Construction Certification Report
Excavation and On-Site Management of Radiologically Affected Soils and Construction of Groundwater Collection Trench

Fansteel Inc.
Muskogee, Oklahoma

Project No. 3789K
December 15, 1999

Earth Sciences Consultants, Inc.

Providing Environmental Consulting Services Since 1979

Earth Sciences Consultants, Inc.

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Akron, Ohio • Philadelphia, Pennsylvania

December 15, 1999
Project No. 3789K-01

Mr. John J. Hunter
Site General Manager
Fansteel Inc.
Number Ten Tantalum Place
Muskogee, OK 74403-9297

Transmittal
Construction Certification Report
Excavation and On-Site Management of Radiologically
Affected Soils and Construction of Groundwater Collection Trench
Fansteel Inc.
Muskogee, Oklahoma

Dear Mr. Hunter:

Enclosed are two copies of the above-referenced construction report. Earth Sciences Consultants, Inc. appreciates the opportunity to provide Fansteel with this report. If you have any comments or require further information, please contact us at your earliest convenience.

Respectfully submitted,

Charles R. Beatty Jr.
Project Manager

Harold P. McCutcheon, P.E.
Chief Engineer

CRB/HPM:cak

Enclosures

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INFORMATION ONLY

Construction Certification Report Excavation and On-Site Management of Radiologically Affected Soils and Construction of Groundwater Collection Trench

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Philadelphia, Pennsylvania

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Construction Certification Report
Excavation and On-Site Management of Radiologically Affected Soils and Construction of Groundwater Collection Trench

1.0 Introduction

1.1 Purpose

This report was prepared to document the excavation and management of radiologically affected soils, construction of the groundwater collection trench, and execution of related activities at the subject site and to certify conformance with the Contract Drawings and Performance Specifications.

The groundwater collection trench is a component of the site groundwater remediation system currently under design and construction. Radiologically affected soils were excavated from areas in the vicinity of the groundwater trench construction.

1.2 Construction Contract Documents

The subject construction documents were entitled "Contract Documents, Bid Package, Excavation and On-Site Management of Radiologically Affected Soils and Construction of Groundwater Collection Trench, Fansteel, Inc., Muskogee, Oklahoma, Project No. 3789G," issued February 25, 1998. The Contract Documents include the Contract Drawing Package and the Performance Specifications.

1.3 Definitions

Radiologically Impacted Soils are defined as soils or other earth materials that contain radioactive materials at activities greater than background levels as a result of ore storage, handling, or processing operations previously conducted at the site as determined by scanning or laboratory analysis.

Above-Action Level (AAL) Soils are defined as radiologically affected soils containing total natural uranium and natural thorium at an activity of 10 picocuries per gram (pCi/g) above background levels. AAL soils require special on-site management procedures.

Below-Action Level (BAL) Soils are defined as unaffected soils or radiologically affected soils that contain less than 10 pCi/g of total natural uranium and natural above background levels. BAL soils do not require special on-site management procedures and are used as general backfill or other uses where suitable.

A *Confirmation Sample* is defined as a soil sample analyzed by an off-site laboratory to confirm all AAL soil has been removed from an excavation area.

1.4 Scope of Construction Work

The scope of work included:

- Installation of erosion and sedimentation (E&S) control measures.
- Protection of existing facilities and utilities during construction.
- Construction and removal of temporary facilities needed during construction, such as access roads.
- Removal and management of radiologically impacted soils from the trench construction area. These areas were identified before construction.
- Construction of a lined and capped temporary AAL soil stockpile.
- Construction and stabilization of a BAL soil stockpile.
- Construction of the groundwater collection trench.
- Restoration of existing facilities and utilities affected by construction.
- Revegetation/restabilization of areas affected by construction.

1.5 As-Built Drawings

As-built drawings are included in this report. The drawing sheets are numbered CD-1 through CD-9, Revision 1. As-built Sheet No. CD-1 provides a list of drawings.

2.0 Facility

2.1 Name of Facility and Contact

Fansteel Inc.
Number Ten Tantalum Place
Muskogee, OK 74403
Contact: John J. Hunter, Site General Manager

2.2 Owner of Facility and Contact

Fansteel Inc.
Number One Tantalum Place
North Chicago, IL 60064
Contact: Michael J. Mocniak

2.3 Site Description

The Fansteel Muskogee facility is located 2.5 miles northeast of Muskogee, Oklahoma. The facility is situated along the western edge of the Arkansas River (Webber Falls Reservoir) and is bounded on the north by land owned by Muskogee Port Authority, on the south by U.S. Highway 62, and on the west by State Highway 165 and a service road. Site location and vicinity maps are provided on Sheet No. CD-1.

The facility, constructed in 1956, occupies approximately 110 acres of land. Prior to construction of the facility, the site was undeveloped. The subsurface strata include fill and alluvial soils approximately 20 to 30 feet thick, underlain by shale bedrock. Groundwater flows primarily east to west (toward the river) with minor variations due to topographic influences and possibly site structures.

2.4 Facility Description

Fansteel's Muskogee plant formerly produced tantalum metal for use in the electrical/electronics industry and columbium oxide for use in the heat-resistant alloys industry. The Fansteel processing facility had been in operation for approximately 33 years when operations ceased in December 1989. Naturally occurring tantalum and columbium ores and tin slag exhibit low-level radioactivity from naturally occurring radioactive elements, specifically uranium and thorium. These radionuclides are present in the existing on-site impoundments at concentrations greater than 0.05 percent. The handling and processing of the ores, slag, and process materials which contain source material are subject to Nuclear Regulatory Commission (NRC) regulations under 10 Code of Federal Regulations 40, Domestic Licensing of Source

Material. The Muskogee facility operated under NRC License No. SMB-911. Fansteel is currently implementing a decommissioning plan to remove radioactive contamination from buildings, land, and groundwater located at, on, or beneath the eastern area of facility property.

3.0 Design, Construction, and Quality Assurance Professionals

3.1 Design Engineer

The design engineer for this project was Earth Sciences Consultants, Inc. (Earth Sciences).

3.2 Construction Contractor

The general contractor for the construction of the groundwater trench was Cook Construction (Cook), 1821 Highway 62 East, Fort Gibson, OK 74434.

3.3 Construction Quality Control Subcontractors

Cook retained the services of subcontractors to perform quality control testing: Manhattan Environmental of Muskogee, Oklahoma welded and inspected the AAL stockpile HDPE liner and cap; and Quality Testing of Muskogee, Oklahoma performed compaction tests during the placement of backfill.

3.4 Construction Quality Assurance Engineer

Construction Quality Assurance (CQA) monitoring was provided by Earth Sciences. During construction, the CQA engineer provided full-time, on-site services including:

- Construction monitoring to assure compliance with the Contract Drawings and Performance Specifications.
- On-site testing of soils for radiological contamination.
- Collection of samples for off-site laboratory analysis to confirm contamination removal.

3.5 Analytical Testing Laboratory

Analytical testing services were provided by Outreach Laboratory, 311 North Aspen, Broken Arrow, Oklahoma 74012.

4.0 Construction Activities

4.1 Site Mobilization/Construction Start Up

Earth Sciences and Cook mobilized to the site in July 1998. Initial activities consisted of clearing and grubbing the construction areas, including the groundwater collection trench area and AAL stockpile area. Cook constructed temporary access roads on site for equipment use during trench construction and for transportation of AAL soils to the stockpile

4.2 E&S Control and Storm Water Management

During construction, Cook installed temporary facilities as needed to manage storm water runoff and control soil E&S. On October 7, 1998, Cook installed E&S controls along areas of the riverbank that eroded due to heavy rains. Silt fencing and straw bales were installed in order to prevent migration of soils. During construction, Cook installed a concrete pipe to reroute a ditch located just north of Sump 4. After construction was completed, Cook reconstructed the ditch.

In January 1999, two small depressions formed near National Pollutant Discharge Elimination System Outfalls 1 and 2, respectively. It was suspected that they could be the result of subsurface piping erosion; therefore, they were investigated. These areas were excavated to a depth of approximately 6 feet and there did not appear to be any pathway for incoming or outgoing water. It was determined that the depressions occurred because of loose backfill at the surface of the site. The excavations were backfilled with the excavated soils and recompacted. Subsequently, the problems did not reoccur.

4.3 Dust Control Measures

Dust control measures were implemented during remedial activities on the site included spraying excavation areas and haul roads with a water truck to reduce wind-blown dust migration.

4.4 Construction of AAL Stockpile Liner

Prior to AAL removal, the AAL soil stockpile base and liner were constructed. The stockpile base and liner were configured according to the Contract Drawings and Performance Specifications. The liner was composed of a high-density polyethylene (HDPE) membrane, as specified. The liner subgrade was prepared by removing all vegetation, rocks, and other materials that could cause damage to the HDPE liner. The subgrade was then rolled, compacted, and smoothed.

The base of the AAL stockpile was lined with 60-mil HDPE rather than 20-mil HDPE as specified; therefore, the material used exceeded the minimum material thickness specification. HDPE panels were rolled out and overlapped by a minimum of 3 inches before welding. Manhattan Environmental, a subcontractor to Cook, welded the seams and inspected the liner. Any area showing a defect was marked and repaired. The liner was extended over the perimeter berm a minimum of 2 feet and anchored as shown in the Contract Drawings.

The location of the AAL stockpile is shown on Sheet No. CD-3. As-built details of the stockpile are shown on Sheet CD-8.

4.5 Management of AAL Soils

AAL soil removal began in early August. AAL soil areas were identified during the 1993 remediation assessment. Four areas of AAL soil, designated as Areas V-b, V-a, VIII-b, and VIII-a, were located along the groundwater collection trench construction area. The areas are shown on Sheet No. CD-3. AAL soils were excavated and relocated to the AAL soil stockpile. Prior to excavation, Earth Sciences' personnel marked the four AAL Areas.

Earth Sciences was responsible for identifying the presence and extent of AAL soils during all excavation activities. Earth Sciences performed field measurements of soil radioactivity using a gamma meter during soil excavation activities. A calibration level of 1,200 counts per minute (cpm) was established to identify AAL soils. All soils identified as AAL were excavated and transported to the AAL stockpile area. Each truckload was weighed on an on-site truck scale and the net soil weight was recorded. Using the gamma meter to scan the open excavation, Earth Sciences determined when excavation of AAL soils was complete.

After removal of AAL material identified using on-site instrument scanning, confirmation sampling and testing was performed. Samples were collected from select locations in the excavations and sent to an off-site laboratory (Outreach Laboratory) for analysis to confirm that the soils remaining in the excavations were BAL.

4.5.1 Excavation of AAL Materials in Area V-b

Excavation began in the northernmost area of Area V-b and proceeded south. In addition to soil, debris, such as concrete, was encountered in Area V-b. This construction debris was scanned and determined to

be BAL, and was segregated and managed separately. A total of 1,055 tons of soil were removed from the Area V-b excavation.

4.5.2 Excavation of AAL Materials in Area V-a

Cook then began excavation of Area V-a. In addition to soil, materials such as concrete rubble and a black and white residual material were encountered in the Area V-a excavation. These materials were scanned and identified to be AAL. A total of 1,185 tons of soil were removed from Area V-a and transferred to the AAL stockpile.

4.5.3 Excavation of AAL Materials in Area VIII-b

Cook then proceeded to Area VIII-b. Debris, such as concrete, tree branches, piping, etc., was encountered to a depth of 2 feet. The debris was scanned and determined to be AAL. Soil fill material extending down to groundwater level in the central portion of VIII-b was excavated, scanned, and determined to be AAL. Area VIII-b was excavated to a depth of approximately 15 feet below ground surface. During the Area VIII-b excavation phase, the gamma meter was recalibrated based on laboratory test results received. The AAL gamma meter calibration was established to be 1,800 cpm. A total of 1,772 tons of soil were removed from VIII-b.

4.5.4 Excavation of AAL Materials in Area VIII-a

Cook then excavated Area VIII-a. Debris, such as two large metal boxes, concrete, shredded bags, and shredded 55-gallon drums, was encountered in Area VIII-a. The debris was scanned and determined to be AAL. This debris was segregated from the AAL soils and hauled to the concrete pad, located north of the Chem A building, where it was decontaminated and then disposed of properly. A total of 2,551 tons of soil were removed from Area VIII-a. This phase of the excavation work was completed in mid-August 1998.

4.5.5 Confirmation Sampling and Testing

The excavations were not backfilled until confirmation sampling and testing demonstrated that the soils remaining in the excavations were BAL.

Earth Sciences collected confirmation samples from each of the excavations. The samples were collected from north to south and from west to east in each of the excavations. A total of 42 confirmation samples were collected: eight from Area V-a; six from Area V-a; fourteen samples from Area VIII-a; and fourteen from VIII-b. The samples from Areas V-a and V-b were combined as one composite sample.

The approximate sample locations are shown on Sheet No. CD-9. All samples were sent to Outreach Laboratory for analysis of thorium-228, thorium-232, uranium-234, and uranium-238. The laboratory test reports are included in Appendix A.

All of the samples collected from Areas V-a, V-b, and VIII-b were BAL, confirming that the AAL material removal was complete in these areas. However, laboratory results indicated that four of the samples collected from Area VIII-a were AAL. Therefore, additional excavation and subsequent reanalysis in four subareas of Area VIII-a was performed. These subareas were designated as VIII-a-03, VIII-a-06, VIII-a-07, and VIII-a-12.

4.5.6 Additional Excavation of AAL Materials in Area VIII-a

In late August 1998, Cook excavated an additional 212 tons of AAL soil from the four remaining AAL areas in VIII-a. Earth Sciences collected soil samples VIII-a-03a, VIII-a-06a, VIII-a-07a, and VIII-a-12a in former VIII-a-03, VIII-a-06, VIII-a-07, and VIII-a-12 areas, respectively. The samples were sent to Outreach Laboratory for analysis. Test results indicated that soils were BAL. The laboratory test reports are included in Appendix A.

4.5.7 Total AAL Material Removed from Areas V-a, V-b, VIII-a, and VIII-b

An overall total of 6,775 tons of soil were removed from the four excavation areas. A summary of soil excavation quantities is provided on a table on Sheet CD-9.

4.5.8 Backfill of Excavations

After laboratory results confirmed complete AAL material removal, the excavation pits in Areas V-a, V-b, VIII-a, and VIII-b were backfilled with BAL soil and compacted with a sheeps foot compactor.

4.5.9 Sampling and Testing of AAL Stockpile

Scanning, sampling, and analysis were performed to determine representative radiological activity levels in the AAL stockpile. On-site scanning was performed using a Ludlum Model 19 meter. Meter readings were performed at 10-foot intervals along the surface of the AAL soil stockpile. Meter readings ranged between 30 microRems (μR) and 150 μR. Two composite samples were collected from the AAL soil stockpile. Composite Sample 082598-001 was collected from the western half of the stockpile, and Composite Sample 082598-002 was collected from the eastern half of the stockpile. Laboratory test reports are included in Appendix B.

4.5.10 Scanning of Haul Road

After completion of AAL materials hauling from the excavation areas to the AAL stockpile, the haul road was scanned to determine if the haul road was contaminated. Alpha and beta-gamma readings were taken along the haul road. Readings were performed at 10-foot intervals along the haul road from the fill material stockpile to the AAL soil stockpile. Alpha readings ranged between 1 and 11 cpm and beta-gamma readings ranged between 54 cpm and 133 cpm. These readings are BAL.

4.5.11 Scanning of Equipment

After completion of the excavation of the AAL soils, all equipment was scanned for radiological contamination using both alpha and beta-gamma meters. If the equipment exhibited net surface radioactivity greater than the criteria for alpha and beta-gamma emitters established by the NRC in Regulatory Guide 1.86, the equipment was decontaminated using pressurized water sprayers and rescanned for radiological contamination. All equipment met release criteria before release from the site or use on BAL soils.

4.6 Construction of Groundwater Collection Trench

In late September 1998, Cook began construction of the groundwater collection trench. Trench construction began at the north end and proceeded south. The excavation for the trench and installation of drainage collection and seepage control components were performed in a continuous manner. The collection trench construction was completed in February 1999. The as-built trench alignment is shown on Sheet No. CD-3. The longitudinal cross-section of the trench is shown on Sheet Nos. CD-4 and CD-5. As-built details are shown on Sheet Nos. CD-6 through CD-8.

4.6.1 Radiological Scanning During Construction

During trench construction, Earth Sciences scanned all excavated soils with a gamma meter. All soils were BAL.

4.6.2 Protection of Sewer Line During Construction

The collection trench passes beneath a buried sewer line at the location shown on Sheet No. CD-3. Before excavating near the sewer line, Cook installed a reinforced concrete beam around the sewer line, extending 40 feet beyond either side of the excavation area. This reinforced concrete beam supported the sewer line as trench construction proceeded beneath the sewer line.

4.6.3 Excavation of Trench

The trench was excavated to the alignment and depths shown on the Contract Drawings. Cook cut back the trench sidewalls to provide safe access. Soils excavated during trench construction were stockpiled in completed areas. In addition, soil was stockpiled along the southern bank near the gas line to ensure stability of the bank.

In some areas, the subsurface conditions encountered varied from the conditions shown on the Contract Drawings. An area of fill material was encountered at approximately 250 feet south of Sump 1 where natural material had been expected. In the area near Sump 1, bedrock was encountered deeper than expected. The trench was excavated to the top of bedrock and the sump was embedded in the bedrock, as required on the Contract Drawings.

The dip of the bedrock was generally as anticipated through the areas of Sumps 1, 2, and 3. The depth to bedrock varied at some points along the trench; however, the trench was installed as the design intended with the trench excavated to the top of bedrock, the sumps embedded in the bedrock, the drainpipes sloped toward the sumps, and cleanouts located at high points between each sump.

Conditions varied from the anticipated conditions between Sumps 3 and 4. At the southeast end of the trench where the trench turns a corner (see Sheet CD-3), bedrock was encountered at a higher elevation than anticipated. Therefore, the corner became a high point along the bottom of the trench, and the access manhole proposed for installation at this location was eliminated from the design and replaced by the cleanout between Sumps 3 and 4.

At the south end of the trench, the bottom of the trench was too deep for the excavator to reach; therefore, Cook constructed a wide excavation to create a suitable working platform. Due to space constraints, excavated soils were loaded into dump trucks, hauled to a completed trench area, and stockpiled. When the trench was completed, the soils were hauled back to the south end of the trench and the area was backfilled to grade.

4.6.4 Water Management During Trench Construction

Cook pumped water out of the trench, as needed, during trench construction. Water pumped from excavation was discharged to Pond No. 9. The location of Pond No. 9 is shown on Sheet No. CD-3.

4.6.5 Installation of Sumps

Four collection sumps, designated as Sumps 1, 2, 3, and 4, were installed at selected points along the groundwater collection trench. The location of Sump 4 was moved because the site conditions varied from the anticipated conditions. In the vicinity of the proposed location of Sump 4, bedrock was encountered at a higher elevation than anticipated, making that location a high point along the bottom of the trench; therefore, Sump 4 was relocated to the local low point and the collection pipe was installed to slope towards the sump. Earth Sciences reviewed and approved the relocation of Sump 4.

The sumps consist of 4-foot-diameter reinforced concrete pipe sections placed vertically. Pipe section joints were placed and sealed in conformance with the drawings and Performance Specifications. The depth of each sump extends into the black shale bedrock approximately 3 to 5 feet below the depth of the horizontal collection pipes. The concrete pipe sections extend to the ground surface and are capped with a manhole cover. The lower pipe sections, located within the water table, were coated with an epoxy coating before installation.

The as-built locations of Sumps 1, 2, 3, and 4 are shown on Sheet No. CD-3. As-built details are shown on Sheet No. CD-6.

4.6.6 Installation of Seepage Control Barrier

Cook installed the seepage control barrier on the bottom and downgradient side of the trench. A 60-mil HDPE membrane is the primary component of the low-permeability barrier. As shown on the design drawings, geotextile fabric was placed on either face of the HDPE membrane to provide protection against damage to the membrane. For protection of workers, Cook used a 3-foot wide trench while installing the trench seepage control components.

Due to an error in construction at the onset of the installation, the HDPE was not placed on the bottom of the trench for the initial 80 feet at the north end of the trench, although the vertical barrier through this area had been installed. This deviation from the intended design was evaluated by Earth Sciences and was determined to be acceptable for the desired project performance. As decided by Earth Sciences, no course of action was taken to correct this deviation from the intended design. All further installation of the seepage cut-off barrier was in conformance with the drawings and specifications. Details of the seepage control barrier are shown on Sheet No. CD-6.

4.6.7 Installation of Collection Pipes and Drainage Media

Subsurface collection drains were installed after the barrier components. All materials used and installations were in conformance with the Contract Drawings and Performance Specifications. For protection of workers, Cook used a 3-foot wide trench while installing the trench seepage control components.

Geotextile filter fabric was placed on the upgradient vertical face of the trench excavation. American Association of State and Highway Transportation Officials (AASHTO) No. 2 aggregate was placed as pipe bedding (6-inch minimum thickness), and the pipe was placed on top of the bedding. The subsurface drainage conduit was a perforated 6-inch-diameter HDPE pipe with a nylon sock fitted around the pipe. Then, approximately 2 to 3 feet of AASHTO No. 2 aggregate were placed over the pipe. AASHTO No. 57 aggregate was then placed to a minimum level of 2 feet above the groundwater table, as shown on the Contract Drawings. The geotextile filter fabric lining the vertical face of the excavation was folded over the aggregate. As-built details of the drainage system components are shown on Sheet No. CD-6.

4.6.8 Installation of Cleanout Access Pipes

Cleanout accesses to the collection pipes were installed at four points along the length of the trench. The relocation of Sump 4 also required the relocation of the corresponding cleanout access. Earth Sciences reviewed and approved the relocation of the cleanout access. The cleanout consists of a solid pipe extending from the subsurface collection pipe to the ground surface. The end of the pipe is fitted with a threaded cap. A larger diameter pipe section with a lockable cap was placed over the top of the cleanout pipe. A manhole cover section, placed flush with the ground surface, was placed over the ends of the pipe. Materials and installation of the cleanouts were in conformance with the Contract Drawings and Performance Specifications.

The locations of the pipe cleanouts are shown on Sheet No. CD-3. As-built details of the cleanouts are shown on Sheet No. CD-7.

4.6.9 Backfill of Excavations

After installation of seepage barrier and drainage collection system components, the excavation was backfilled with previously excavated and stockpiled BAL soils. The soils were spread with a bulldozer and compacted with either the bulldozer or a sheeps foot compactor. Compaction tests were performed during the placement of the backfill by Quality Testing of Muskogee, Oklahoma. Compaction tests at the

surface demonstrated that the backfill was compacted to the specified minimum density of 95 percent standard proctor maximum dry density.

4.7 Construction of AAL Stockpile Cap

In mid October 1998, Cook installed the cap for the AAL pile. The AAL stockpile and cap were constructed according to the Contract Drawings and Performance Specifications. Cook first reshaped the AAL pile to the correct slope for the cover system. The cap was composed of a HDPE membrane, 20-mil minimum thickness, as specified.

The HDPE cap was anchored as shown in the Contract Drawings. Cook excavated an anchor trench along the perimeter of the AAL stockpile berm, lapped the cap over the berm, extending the cap across the bottom of the anchor trench. Cook then placed and compacted soil in the anchor trench. After completion, Cook covered the stockpile cover system with sandbags.

The location of the AAL stockpile is shown on Sheet No. CD-3. As-built details of the stockpile are shown on Sheet No. CD-8.

4.7 Abandonment of Groundwater Monitoring Wells

Abandonment of five shallow groundwater monitoring wells, located along the path of the groundwater collection trench, was necessary. The wells were designated as MW-58S, MW-59S, MW-60S, MW-66S, and MW-74S and used for groundwater sampling and testing in compliance with the facility's joint permit. In accordance with the proposed joint permit modification, dated November 24, 1998, Sumps 1, 2, 3, and 4, installed as part of the groundwater collection trench, will be used as the groundwater sampling points to replace the abandoned wells.

4.8 Installation of Piezometers

Two piezometers were installed by Cook at locations adjacent to the groundwater collection trench. The piezometers will be used to monitor groundwater levels downgradient of the groundwater collection trench. The locations of the piezometers are shown on Sheet CD-3.

4.9 Project Closeout Activities

4.9.1 Scanning of Equipment

After completion of the trench construction, Earth Sciences scanned the equipment and workers before they left the site. The workers and equipment exhibited net surface radioactivity less than the criteria for alpha and beta-gamma emitters established by the NRC in Regulatory Guide 1.86.

4.9.2 Placement of Topsoil

A total of 2,242 tons of topsoil were hauled to the site in March 1998. The topsoil was spread over completed trench areas with a bulldozer.

4.9.3 Revegetation of Disturbed Areas

The areas disturbed during construction were revegetated in spring 1999, in accordance with the Performance Specifications.

4.9.4 Replacement of Chain Link Fence

After completion of the trench construction, Cook replaced all chain link fences removed during construction.

5.0 Conformance with Contract Drawings and Specifications

In summary, Earth Sciences has concluded that the AAL soil management and groundwater collection trench installation were performed in conformance with the Contract Drawings and Performance Specifications. All materials were installed at the locations shown, to the dimensions shown on the Contract Drawings, in conformance with the requirements of the Performance Specifications, except as noted herein. Modifications, variations, and/or alterations from the original design were incorporated into the trench construction as described herein and were approved by Earth Sciences as being consistent with the intended performance requirements of the design.

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Drawings

The 9 Drawings specifically referenced in the Table of Contents have been processed into ADAMS.

These drawings can be accessed within the ADAMS package or by performing a search on the Document/Report Number.

D-01 through D-09

Appendix A

Laboratory Test Reports
Confirmation Samples

Outreach Laboratory
311 North Aspen
Broken Arrow, Ok 74012
(918) 251-2515
FAX (918) 251-0008

Project Number:	980755
Organization Name:	Earth Sciences
Date Submitted:	8/18/98
Date Completed:	8/23/98
Reported:	24-Aug-98
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LAB ID	SAMPLE ID	MATRIX	SAMPLE DATE		RESULTS	MDA	UNITS	METHOD	TECH
98075501	Vb-01	soil		**Th232**	0.21 +/- 0.17	0.07	pCi/g	ER200	re
				Th228	0.23 +/- 0.18	0.08	pCi/g	ER200	re
				U-238	0.92 +/- 0.36	0.23	pCi/g	ER290	re
				U-234	1.18 +/- 0.43	0.40	pCi/g	ER290	re
98075502	Vb-02	soil		**Th232**	0.37 +/- 0.17	0.13	pCi/g	ER200	re
				Th228	0.31 +/- 0.16	0.12	pCi/g	ER200	re
				U-238	0.71 +/- 0.34	0.27	pCi/g	ER290	re
				U-234	0.82 +/- 0.38	0.45	pCi/g	ER290	re
75503	Vb-03	soil		**Th232**	0.26 +/- 0.15	0.10	pCi/g	ER200	re
				Th228	0.20 +/- 0.13	0.09	pCi/g	ER200	re
				U-238	0.82 +/- 0.38	0.3	pCi/g	ER290	re
				U-234	0.65 +/- 0.33	0.41	pCi/g	ER290	re
98075504	Vb-04	soil		**Th232**	0.17 +/- 0.07	0.15	pCi/g	ER200	re
				Th228	0.76 +/- 0.14	0.32	pCi/g	ER200	re
				U-238	0.8 +/- 0.37	0.29	pCi/g	ER290	re
				U-234	0.80 +/- 0.37	0.44	pCi/g	ER290	re
98075505	Vb-05	soil		**Th232**	0.24 +/- 0.18	0.08	pCi/g	ER200	re
				Th228	0.23 +/- 0.18	0.08	pCi/g	ER200	re
				U-238	0.83 +/- 0.35	0.25	pCi/g	ER290	re
				U-234	1.77 +/- 0.63	0.55	pCi/g	ER290	re

Outreach Laboratory
311 North Aspen
Broken Arrow, Ok 74012
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LAB ID	SAMPLE ID	MATRIX	SAMPLE DATE		RESULTS	MDA	UNITS	METHOD	TECH
98075506	Vb-06	soil		Th232	0.22 +/- 0.10	0.13	pCi/g	ER200	re
				Th228	0.26 +/- 0.11	0.14	pCi/g	ER200	re
				U-238	1.48 +/- 1.06	0.96	pCi/g	ER290	re
				U-234	0.98 +/- 0.84	1.21	pCi/g	ER290	re
98075507	Va-07	soil		Th232	0.23 +/- 0.20	0.07	pCi/g	ER200	re
				Th228	0.30 +/- 0.22	0.08	pCi/g	ER200	re
				U-238	0.6 +/- 0.25	0.18	pCi/g	ER290	re
				U-234	0.64 +/- 0.27	0.29	pCi/g	ER290	re
98075508	Va-08	soil		Th232	0.14 +/- 0.13	0.06	pCi/g	ER200	re
				Th228	0.21 +/- 0.16	0.08	pCi/g	ER200	re
				U-238	0.87 +/- 0.33	0.21	pCi/g	ER290	re
				U-234	1.16 +/- 0.42	0.37	pCi/g	ER290	re
98075509	Va-09	soil		Th232	0.23 +/- 0.15	0.06	pCi/g	ER200	re
				Th228	0.23 +/- 0.15	0.06	pCi/g	ER200	re
				U-238	0.56 +/- 0.23	0.16	pCi/g	ER290	re
				U-234	1.08 +/- 0.38	0.33	pCi/g	ER290	re
98075510	Va-10	soil		Th232	0.25 +/- 0.13	0.12	pCi/g	ER200	re
				Th228	0.26 +/- 0.13	0.12	pCi/g	ER200	re
				U-238	1.2 +/- 1.4	1.35	pCi/g	ER290	re
				U-234	2.79 +/- 2.22	3.16	pCi/g	ER290	re

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98075511	Va-11	soil		Th232	0.42 +/- 0.17	0.15	pCi/g	ER200	re
				Th228	0.53 +/- 0.19	0.10	pCi/g	ER200	re
				U-238	1.3 +/- 0.52	0.36	pCi/g	ER290	re
				U-234	1.92 +/- 0.71	0.66	pCi/g	ER290	re
98075512	Va-12	soil		Th232	0.28 +/- 0.18	0.09	pCi/g	ER200	re
				Th228	0.31 +/- 0.19	0.28	pCi/g	ER200	re
				U-238	0.64 +/- 0.55	0.52	pCi/g	ER290	re
				U-234	2.25 +/- 1.17	1.48	pCi/g	ER290	re
98075513	Va-13	soil		Th232	0.17 +/- 0.15	0.07	pCi/g	ER200	re
				Th228	0.18 +/- 0.15	0.07	pCi/g	ER200	re
				U-238	1.8 +/- 0.72	0.48	pCi/g	ER290	re
				U-234	2.78 +/- 1.02	0.92	pCi/g	ER290	re
98075514	Va-14	soil		Th232	0.25 +/- 0.18	0.08	pCi/g	ER200	re
				Th228	0.27 +/- 0.19	0.09	pCi/g	ER200	re
				U-238	1.53 +/- 0.79	1.73	pCi/g	ER290	re
				U-234	1.53 +/- 1.79	2.65	pCi/g	ER290	re
98075515	VIIIb-01	soil		Th232	0.17 +/- 0.13	0.08	pCi/g	ER200	re
				Th228	0.15 +/- 0.12	0.08	pCi/g	ER200	re
				U-238	0.59 +/- 0.27	0.2	pCi/g	ER290	re
				U-234	1.12 +/- 0.43	0.42	pCi/g	ER290	re

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98075516	VIIIb-02	soil		Th232	0.20 +/- 0.14	0.08	pCi/g	ER200	re
				Th228	0.18 +/- 0.14	0.08	pCi/g	ER200	re
				U-238	0.98 +/- 0.48	0.38	pCi/g	ER290	re
				U-234	1.02 +/- 0.49	0.60	pCi/g	ER290	re
98075517	VIIIb-03	soil		Th232	0.17 +/- 0.15	0.07	pCi/g	ER200	re
				Th228	0.25 +/- 0.18	0.08	pCi/g	ER200	re
				U-238	0.53 +/- 0.22	0.16	pCi/g	ER290	re
				U-234	1.29 +/- 0.45	0.37	pCi/g	ER290	re
98075518	VIIIb-04	soil		Th232	0.16 +/- 0.16	0.06	pCi/g	ER200	re
				Th228	0.16 +/- 0.16	0.06	pCi/g	ER200	re
				U-238	0.81 +/- 0.31	0.19	pCi/g	ER290	re
				U-234	1.16 +/- 0.41	0.35	pCi/g	ER290	re
98075519	VIIIb-05	soil		Th232	0.19 +/- 0.17	0.06	pCi/g	ER200	re
				Th228	0.21 +/- 0.19	0.07	pCi/g	ER200	re
				U-238	0.52 +/- 0.23	0.18	pCi/g	ER290	re
				U-234	0.89 +/- 0.35	0.35	pCi/g	ER290	re
98075520	VIIIb-06	soil		Th232	0.12 +/- 0.12	0.06	pCi/g	ER200	re
				Th228	0.14 +/- 0.13	0.06	pCi/g	ER200	re
				U-238	0.99 +/- 0.61	0.54	pCi/g	ER290	re
				U-234	1.22 +/- 0.70	0.92	pCi/g	ER290	re

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98075521	VIIIb-07	soil		Th232	0.36 +/- 0.23	0.09	pCi/g	ER200	re
				Th228	0.49 +/- 0.27	0.11	pCi/g	ER200	re
				U-238	1.66 +/- 0.59	0.32	pCi/g	ER290	re
				U-234	1.87 +/- 0.65	0.53	pCi/g	ER290	re
98075522	VIIIb-08	soil		Th232	0.23 +/- 0.16	.08	pCi/g	ER200	re
				Th228	0.30 +/- 0.19	0.10	pCi/g	ER200	re
				U-238	0.27 +/- 0.15	0.13	pCi/g	ER290	re
				U-234	0.60 +/- 0.26	0.29	pCi/g	ER290	re
98075523	VIIIb-09	soil		Th232	0.20 +/- 0.15	.08	pCi/g	ER200	re
				Th228	0.22 +/- 0.16	0.08	pCi/g	ER200	re
				U-238	0.77 +/- 0.31	0.21	pCi/g	ER290	re
				U-234	1.23 +/- 0.45	0.40	pCi/g	ER290	re
98075524	VIIIb-10	soil		Th232	0.36 +/- 0.16	0.14	pCi/g	ER200	re
				Th228	0.34 +/- 0.15	0.13	pCi/g	ER200	re
				U-238	0.41 +/- 0.18	0.13	pCi/g	ER290	re
				U-234	1.21 +/- 0.42	0.35	pCi/g	ER290	re
98075525	VIIIb-11	soil		Th232	0.25 +/- 0.09	0.16	pCi/g	ER200	re
				Th228	0.33 +/- 0.11	0.18	pCi/g	ER200	re
				U-238	0.83 +/- 0.32	0.21	pCi/g	ER290	re
				U-234	1.32 +/- 0.48	0.40	pCi/g	ER290	re

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LAB ID	SAMPLE ID	MATRIX	SAMPLE DATE		RESULTS	MDA	UNITS	METHOD	TECH
98075526	VIIIb-12	soil		Th232	0.26 +/- 0.19	0.08	pCi/g	ER200	re
				Th228	0.33 +/- 0.21	0.09	pCi/g	ER200	re
				U-238	2.43 +/- 0.92	0.57	pCi/g	ER290	re
				U-234	1.53 +/- 0.64	0.69	pCi/g	ER290	re
98075527	VIIIb-13	soil		Th232	0.32 +/- 0.20	0.09	pCi/g	ER200	re
				Th228	0.36 +/- 0.22	0.10	pCi/g	ER200	re
				U-238	0.86 +/- 0.36	0.25	pCi/g	ER290	re
				U-234	1.11 +/- 0.43	0.43	pCi/g	ER290	re
98075528	VIIIb-14	soil		Th232	0.67 +/- 0.14	0.29	pCi/g	ER200	re
				Th228	0.68 +/- 0.14	0.29	pCi/g	ER200	re
				U-238	1.14 +/- 0.46	0.31	pCi/g	ER290	re
				U-234	1.10 +/- 0.45	0.47	pCi/g	ER290	re
98075529	VIIIa-01	soil		Th232	0.33 +/- 0.20	0.10	pCi/g	ER200	re
				Th228	0.29 +/- 0.19	0.09	pCi/g	ER200	re
				U-238	0.68 +/- 0.8	0.77	pCi/g	ER290	re
				U-234	2.50 +/- 1.65	2.26	pCi/g	ER290	re
98075530	VIIIa-02	soil		Th232	0.72 +/- 0.29	0.15	pCi/g	ER200	re
				Th228	0.73 +/- 0.29	0.15	pCi/g	ER200	re
				U-238	2.71 +/- 0.89	0.4	pCi/g	ER290	re
				U-234	3.53 +/- 1.13	0.71	pCi/g	ER290	re

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98075531	VIIIa-03	soil		Th232	1.44 +/- 0.49	0.18	pCi/g	ER200	re
				Th228	1.35 +/- 0.48	0.18	pCi/g	ER200	re
				U-238	8.26 +/- 2.55	0.79	pCi/g	ER290	re
				U-234	9.08 +/- 2.80	1.27	pCi/g	ER290	re
98075532	VIIIa-04	soil		Th232	0.32 +/- 0.23	0.08	pCi/g	ER200	re
				Th228	0.37 +/- 0.25	0.09	pCi/g	ER200	re
				U-238	0.93 +/- 0.41	0.31	pCI/g	ER290	re
				U-234	1.12 +/- 0.47	0.52	pCi/g	ER290	re
98075533	VIIIa-05	soil		Th232	0.29 +/- 0.23	0.07	pCi/g	ER200	re
				Th228	0.35 +/- 0.25	0.08	pCi/g	ER200	re
				U-238	0.97 +/- 0.38	0.25	pCi/g	ER290	re
				U-234	1.05 +/- 0.40	0.40	pCi/g	ER290	re
98075534	VIIIa-06	soil		Th232	0.71 +/- 0.32	0.13	pCi/g	ER200	re
				Th228	0.62 +/- 0.30	0.13	pCi/g	ER200	re
				U-238	1.85 +/- 0.66	0.37	pCi/g	ER290	re
				U-234	2.18 +/- 0.76	0.61	pCi/g	ER290	re
98075535	VIIIa-07	soil		Th232	0.38 +/- 0.21	0.11	pCi/g	ER200	re
				Th228	0.44 +/- 0.23	0.12	pCi/g	ER200	re
				U-238	20.1 +/- 6.1	1.51	pCi/g	ER290	re
				U-234	20.9 +/- 6.33	2.36	pCi/g	ER290	re

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LAB ID	SAMPLE ID	MATRIX	SAMPLE DATE		RESULTS	MDA	UNITS	METHOD	TECH
98075536	VIIIa-08	soil		Th232	0.38 +/- 0.22	0.10	pCi/g	ER200	re
				Th228	0.41 +/- 0.23	0.11	pCi/g	ER200	re
				U-238	33.3 +/- 10	2.18	pCi/g	ER290	re
				U-234	31.5 +/- 9.50	3.25	pCi/g	ER290	re
98075537	VIIIa-09	soil		Th232	0.34 +/- 0.07	0.31	pCi/g	ER200	re
				Th228	0.43 +/- 0.07	0.35	pCi/g	ER200	re
				U-238	0.71 +/- 0.33	0.25	pCi/g	ER290	re
				U-234	0.65 +/- 0.31	0.37	pCi/g	ER290	re
98075538	VIIIa-10	soil		Th232	2.07 +/- 0.46	0.27	pCi/g	ER200	re
				Th228	1.38 +/- 0.38	0.22	pCi/g	ER200	re
				U-238	3.23 +/- 1.08	0.52	pCi/g	ER290	re
				U-234	4.40 +/- 1.43	0.92	pCi/g	ER290	re
98075539	VIIIa-11	soil		Th232	1.18 +/- 0.41	0.17	pCi/g	ER200	re
				Th228	1.1 +/- 0.39	0.17	pCi/g	ER200	re
				U-238	3.8 +/- 1.17	0.33	pCi/g	ER290	re
				U-234	4.35 +/- 1.33	0.54	pCi/g	ER290	re
98075540	VIIIa-12	soil		Th232	3.31 +/- 0.59	0.34	pCi/g	ER200	re
				Th228	2.92 +/- 0.56	0.32	pCi/g	ER200	re
				U-238	4.86 +/- 1.55	0.61	pCi/g	ER290	re
				U-234	6.39 +/- 2.00	1.07	pCi/g	ER290	re

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98075541	VIIIa-13	soil		Th232	0.73 +/- 0.15	0.30	pCi/g	ER200	re
				Th228	0.89 +/- 0.16	0.33	pCi/g	ER200	re
				U-238	2.9 +/- 0.97	0.47	pCi/g	ER290	re
				U-234	3.12 +/- 1.04	0.75	pCi/g	ER290	re
98075542	VIIIa-14	soil		Th232	0.49 +/- 0.24	0.12	pCi/g	ER200	re
				Th228	0.44 +/- 0.23	0.11	pCi/g	ER200	re
				U-238	0.96 +/- 0.38	0.25	pCi/g	ER290	re
				U-234	1.60 +/- 0.57	0.50	pCi/g	ER290	re

ORATORY APPROVALS:

QA/OC OFFICER: _____

LABORATORY DIRECTOR _____

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QC REPORT

analyte U234 units pCi/g
project 980755 sample id 42

	result	error	known	%rec	rpd
blank	0.045	0.045			
lcs	91.8	27.4	111	82.7%	
lcsd					
sample	1.59	0.572			
md	1.09	0.422			35.4%
ms	31.30	9.4	44.01	67.5%	
msd					

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QC REPORT

analyte	U238		units	pCi/g	
project	980755		sample id	42	
	result	error	known	%rec	rpd
blank	0.022	0.032			
lcs	99.1	29.6	111	89.3%	
lcsd					
sample	0.96	0.377			
md	0.65	0.287			34.5%
ms	33.10	9.9	44.01	73.0%	
msd					

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QC REPORT

analyte U238 units pCi/g
project 980755 sample id 1

	result	error	known	%rec	rpd
blank	0.275	0.22			
lcs	99.2	29.4	111	89.4%	
lcsd					
sample	0.92	0.356			
md	0.59	0.291			36.3%
ms	35.26	10.52	44.01	78.0%	
msd					

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QC REPORT

analyte U234 units pCi/g
project 980755 sample id 1

	result	error	known	%rec	rpd
blank	0.354	0.254			
lcs	92.3	27.5	111	83.2%	
lcsd					
sample	1.18	0.434			
md	0.64	0.307			51.9%
ms	32.50	9.71	44.01	71.2%	
msd					

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QC REPORT

analyte	U234		units	pCi/g	
project	980755		sample id	24	

	result	error	known	%rec	rpd
blank	0.157	0.074			
lcs	89.4	26.8	111	80.5%	
lcsd					
sample	1.21	0.421			
md	0.78	0.306			40.1%
ms	37.50	11.1	44.01	82.5%	
msd					

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QC REPORT

analyte U238 units pCi/g
project 980755 sample id 24

	result	error	known	%rec	rpd
blank	0.076	0.046			
lcs	91.6	27.4	111	82.5%	
lcsd					
sample	0.41	0.178			
md	0.53	0.228			24.2%
ms	38.40	11.4	44.01	86.3%	
msd					

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QC REPORT

analyte Thorium 232 units pCi/g
project 980755 sample id 12

	result	error	known	%rec	rpd
blank	0.105	0.529			
lcs	21.7	5.9	25.3	85.8%	
lcsd					
sample	0.28	0.183			
md	0.23	0.172			13.1%
ms	2.62	0.565	2.53	92.5%	
msd					

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QC REPORT

analyte Th228 units pCi/g
project 980755 sample id 12

	result	error	known	%rec	rpd
blank	0.06	0.4			
lcs	22.4	6	25.3	88.5%	
lcsd					
sample	0.31	0.194			
md	0.39	0.221			18.5%
ms	2.61	0.564	2.53	90.8%	
msd					

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QC REPORT

analyte Th228 units pCi/g
project 980755 sample id 25

	result	error	known	%rec	rpd
blank	0.161	0.566			
lcs	23.6	6.7	25.3	93.3%	
lcsd					
sample	0.33	0.107			
md	0.20	0.183			11.9%
ms	2.32	0.569	2.53	78.7%	
msd					

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QC REPORT

analyte Th232 units pCi/g
project 980755 sample id 25

	result	error	known	%rec	rpd
blank	0.161	0.566			
lcs	23.5	6.7	25.3	92.9%	
lcsd					
sample	0.25	0.093			
md	0.23	0.196			22.8%
ms	2.45	0.586	2.53	87.0%	
msd					

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QC REPORT

analyte Th232 units pCi/g
project 980755 sample id 42

	result	error	known	%rec	rpd
blank	0.561	0.256			
lcs	27.7	7.27	25.3	109.5%	
lcsd					
sample	0.49	0.244			
md	0.56	0.242			8.2%
ms	2.61	0.554	2.53	83.6%	
msd					

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For Laboratory Use Only
Laboratory Project No.: 980725

Project Name: Fansteel - Muskogee Project No.: 3789K Sampler: Colleen Carmody (Printed Name) (Signature) for C. Colleen

Relinquished By: (Signature and Printed Name)	Date	Time	Received By: (Signature and Printed Name)	Date	Time
	8/17/98		J. L. Sloan	8/17/98	1530
Relinquished By: (Signature and Printed Name)	Date	Time	Received By: (Signature and Printed Name)	Date	Time
			Angela Melrose	8/18/98	

Antech Quote ID No.:
Antech Contact Name:
Client Purchase Order No.:
Method of Shipment:
Shipment ID:

Circle Bottle Size | Other (Please Specify)

Sample ID Number	Sample Description: Date	Time	Description	Grab	Composite	Chemistry (500 ml, 1000 ml)	Nutrient (250 ml, 500 ml)	Total Metals (250 ml, 500 ml)	Dissolved Metals (250 ml, 500 ml)	Cyanide (1000 ml)	Phenolics (1000 ml)	TOC (125 ml)	TOX (250 ml)	Sulfide (500 ml)	Radiological (1000 ml)	Oil & Grease (1000 ml)	TPHC (1000 ml)	VOA (40 ml)	Organics (1000 ml, 2.5 liter)	Bacteriological (125 ml)	Widemouth Jar, Soil (250 ml, 500 ml, 1000 ml)	VOA Septa Jar, Soil (125 ml)	Thorium-228	Uranium-232	Uranium-234	Uranium-238	No. of Containers	For Lab Use Only Laboratory ID
VIIIa-01																												980725-89
thru																												(1)
VIII-14																												980725-102

Please Check when Monitoring Samples are Collected:
- ☐ Residual Chlorine Present
- ☐ Residual Chlorine Not Present

Please Check when VOA Vials are Collected:
- ☐ Free of Bubbles
- ☐ Bubbles Present

(Specify in Special Instructions/Comments)

Special Instructions/Comments:
Rush per Reid T 8/19/98

Sample Return/Disposal:
- ☒ Return to Client
- ☐ Disposal by Antech

Results To:
Client Name:
Company:
Address:

Invoice To:
Client Name:
Company:
Address:

For Laboratory Use Only:
Sample Condition Upon Receipt: Good
Was Temperature Vial Sent With Cooler? YES NO N/A Cooler Temperature N/A

WHITE - Original COC File YELLOW - Return with Report PINK - Project File GOLD - Client Receipt

MAC.Antech-Admin.Antech-Chain of Custody
Rev.: 02/16/98

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FAX (724) 327-7793

For Laboratory Use Only
Laboratory Project No.: 980755

Project Name: Fanstel - Muskogee Project No.: 3789K-01 Sampler: Colleen Carmody (Printed Name) G.Williams for C.Carmody (Signature)

Relinquished By: (Signature and Printed Name)	Date	Time	Received By: (Signature and Printed Name)	Date	Time
Gerald E Williams	8/17/98		Richard Blum	8/17/98	15:30
Relinquished By: (Signature and Printed Name)	Date	Time	Received By: (Signature and Printed Name)	Date	Time
			Angela Melrose Angela Melrose	8/18/98	

Antech Quote ID No.:
Antech Contact Name: E. Farrai
Client Purchase Order No.:
Method of Shipment:
Shipment ID:

Sample ID Number	Sample Description: Date	Time	Description	Grab	Composite	Circle Bottle Size: Chemistry (500 ml, 1000 ml)	Nutrient (250 ml, 500 ml)	Total Metals (250 ml, 500 ml)	Dissolved Metals (250 ml, 500 ml)	Cyanide (1000 ml)	Phenolics (1000 ml)	TOC (125 ml)	TOX (250 ml)	Sulfide (500 ml)	Radiological (1000 ml)	Oil & Grease (1000 ml)	TPHC (1000 ml)	VOA (40 ml)	Organics (1000 ml, 2.5 liter)	Bacteriological (125 ml)	Widemouth Jar, Soil (250 ml, 500 ml, 1000 ml)	VOA Septa Jar, Soil (125 ml)	Other (Please Specify): Thorium-228	Thorium-230	Uranium-234	Uranium-238	No. of Containers	For Lab Use Only Laboratory ID
1 Vb-01			Soil																				X	X				980755-1
2 Vb-02			↓																				↓	↓				980755-2
3 Vb-03							+																					980755-3
4 Vb-04																												980755-4
5 Vb-05																												980755-5
6 Vb-06																												980755-6
7 Va-07																												980755-7
8 Va-08																												980755-8
9 Va-09			↓																				↓	↓				980755-9

Please Check when Monitoring Samples are Collected:
☐ Residual Chlorine Present
☐ Residual Chlorine Not Present

Please Check when VOA Vials are Collected:
☐ Free of Bubbles
☐ Bubbles Present
(Specify in Special Instructions/Comments)

Special Instructions/Comments: RUSH per Paul T. 8/19/98

Sample Return/Disposal:
☒ Return to Client
☐ Disposal by Antech

Results To:
Client Name:
Company:
Address:

Invoice To:
Client Name:
Company:
Address:

For Laboratory Use Only:
Sample Condition Upon Receipt: Good
Was Temperature Vial Sent With Cooler? YES NO X Cooler Temperature: N/A
WHITE - Original COC File; YELLOW - Return with Report; PINK - Project File; GOLD - Client Receipt

Antech Ltd.
Chain of Custody Record

Ship To:
Antech Ltd.
One Triangle Drive
Export, PA 15632
(724) 733-1161
FAX (724) 327-7793

For Laboratory Use Only
Laboratory Project No.: 980755

Project Name: Fanstee1 - Muskogee Project No.: 3789K-01 Sampler: Colleen Carmody (Printed Name) Colleen for C. Carmody (Signature)

Relinquished By: (Signature and Printed Name)	Date	Time	Received By: (Signature and Printed Name)	Date	Time
Gerald E Wells			[illegible]	5/17/98	15:30
Relinquished By: (Signature and Printed Name)	Date	Time	Received By: (Signature and Printed Name)	Date	Time
			Angela Melrose Angela Melrose	5/18/98	

Antech Quote ID No.:
Antech Contact Name:
Client Purchase Order No.:
Method of Shipment:
Shipment ID:

Sample ID Number	Sample Description: Date	Time	Description	Grab	Composite	Circle Bottle Size: Chemistry (500 ml, 1000 ml)	Nutrient (250 ml, 500 ml)	Total Metals (250 ml, 500 ml)	Dissolved Metals (250 ml, 500 ml)	Cyanide (1000 ml)	Phenolics (1000 ml)	TOC (125 ml)	TOX (250 ml)	Sulfide (500 ml)	Radiological (1000 ml)	Oil & Grease (1000 ml)	TPHC (1000 ml)	VOA (40 ml)	Organics (1000 ml, 2.5 liter)	Bacteriological (125 ml)	Wipe/mouth Jar, Soil (250 ml, 500 ml, 1000 ml)	VOA Scrpd Jar, Soil (125 ml)	Other (Please Specify): Thorium-228	Thorium-232	Uranium-234	Uranium-238	No. of Containers	For Lab Use Only Laboratory ID
10	Va-10																											980755-10
11	Va-11																											980755-11
12	Va-12																											980755-12
13	Va-13																											980755-13
14	Va-14																											980755-14
15	VIII b-01																											980755-15
	thru																											
29	VIII b-14																											980755-29

Please Check when Monitoring Samples are Collected:
- ☐ Residual Chlorine Present
- ☐ Residual Chlorine Not Present

Please Check when VOA Vials are Collected:
- ☐ Free of Bubbles
- ☐ Bubbles Present

(Specify in Special Instructions/Comments)

Special Instructions/Comments: Rush per Taylor 5/14/98

Sample Return/Disposal:
- ☒ Return to Client
- ☐ Disposal by Antech

Results To:
Client Name:
Company:
Address:

Invoice To:
Client Name:
Company:
Address:

For Laboratory Use Only:
Sample Condition Upon Receipt: good

Was Temperature Vial Sent With Cooler? YES NO N/A Cooler Temperature: N/A

WHITE - Original COC File; YELLOW - Return with Report; PINK - Project File; GOLD - Client Receipt

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

CLIENT Earth Sciences		BILL TO:	
CONTACT		CONTACT	
ADDRESS		ADDRESS	
CITY STATE ZIP		CITY STATE ZIP	
PHONE		PHONE	
FAX		FAX	

CHAIN OF CUSTODY RECORD

PROJECT NO.
PROJECT NAME
TURNAROUND TIME RUSH
SAMPLER [signature]
(SIGNATURE)

ANALYSIS REQUEST

LAB SAMPLE #	CLIENT SAMPLE ID	DATE SAMPLED	TIME SAMPLED	MATRIX	# CONTAINERS	Thorium-228 Thorium 232	Uranium 234 Uranium 238									COMMENTS
	V9-07	8/21/98	0820	soil	1	X	X									
																RUSH

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
[signature]	8/21/98	0750	[signature]				
RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:

REMARKS:

Outreach Laboratory
311 North Aspen
Broken Arrow, Ok 74012
(918) 251-2515
FAX (918) 251-0008

Project Number:	980800
Organization Name:	Earth Sciences
Date Submitted:	27-Aug-98
Date Completed:	01-Sep-98
Reported:	01-Sep-98
Page:	1

LAB ID	SAMPLE ID	MATRIX	SAMPLE DATE		RESULTS	MDA	UNITS	METHOD	TECH
98080001	VIIIa-12a	SOIL	8/27/98	**Th232**	0.25 +/- 0.63	0.23	pCi/g	ER200	SE
				Th228	0.29 +/- 0.69	0.25	pCi/g	ER200	SE
				Th230	0.91 +/- 1.22	0.4	pCi/g	ER200	SE
				U-238	0.82 +/- 0.3	0.18	pCI/g	ER290(M)	SE
				U-234	1.06 +/-0.37	0.31	pCi/g	ER290(M)	SE
98080002	VIIIa-07a	SOIL	8/27/98	**Th232**	0.28 +/- 0.66	0.26	pCi/g	ER200	SE
				Th228	0.33 +/- 0.72	0.28	pCi/g	ER200	SE
				Th230	0.82 +/- 1.13	0.44	pCi/g	ER200	SE
				U-238	0.62 +/- 0.24	0.16	pCI/g	ER290(M)	SE
				U-234	0.90 +/-0.33	0.30	pCi/g	ER290(M)	SE
98080003	VIIIa-06a	SOIL	8/27/98	**Th232**	0.26 +/- 0.57	0.28	pCi/g	ER200	SE
				Th228	0.68 +/- 0.92	0.45	pCi/g	ER200	SE
				Th230	1.62 +/- 1.41	0.69	pCi/g	ER200	SE
				U-238	0.71 +/- 0.29	0.21	pCI/g	ER290(M)	SE
				U-234	0.96 +/-0.37	0.37	pCi/g	ER290(M)	SE
98080004	VIIIa-03a	SOIL	8/27/98	**Th232**	0.34 +/- 0.75	0.28	pCi/g	ER200	SE
				Th228	0.34 +/- 0.75	0.28	pCi/g	ER200	SE
				Th230	0.30 +/- 0.69	0.26	pCi/g	ER200	SE
				U-238	3.59 +/- 1.14	0.43	pCI/g	ER290(M)	SE
				U-234	3.10 +/-1.00	0.61	pCi/g	ER290(M)	SE

Outreach Laboratory
311 North Aspen
Broken Arrow, Ok 74012
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FAX (918) 251-0008

Project Number:	980800
Organization Name:	Earth Sciences
Date Submitted:	27-Aug-98
Date Completed:	01-Sep-98
Reported:	01-Sep-98
Page:	2

LAB ID	SAMPLE ID	MATRIX	SAMPLE DATE	RESULTS	MDA	UNITS	METHOD	TECH

LABORATORY APPROVALS:

QA/OC OFFICER: _____

LABORATORY DIRECTOR _____

QC REPORT

PARAMETER	BLANK	LCS	LCSD		DUP	MS	MSD		DATE	METHOD	ANALY
		%REC	%REC	RPD	RPD	%REC	%REC	RPD			
TH-228	0+/-0.4	102			NC	99.6			9/1/98	ER200	SE
2	0+/-0.4	108			NC	105			9/1/98	ER200	SE
U-234	0.3+/-0.2	85.2			6.9	86.9			9/1/98	ER290M	SE
U-238	0.4+/-0.3	88.5			14.3	87.9			9/1/98	ER290M	SE

OUTREACH TECHNOLOGIES, INC.

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

CLIENT	Earth Sciences	BILL TO:	Earth Sciences
CONTACT	Paul Taylor	CONTACT	G.E. Williams
ADDRESS	12894 US 285	ADDRESS	One Triangle Drive
CITY	Conifer STATE CO ZIP 80433	CITY	Export STATE PA ZIP 15632
PHONE	(303) 838-8143	PHONE	1-800-78EARTH
FAX	(303) 838-8143	FAX	1-724-325-3352

CHAIN OF CUSTODY RECORD

PROJECT NO.

PROJECT NAME

TURNAROUND TIME

SAMPLER (SIGNATURE) Colleen A. Carmody

ANALYSIS REQUEST

LAB SAMPLE #	CLIENT SAMPLE ID	DATE SAMPLED	TIME SAMPLED	MATRIX	# CONTAINERS	Thorium 228 Thorium 232	Uranium 234 Uranium 238									COMMENTS
[illegible]	VIII9-129	8/27/98	12:36	soil	1	✓	✓									Rush turn around time
[illegible]	VIII9-079	8/27/98	13:02	soil	1	✓	✓									
[illegible]	VIII9-069	8/27/98	13:25	soil	1	✓	✓									
[illegible]	VIII9-039	8/27/98	14:02	soil	1	✓	✓									

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
Colleen A. Carmody	8/27/98	3:15	[signature]				

REMARKS:

980800

Appendix B

Laboratory Test Results
AAL Stockpile Composite Samples

Outreach Laboratory
311 North Aspen
Broken Arrow, Ok 74012
(918) 251-2515
FAX (918) 251-0008

Project Number:	980794
Organization Name:	Earth Sciences
Date Submitted:	8/26/98
Date Completed:	8/28/98
Reported:	28-Aug-98
Page:	1

LAB ID	SAMPLE ID	MATRIX	SAMPLE DATE		RESULTS	MDA	UNITS	METHOD	TECH
98079401	082598-001	soil	8/25/98	Th232	2.48 +/- 1.66	0.4	pCi/g	ER200	RE
				Th228	2.30 +/- 1.60	0.4	pCi/g	ER200	RE
				U-238	9.73 +/- 2.88	0.4	pCI/g	ER290	RE
				U-234	8.72 +/- 2.59	0.53	pCi/g	ER290	RE
98079402	082598-002	soil	8/25/98	Th232	2.67 +/- 1.72	0.4	pCi/g	ER200	RE
				Th228	2.34 +/- 1.61	0.4	pCi/g	ER200	RE
				U-238	12.8 +/- 3.97	1.31	pCI/g	ER290	RE
				U-234	15.7 +/- 4.84	2.22	pCi/g	ER290	RE

LABORATORY APPROVALS:

QA/OC OFFICER: _____

LABORATORY DIRECTOR _____

Outreach Laboratory
311 North Aspen
Broken Arrow, Ok 74012
(918) 251-2515
FAX (918) 251-0008

QC REPORT

analyte TH232 units pCi/g
project 980794 sample id 1

	result	error	known	%rec	rpd	
blank	0	0.4				
lcs	27.4	6.25	25.3	108.3%		
sample	0.25	0.600				
md	0.52	0.800				nc
ms	26.90	6.4	25.3	105.3%		

Outreach Laboratory

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

QC REPORT

analyte TH228 units pCi/g
project 980794 sample id 1

	result	error	known	%rec	rpd
blank	0	0.4			
lcs	25.6	6.1	25.3	101%	
sample	0.30	0.700			
md	0.50	0.800			nc
ms	25.50	6.2	25.3	100%	

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

CLIENT Earth Sciences
CONTACT Paul Taylor
ADDRESS 12894 US 285
CITY Conifer STATE CO ZIP 80433
PHONE (303) 838-8143
FAX (303) 838-8143

BILL TO: Earth Sciences
CONTACT C.E. Williams
ADDRESS One Triangle Drive
CITY STATE ZIP
PHONE 1-800-78EARTH x 200
FAX 1-724-325-3350

CHAIN OF CUSTODY RECORD

PROJECT NO.
PROJECT NAME
TURNAROUND TIME
SAMPLER Colleen A. Cameron
(SIGNATURE)

ANALYSIS REQUEST

LAB SAMPLE #	CLIENT SAMPLE ID	DATE SAMPLED	TIME SAMPLED	MATRIX	# CONTAINERS	Thorium-228	Thorium-232	Uranium-234	Uranium-238	COMMENTS
	082598-001	8/25/98	1230	soil						
	082598-002	8/25/98	1245	soil						

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
Colleen A. Cameron	8/25/98	2:30					
RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:

REMARKS:

98054