6010B	6.19	mg/l	0.120	5/17/01	5/17/01	MG
TCLP-Cadmium	EPA 1311/6010B	BDL	mg/l	0.011	5/17/01	5/17/01	MG
TCLP-Chromium	EPA 1311/6010B	BDL	mg/l	0.010	5/17/01	5/17/01	MG
TCLP-Lead	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Mercury	EPA 7470/7471A	BDL	mg/l	0.0005	5/18/01	5/22/01	MG
TCLP-Selenium	EPA 1311/6010B	0.007	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Silver	EPA 1311/6010B	BDL	mg/l	0.009	5/17/01	5/17/01	MG

### Organics Analyses

1,1-Dichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
1,2-Dichloroethane	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
2-Butanone (MEK)	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Benzene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Carbon tetrachloride	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Chloroform	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Tetrachloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Trichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	

BDL - Below Detection Limit



# Outreach Laboratory

311 North Aspen  
Broken Arrow, OK 74012  
(918) 251-2515  
FAX (918) 251-0008

Client:

Kaiser Aluminum

Client Project:

Add Characterization Plan 5427f

Lab Number:

20010471

Date Reported:

5/23/01

Date Received:

5/9/01

Page Number:

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## Analytical Report

	Method	Result	Units	DL	Prep Date	Analysis Date	Analyst
Vinyl Chloride	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	
Chlorobenzene	EPA 1311/8240A	ND	mg/l	0.0050	5/10/01	5/21/01	

Lab ID: 20010471-07

Client ID: 007

Date Sampled: 5/9/01 3:16:00 PM

Matrix: Soil

### Metals Analyses

TCLP-Arsenic	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Barium	EPA 1311/6010B	3.61	mg/l	0.120	5/17/01	5/17/01	MG
TCLP-Cadmium	EPA 1311/6010B	BDL	mg/l	0.011	5/17/01	5/17/01	MG
TCLP-Chromium	EPA 1311/6010B	BDL	mg/l	0.010	5/17/01	5/17/01	MG
TCLP-Lead	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Mercury	EPA 7470/7471A	BDL	mg/l	0.0005	5/18/01	5/22/01	MG
TCLP-Selenium	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Silver	EPA 1311/6010B	0.010	mg/l	0.009	5/17/01	5/17/01	MG

### Organics Analyses

1,1-Dichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
1,2-Dichloroethane	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
2-Butanone (MEK)	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Benzene	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Carbon tetrachloride	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Chloroform	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Tetrachloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Trichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Vinyl Chloride	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Chlorobenzene	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	

Lab ID: 20010471-08

Client ID: 008

Date Sampled: 5/9/01 3:26:00 PM

Matrix: Soil

### Metals Analyses

TCLP-Arsenic	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Barium	EPA 1311/6010B	6.14	mg/l	0.120	5/17/01	5/17/01	MG
TCLP-Cadmium	EPA 1311/6010B	BDL	mg/l	0.011	5/17/01	5/17/01	MG
TCLP-Chromium	EPA 1311/6010B	BDL	mg/l	0.010	5/17/01	5/17/01	MG

BDL = Below Detection Limit



# Outreach Laboratory

311 North Aspen  
Broken Arrow, OK 74012  
(918) 251-2515  
FAX (918) 251-0008

Client:

Kaiser Aluminum

Client Project:

Add Characterization Plan 54276

Lab Number:

20010471

Date Reported:

5/23/01

Date Received:

5/9/01

Page Number:

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## Analytical Report

	Method	Result	Units	DL	Prep Date	Analysis Date	Analyst
TCLP-Lead	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Mercury	EPA 7470/7471A	BDL	mg/l	0.0005	5/18/01	5/22/01	MG
TCLP-Selenium	EPA 1311/6010B	0.008	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Silver	EPA 1311/6010B	BDL	mg/l	0.009	5/17/01	5/17/01	MG
Organics Analyses							
1,1-Dichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
1,2-Dichloroethane	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
2-Butanone (MEK)	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Benzene	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Carbon tetrachloride	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Chloroform	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Tetrachloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Trichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Vinyl Chloride	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Chlorobenzene	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	

Lab ID: 20010471-09

Client ID: 009

Date Sampled: 5/9/01 3:36:00 PM

Matrix: Soil

### Metals Analyses

TCLP-Arsenic	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Barium	EPA 1311/6010B	5.16	mg/l	0.120	5/17/01	5/17/01	MG
TCLP-Cadmium	EPA 1311/6010B	BDL	mg/l	0.011	5/17/01	5/17/01	MG
TCLP-Chromium	EPA 1311/6010B	BDL	mg/l	0.010	5/17/01	5/17/01	MG
TCLP-Lead	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Mercury	EPA 7470/7471A	BDL	mg/l	0.0005	5/18/01	5/22/01	MG
TCLP-Selenium	EPA 1311/6010B	0.006	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Silver	EPA 1311/6010B	0.034	mg/l	0.009	5/17/01	5/17/01	MG

### Organics Analyses

1,1-Dichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/15/01	5/21/01	
1,2-Dichloroethane	EPA 1311/8240A	ND	mg/l	0.0050	5/15/01	5/21/01	
2-Butanone (MEK)	EPA 1311/8240A	ND	mg/l	0.0050	5/15/01	5/21/01	
Benzene	EPA 1311/8240A	ND	mg/l	0.0050	5/15/01	5/21/01	
Carbon tetrachloride	EPA 1311/8240A	ND	mg/l	0.0050	5/15/01	5/21/01	
Chloroform	EPA 1311/8240A	ND	mg/l	0.0050	5/15/01	5/21/01	
Tetrachloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/15/01	5/21/01	

BDL = Below Detection Limit





# Outreach Laboratory

311 North Aspen  
Broken Arrow, OK 74012  
(918) 251-2515  
FAX (918) 251-0008

Client:

Kaiser Aluminum

Client Project:

Add Characterization Plan 5427f

Lab Number:

20010471

Date Reported:

5/23/01

Date Received:

5/9/01

Page Number:

7 of 8

## Analytical Report

	Method	Result	Units	DL	Prep Date	Analysis Date	Analyst
Trichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/15/01	5/21/01	
Vinyl Chloride	EPA 1311/8240A	ND	mg/l	0.0050	5/15/01	5/21/01	
Chlorobenzene	EPA 1311/8240A	ND	mg/l	0.0050	5/15/01	5/21/01	

Lab ID: 20010471-10

Client ID: 010

Date Sampled: 5/9/01 3:46:00 PM

Matrix: Soil

### Metals Analyses

TCLP-Arsenic	EPA 1311/6010B	0.01	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Barium	EPA 1311/6010B	8.71	mg/l	0.120	5/17/01	5/17/01	MG
TCLP-Cadmium	EPA 1311/6010B	BDL	mg/l	0.011	5/17/01	5/17/01	MG
TCLP-Chromium	EPA 1311/6010B	0.011	mg/l	0.010	5/17/01	5/17/01	MG
TCLP-Lead	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Mercury	EPA 7470/7471A	BDL	mg/l	0.0005	5/18/01	5/22/01	MG
TCLP-Selenium	EPA 1311/6010B	BDL	mg/l	0.005	5/17/01	5/17/01	MG
TCLP-Silver	EPA 1311/6010B	0.013	mg/l	0.009	5/17/01	5/17/01	MG

### Organics Analyses

1,1-Dichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
1,2-Dichloroethane	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
2-Butanone (MEK)	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Benzene	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Carbon tetrachloride	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Chloroform	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Tetrachloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Trichloroethene	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Vinyl Chloride	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	
Chlorobenzene	EPA 1311/8240A	ND	mg/l	0.0050	5/14/01	5/21/01	

BDL = Below Detection Limit



# Outreach Laboratory

311 North Aspen  
Broken Arrow, OK 74012  
(918) 251-2515  
FAX (918) 251-0008

Client: Kaiser Aluminum  
Client Project: Add Characterization Plan 5427f  
Lab Number: 20010471  
Date Reported: 5/23/01  
Date Received: 5/9/01  
Page Number: 8 of 8

QC Report								
Parameter	Blank	LCS %REC	LCSD %REC	DUP RPD	MS %REC	MSD %REC	RPD	Date
I,1-Dichloroethane					91.0	105.0	14.2	5/21/01
Benzene					93.0	108.0	15.1	5/21/01
Chlorobenzene					89.0	104.0	15.1	5/21/01
TCLP-Arsenic	BDI	99.3			95.5	95.4	0.1	5/17/01
TCLP-Barium	BDI	102.0			83.0	91.0	9.2	5/17/01
TCLP-Cadmium	BDI	101.0			94.0	93.6	0.3	5/17/01
TCLP-Chromium	BDI	98.2			101.0	99.4	1.6	5/17/01
TCLP-Lead	BDI	100.0			104.0	103.0	1.4	5/17/01
TCLP-Mercury		94.0			94.0	97.0	2.6	5/22/01
TCLP-Selenium	BDI	94.8			95.0	97.4	2.4	5/17/01
TCLP-Silver	BDI	120.0			112.0	115.0	3.0	5/17/01
Trichloroethane					91.0	105.0	14.6	5/21/01

QA Approval:

Lab Approval:

BDL = Below Detection Limit

## **Appendix D**


### **Procedure: ESC/HPM 3-6 Gross Gamma Surveys of Soil Cores**

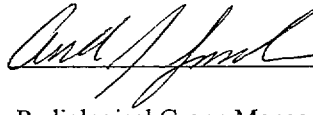
**Procedure: ESC/HPM3-6**

**Gross Gamma Surveys of Soil Cores**  
**Kaiser Aluminum & Chemical Corporation**  
**Tulsa, Oklahoma Site**

**Revision: 0**

**Effective Date: February 2001**

 2/8/01  
Prepared by: \_\_\_\_\_ Date: \_\_\_\_\_

 2/8/01  
Radiological Group Manager: \_\_\_\_\_ Date: \_\_\_\_\_

# Health Physics Manual

Earth Sciences Consultants, Inc.  
One Triangle Lane  
Export, PA 15632  
(724) 733-3000

Procedure: ESC/HPM-3-6

Title: Gross Gamma Surveys of Soil Cores

## 1.0 PURPOSE

As part of the adjacent land remediation activities, characterization soil core samples will be surveyed to identify the highest gross gamma reading 1-foot segment. At a minimum, the identified segment will be separated from the core, mixed, sampled as a surface sample and analyzed by gamma spectroscopy. Part of the sample may be added to a composite sample of soil cores. The purpose of this procedure is to provide instruction for performing gross gamma surveys of soil boring cores (soil cores) and the subsequent sampling of the core.

## 2.0 DEFINITIONS

*Soil Core* – A soil sample obtaining by boring down vertically through soil, usually in 4-foot increments. The resulting sample is a cylinder in shape with a constant diameter.

## 3.0 PREREQUISITES / PRECAUTIONS / LIMITATIONS

- 3.1 Instrument must pass pre-operational checks as outlined in ESC/HPM-2-1 and the appropriate instrument procedure. Ensure the pre-operational and source checks have been completed prior to initiating survey.
- 3.2 Background count rates may vary. Background should be at least daily for each area and counting geometry to be used.
- 3.3 Before initiating a gross gamma soil survey be sure to record the instrument serial number (s), calibration date (s), date of survey, time of survey, and any other pertinent information.
- 3.4 The NaI detector should be shielded with at least 1/16 inch of lead.
- 3.5 The detector and the scaler should be configured so that the Health Physics Technician can move the core past the detector while observing the count rate and hear the audible response.
- 3.6 Ensure that the NaI detector is in the standard counting configuration for the type of survey to be performed, e.g., inside of the shield, at a low background location.
- 3.7 Ensure that all samples are properly labeled with the Characterization Grid number and Quadrant letter.

## 4.0 EQUIPMENT

- 4.1 2-inch X 2-inch NaI scintillator detector, Ludlum Model 44-10 or equivalent
- 4.2 Ludlum Model 2221 Scaler or equivalent

# Health Physics Manual

Earth Sciences Consultants, Inc.  
One Triangle Lane  
Export, PA 15632  
(724) 733-3000

Procedure: ESC/HPM-3-6

Title: Gross Gamma Surveys of Soil Cores

## 4.3 Sturdy Mixing Bucket, or equivalent and trowel

## 5.0 PROCEDURE

Record the results of all measurements on HPM Form 1-2-15. Sections of the form that are not applicable to the survey should be marked "N/A". At a minimum, each soil core sample selected for survey should be scanned to identify the most elevated 1-foot section. This section should be separated from the core, mixed and forwarded to an appropriate lab for gamma spectroscopy analysis.

### 5.1 Determine background.

5.1.1 Ensure that the NaI detector is in the standard counting configuration, e.g., inside of the shield, at the location that scans or fixed counts are to be performed.

5.1.2 Perform five consecutive 1-minute fixed counts with the detector in the desired standard scanning configuration. (Ambient Background Geometry)

5.1.3 Calculate the average background count rate.

### 5.2 Perform soil core scan surveys as follows.

5.2.1 Record the soil core serial number, e.g., for a core taken in Characterization Grid 24, Quadrant B from 4 to 8 feet depth, 24-B (4-8 feet).

5.2.2 With the instrument in the rate mode, move the detector (or the soil core) at a rate of no greater than 1-inch per second, keeping the detector as close as possible to the soil core. Ensure that the scan rate is slow enough to detect changes in the audible response of the instrument.

5.2.3 Record the maximum count rate observed for each 1-foot segment of the soil core. Core segments are 0-1 foot, 1-2 feet, 2-3 feet, etc.

### 5.3 Sample the most elevated 1-foot section of core as follows.

5.3.1 Separate the most elevated 1-foot segments using an appropriate tool, e.g. a saw.

5.3.2 Place the 1-foot segment into the bucket and mix the core thoroughly with the trowel.

5.3.3 From the bucket fill a standard soil sample container with the soil. Clean the bucket and

# Health Physics Manual

Earth Sciences Consultants, Inc.  
One Triangle Lane  
Export, PA 15632  
(724) 733-3000

Procedure: ESC/HPM-3-6

Title: Gross Gamma Surveys of Soil Cores

trowel before handling the next sample.

- 5.3.4 Label the sample container with the Characterization Grid number, the Quadrant letter and the depth interval, e.g., 24-B (5-6 feet).
- 5.4 Calculate the net cpm for each measurement by subtracting the appropriate average background, i.e., ambient background for scan measurements and the sample container background for fixed counts.
- 5.5 Forward the maximum 1-foot segment of the soil core sample to the laboratory for gamma spectroscopy analysis.
- 5.6 Archive the remaining samples and/or soil core.

## 6.0 REFERENCES

- 6.1 ESC/HPM-2-1, Basic Instrument Operation

## 7.0 ATTACHMENTS

### 7.1 Forms

- 7.1.1 Form HPM-1-2-15, Soil Core Gross Gamma Survey

## **Appendix E**

### **Soil Core Hole Samples Analytical Data Report**





# OUTREACH LABORATORY

311 North Aspen  
Broken Arrow, OK 74012  
Phone: (918) 251-2515  
Fax: (918) 251-0008

## CHAIN OF CUSTODY

Results To:

Company

Name

Address

City

State

Zip

Phone

Fax #

Bill To:

Company

Name

Address

City

State

Zip

## ANALYSIS REQUESTED

PO #

PROJECT #

PROJECT NAME

REQUESTED TURNAROUND TIME  
(ADDITIONAL CHARGES MAY APPLY)

SAMPLER

Signature

# CONTAINERS

CONTAINER  
SIZE &  
TYPE  
  
PLASTIC  
OR  
GLASS

PRESERVATIVE  
1. HNO<sub>3</sub> pH<2  
2. Ice <4°C  
3. HCl pH<2  
4. H<sub>2</sub>SO<sub>4</sub> pH<2  
5. NaOH pH>11

gms. See Thru

REMARKS  
(I.E. FILTERED, UNFILTERED,  
GRAB, COMPOSITE)

LAB SAMPLE ID	CLIENT SAMPLE ID	DATE SAMPLED	TIME SAMPLED	MATRIX
1	1500-2a	5-11-01	2400	Soil
2	1501-12a			
3	1502-8b			
4	1503-6a			
5	1504-16b			
6	1505-23a			
7	1506-5b			
8	1507-14a			
9	1508-3a			
10	1509-21a			
11	1510-20a			
12	1511-7a			
13	1512-13a			
14	1513-10a			

RELINQUISHED BY: Spruells

DATE

TIME

RECEIVED BY: Shaker

DATE

TIME

RELINQUISHED BY: \_\_\_\_\_

DATE

TIME

RECEIVED BY: \_\_\_\_\_

DATE

TIME

My signature on this chain of custody form indicates that I am authorized by the above company to release samples for analysis. The company agrees to pay the entire balance upon receipt of sample data and it is understood and agreed that any balance carried over thirty (30) days is subject to a 1.5% per month (18% per annum) late charge. In the event of default, the company becomes legally liable for any reasonable attorney and/or collection fees and all related costs necessary to remit the entire balance to Outreach Technologies, Inc. (Outreach Laboratory).

SAMPLE RETURN/DISPOSAL: All non hazardous aqueous samples shall be disposed of 30 days after issue of final report. All others will be returned at client's expense.

FOR LABORATORY USE ONLY:

Sample Condition Upon Receipt \_\_\_\_\_

Custody Seals Intact Y N

Cooler Temperature \_\_\_\_\_

21010484



# OUTREACH LABORATORY

311 North Aspen  
Broken Arrow, OK 74012  
Phone: (918) 251-2515  
Fax: (918) 251-0008

## CHAIN OF CUSTODY

Results To:

Company

Name

Address

City

State

Zip

Phone

Fax #

Bill To:

Company

Name

Address

City

State

Zip

## ANALYSIS REQUESTED

PO #

PROJECT #

PROJECT NAME

REQUESTED TURNAROUND TIME  
(ADDITIONAL CHARGES MAY APPLY)

SAMPLER

Signature

# CONTAINERS

CONTAINER  
SIZE &  
TYPE

PLASTIC  
OR  
GLASS

PRESERVATIVE

1. HNO<sub>3</sub> pH<2
2. Ice <4°C
3. HCl pH<2
4. H<sub>2</sub>SO<sub>4</sub> pH<2
5. NaOH pH>11

REMARKS  
(I.E. FILTERED, UNFILTERED,  
GRAB, COMPOSITE)

LAB SAMPLE ID	CLIENT SAMPLE ID	DATE SAMPLED	TIME SAMPLED	MATRIX	CONTAINER SIZE & TYPE	PRESERVATIVE	ANALYSIS REQUESTED
15	1514-1c	5-11-01	2400	Soil	P	N/A	✓
16	1515-19a						✓
17	1516-17a						✓
18	1517-24a						✓
19	1518-15a						✓
20	1519-11a						✓
21	1520-22a						✓
22	1521-18a						✓
23	1522-9a						✓
24	1523-4a						✓

RELINQUISHED BY: SPHawde

DATE

TIME

RECEIVED BY: RE-hm

DATE

TIME

RELINQUISHED BY: \_\_\_\_\_

DATE

TIME

RECEIVED BY: \_\_\_\_\_

DATE

TIME

My signature on this chain of custody form indicates that I am authorized by the above company to release samples for analysis. The company agrees to pay the entire balance upon receipt of sample data and it is understood and agreed that any balance carried over thirty (30) days is subject to a 1.5% per month (18% per annum) late charge. In the event of default, the company becomes legally liable for any reasonable attorney and/or collection fees and all related costs necessary to remit the entire balance to Outreach Technologies, Inc. (Outreach Laboratory).

SAMPLE RETURN/DISPOSAL: All non-hazardous aqueous samples shall be disposed of 30 days after issue of final report. All others will be returned at client's expense.

FOR LABORATORY USE ONLY:

Sample Condition Upon Receipt \_\_\_\_\_

Custody Seals Intact Y N

Cooler Temperature \_\_\_\_\_

2001 0484



**Outreach  
Laboratory**

1 North Aspen  
Broken Arrow, OK 74012  
(8) 251-2515  
X (918) 251-0008

Client:	Kaiser Aluminum
Client Project:	ACP 5427F
Lab Number:	20010484
Date Reported:	5/21/2001
Date Received:	5/14/01
Page Number:	1 of 6

### Analytical Report

Method		Result	Units	DL	Prep Date	Analysis Date	Analyst
<hr/>							
Lab ID:	20010484-01						
Client ID:	1500-2a						
Date Sampled:	5/11/2001						
Matrix:	Soil						
Radiochemical Analyses							
Th-232	HASL 300	1.82 +/- 0.062	pCi/g	0.368		5/17/2001	SD
Lab ID:	20010484-02						
Client ID:	1501-12a						
Date Sampled:	5/11/2001						
Matrix:	Soil						
Radiochemical Analyses							
Th-232	HASL 300	0.725 +/- 0.105	pCi/g	0.355		5/17/2001	SD
Lab ID:	20010484-03						
Client ID:	1502-8b						
Date Sampled:	5/11/2001						
Matrix:	Soil						
Radiochemical Analyses							
Th-232	HASL 300	3.33 +/- 0.143	pCi/g	0.275		5/17/2001	SD
Lab ID:	20010484-04						
Client ID:	1503-6a						
Date Sampled:	5/11/2001						
Matrix:	Soil						
Radiochemical Analyses							
Th-232	HASL 300	71.4 +/- 1.91	pCi/g	1.26		5/17/2001	SD
Lab ID:	20010484-05						
Client ID:	1504-16b						
Date Sampled:	5/11/2001						
Matrix:	Soil						
Radiochemical Analyses							
Th-232	HASL 300	0.659 +/- 0.068	pCi/g	0.282		5/17/2001	SD

BDL = Below Detection Limit



1 North Aspen  
oken Arrow, OK 74012  
18) 251-2515  
X (918) 251-0008

Client: Kaiser Aluminum  
Client Project: ACP 5427F  
Lab Number: 20010484  
Date Reported: 5/21/2001  
Date Received: 5/14/01  
Page Number: 2 of 6

## Analytical Report

Method	Result	Units	DL	Prep Date	Analysis Date	Analyst
<b>Lab ID: 20010484-06</b>						
<b>Client ID: 1505-23a</b>						
<b>Date Sampled: 5/11/2001</b>						
<b>Matrix: Soil</b>						
<b>Radiochemical Analyses</b>						
Th-232	HASL 300	45.7 +/- 0.851 pCi/g	0.711		5/17/2001	SD
<b>Lab ID: 20010484-07</b>						
<b>Client ID: 1506-5b</b>						
<b>Date Sampled: 5/11/2001</b>						
<b>Matrix: Soil</b>						
<b>Radiochemical Analyses</b>						
Th-232	HASL 300	30.7 +/- 0.870 pCi/g	1.26		5/17/2001	SD
<b>Lab ID: 20010484-08</b>						
<b>Client ID: 1507-14a</b>						
<b>Date Sampled: 5/11/2001</b>						
<b>Matrix: Soil</b>						
<b>Radiochemical Analyses</b>						
Th-232	HASL 300	6.26 +/- 0.256 pCi/g	0.460		5/17/2001	SD
<b>Lab ID: 20010484-09</b>						
<b>Client ID: 1508-3a</b>						
<b>Date Sampled: 5/11/2001</b>						
<b>Matrix: Soil</b>						
<b>Radiochemical Analyses</b>						
Th-232	HASL 300	11.1 +/- 0.470 pCi/g	0.781		5/17/2001	SD
<b>Lab ID: 20010484-10</b>						
<b>Client ID: 1509-21a</b>						
<b>Date Sampled: 5/11/2001</b>						
<b>Matrix: Soil</b>						
<b>Radiochemical Analyses</b>						
Th-232	HASL 300	2.69 +/- 0.122 pCi/g	0.398		5/17/2001	SD

BDL = Below Detection Limit



1 North Aspen  
Broken Arrow, OK 74012  
(8) 251-2515  
X (918) 251-0008

Client: Kaiser Aluminum  
Client Project: ACP 5427F  
Lab Number: 20010484  
Date Reported: 5/21/2001  
Date Received: 5/14/01  
Page Number: 3 of 6

## Analytical Report

	Method	Result	Units	DL	Prep Date	Analysis Date	Analyst
Lab ID:	20010484-11						
Client ID:	1510-20a						
Date Sampled:	5/11/2001						
Matrix:	Soil						
		Radiochemical Analyses					
Th-232	HASL 300	0.283 +/- 0.085	pCi/g	0.352		5/17/2001	SD
Lab ID:	20010484-12						
Client ID:	1511-7a						
Date Sampled:	5/11/2001						
Matrix:	Soil						
		Radiochemical Analyses					
Th-232	HASL 300	89.0 +/- 1.41	pCi/g	1.09		5/17/2001	SD
Lab ID:	20010484-13						
Client ID:	1512-13a						
Date Sampled:	5/11/2001						
Matrix:	Soil						
		Radiochemical Analyses					
Th-232	HASL 300	0.863 +/- 0.111	pCi/g	0.256		5/17/2001	SD
Lab ID:	20010484-14						
Client ID:	1513-10a						
Date Sampled:	5/11/2001						
Matrix:	Soil						
		Radiochemical Analyses					
Th-232	HASL 300	0.792 +/- 0.093	pCi/g	0.277		5/17/2001	SD
Lab ID:	20010484-15						
Client ID:	1514-1c						
Date Sampled:	5/11/2001						
Matrix:	Soil						
		Radiochemical Analyses					
Th-232	HASL 300	4.21 +/- 0.236	pCi/g	0.420		5/17/2001	SD

BDL = Below Detection Limit



**Outreach  
Laboratory**

1 North Aspen  
Jensen Arrow, OK 74012  
8) 251-2515  
X (918) 251-0008

Client:

Kaiser Aluminum

Client Project:

ACP 5427F

Lab Number:

20010484

Date Reported:

5/21/2001

Date Received:

5/14/01

Page Number:

4 of 6

## Analytical Report

Method	Result	Units	DL	Prep Date	Analysis Date	Analyst
<b>Lab ID: 20010484-16</b>						
<b>Client ID: 1515-19a</b>						
<b>Date Sampled: 5/11/2001</b>						
<b>Matrix: Soil</b>						
<b>Radiochemical Analyses</b>						
Th-232	HASL 300	5.63 +/- 0.246 pCi/g	0.529		5/17/2001	SD
<b>Lab ID: 20010484-17</b>						
<b>Client ID: 1516-17a</b>						
<b>Date Sampled: 5/11/2001</b>						
<b>Matrix: Soil</b>						
<b>Radiochemical Analyses</b>						
Th-232	HASL 300	0.674 +/- 0.111 pCi/g	0.270		5/17/2001	SD
<b>Lab ID: 20010484-18</b>						
<b>Client ID: 1517-24a</b>						
<b>Date Sampled: 5/11/2001</b>						
<b>Matrix: Soil</b>						
<b>Radiochemical Analyses</b>						
Th-232	HASL 300	9.57 +/- 1.67 pCi/g	1.30		5/17/2001	SD
<b>Lab ID: 20010484-19</b>						
<b>Client ID: 1518-15a</b>						
<b>Date Sampled: 5/11/2001</b>						
<b>Matrix: Soil</b>						
<b>Radiochemical Analyses</b>						
Th-232	HASL 300	11.1 +/- 0.483 pCi/g	0.605		5/17/2001	SD
<b>Lab ID: 20010484-20</b>						
<b>Client ID: 1519-11a</b>						
<b>Date Sampled: 5/11/2001</b>						
<b>Matrix: Soil</b>						
<b>Radiochemical Analyses</b>						
Th-232	HASL 300	0.641 +/- 0.067 pCi/g	0.285		5/17/2001	SD

BDL = Below Detection Limit



**Outreach  
Laboratory**

1 North Aspen  
Aiken Arrow, OK 74012  
8) 251-2515  
K (918) 251-0008

Client:	Kaiser Aluminum
Client Project:	ACP 5427F
Lab Number:	20010484
Date Reported:	5/21/2001
Date Received:	5/14/01
Page Number:	5 of 6

## Analytical Report

Method		Result	Units	DL	Prep Date	Analysis Date	Analyst
<hr/>							
Lab ID:	20010484-21						
Client ID:	1520-22a						
Date Sampled:	5/11/2001						
Matrix:	Soil						
Radiochemical Analyses							
Th-232	HASL 300	6.11 +/- 0.255	pCi/g	0.334		5/17/2001	SD
Lab ID:	20010484-22						
Client ID:	1521-18a						
Date Sampled:	5/11/2001						
Matrix:	Soil						
Radiochemical Analyses							
h-232	HASL 300	1.33 +/- 0.086	pCi/g	0.201		5/17/2001	SD
Lab ID:	20010484-23						
Client ID:	1522-9a						
Date Sampled:	5/11/2001						
Matrix:	Soil						
Radiochemical Analyses							
Th-232	HASL 300	0.954 +/- 0.088	pCi/g	0.352		5/17/2001	SD
Lab ID:	20010484-24						
Client ID:	1523-4a						
Date Sampled:	5/11/2001						
Matrix:	Soil						
Radiochemical Analyses							
Th-232	HASL 300	2.83 +/- 0.164	pCi/g	0.341		5/17/2001	SD

BDL - Below Detection Limit



1 North Aspen  
oken Arrow, OK 74012  
18) 251-2515  
X (918) 251-0008

Client: Kaiser Aluminum  
Client Project: ACP 5427F  
Lab Number: 20010484  
Date Reported: 5/21/2001  
Date Received: 5/14/01  
Page Number: 6 of 6

### QC Report

Parameter	Blank	LCS %REC	LCSD %REC RPD	DUP RPD	MS %REC	MSD %REC RPD	Date
Ac-228	BDL			9.1			5/18/2001
Ac-228	BDL			8.6			5/17/2001
Co-60		95.1					5/18/2001
Co-60		97.2					5/17/2001
Cs-137		93.1					5/18/2001
Cs-137		97.6					5/17/2001
K-40		74.7					5/18/2001
K-40		90.5					5/17/2001
Mn-54		92.0					5/18/2001
Mn-54		89.4					5/17/2001

QA Approval:

Lab Approval:

BDL = Below Detection Limit