9.0 Project Management and Organization

9.1 Decommissioning Management Organization

The following is an outline of the decommissioning organization. This organizational structure may be revised by the Fansteel Corporate Project Manager (CPM) as deemed appropriate to facilitate execution of the project and to conform to NRC material license conditions. Any revisions of the organizational structure will be documented by the Fansteel CPM.

9.1.1 Fansteel CPM

The CPM has the direct responsibility for operational oversight of remediation activities and for submitting license documentation. The CPM has overall responsibility for planning and management of the decommissioning activities and implementing a safety conscious work environment (SCWE) program. The CPM will ensure that remediation activities meet the established environmental, health and safety (H&S), and quality assurance (QA) requirements, and technical performance, in accordance with written procedures. The CPM has authority to make necessary changes to the contractor's work and to stop any activity. The CPM must possess a B.A./B.S. degree and have a minimum of 10 years of management experience including 5 years of health, safety, and environmental management experience.

9.1.2 Plant Radiation Safety Officer

The Plant Radiation Safety Officer (PRSO) will be responsible for the radiological health and safety of all license activities involving radioactive materials. In addition, the PRSO will review the implementation and documentation of all work activities involving radioactive materials including surveying, dosimetry, compliance issues, instrumentation, audits, data interpretation, training, wastes, shipping and receiving, decommissioning, decontamination, and emergency response. The PRSO will have "stop work" authority for all activities involving radioactive material at the site. The PRSO will possess a minimum B.S./B.A. degree in Physical Sciences, Industrial Hygiene, or Engineering from an accredited college or university, or an equivalent (i.e., 2:1) combination of training and relevant experience in radiological protection.

In addition, the PRSO will perform the following:

- Review and approve individuals as radiation workers at the site.
- Conduct audits and inspections to ensure that activities involving the use of radioactive material are being conducted safely.
- Monitor materials use and storage areas at the site.

- Oversee the inventory, ordering, receipt, and shipment of all radioactive material and radioactive waste at the site.
- Ensure that all personnel at the site are trained in site radiation safety procedures and practices.
- Ensure that sealed sources are leak-tested per NRC requirements.
- Respond to and investigate incidents and accidents involving radioactive material at the site.
- Monitor and evaluate radiation worker exposures at the site.
- Maintain all required records.

9.1.3 Site Project Manager

The Site Project Manager (SPM) has the direct responsibility for planning and managing remediation activities. The SPM is responsible for ensuring that the remediation project activities meet the established environmental, H&S, and QA requirements; technical performance; budgeting; and scheduling criteria. In addition, the SPM has the authority to make appropriate changes to the QA Plan deemed necessary, as the remediation activities progress. The SPM will possess a minimum of a B.S. in Science or Engineering and have 2 years of management experience, or equivalent experience.

9.1.4 Health Physics Supervisor

The Health Physics Supervisor (HPS) is responsible for directing the Data Manager (DM) and HPT in their assigned work activities. In addition, the HPS assists in maintaining proper radiological controls on the project. The HPS has the authority to make appropriate changes to the FSSP deemed necessary, as remediation activities progress. The HPS will oversee all HPTs working at the site. The HPS reports to the PRSO and has the authority to stop work that may be unsafe due to radiological exposure considerations.

9.1.5 Construction Supervisor

The Construction Supervisor (CS) is responsible for overseeing site remediation activities and day-to-day administration of contractor performance to assure that remediation activities are performed safely, in accordance with approved plans, design specifications, and government permits and regulations. The CS has the authority to stop work that may be unsafe or that may violate an approved plan, design specification, government permit, or regulation. The CS reports to the SPM.

9.1.6 Quality Control Officer

The Quality Control Officer (QCO) has the responsibility and authority to assure that quality control (QC) objectives are met. Responsibilities of the QCO include overseeing that appropriate quality management, policy, training, and verification controls are present. Additional QCO responsibilities include conducting QC audits relating to remediation activities and surveillance of contractor activities. The QCO will be allowed to inspect the work at any time and provide all reasonable facilities and equipment necessary to inspect the work. The QCO is not authorized to revoke, alter, or waive any requirements of this plan. The QCO has the authority to suspend work until any quality-related issues can be resolved and to initiate, recommend, or provide solutions and to verify implementation of solutions.

9.1.7 HPTs

The HPTs will ensure all necessary sampling and scanning required in the FSSP are performed in accordance with such plan and written procedures. The HPT is also responsible for sampling of soil stockpiles, off-site borrow material, and transportation containers, and will perform the preliminary review of survey data and analytical results.

Individuals who collect samples and/or operate survey instruments or analytical counting systems will be trained accordingly and such training documented. Training will be commensurate with the education, experience, and proficiency of the individual and the scope, complexity, and nature of the assigned activity.

Individuals who collect samples and/or operate survey instruments or analytical counting systems will be qualified and such qualification documented. Qualification requirements will be commensurate with the scope, complexity, and nature of the assigned activity.

9.1.8 DM

The DM will ensure that all required surveys and sampling are performed in accordance with the FSSP and applicable written procedures. Data will be reviewed by the DM to ensure that the requirements stated in the FSSP are implemented as prescribed and that the results of the data collection activities support the objectives of the survey, or permit a determination that these objectives should be modified. The DM will determine if the data are of the right type, quality, and quantity to demonstrate compliance with the plan objective. The DM reports to the HPS.

9.1.9 Decommissioning Management Organization Chart

Figure 9-1 depicts the Decommissioning Management Organization and reporting hierarchy. The chart depicts necessary job functions for decommissioning of the site. More than one function may be performed by one individual in the organization.

9.2 Decommissioning Task Management

Remediation activities will be authorized and conducted in accordance with written and approved remedial action work plans (RAWP). Each RAWP will specify the entire scope of the approved work including provisions to control worker exposure to anticipated H&S hazards. Where required, the RAWP will tier to written procedures for work performance (e.g., establishing radiological controls using the radiation work permit [RWP] program, assuring correct occupational safety controls using an H&S Plan). All necessary programs and procedures will be written and approved prior to RAWP implementation.

9.2.1 Design and Construction Specifications

An engineering design will be completed and construction specifications will be developed so that the DP can be implemented. Specifications may be performance specifications or may be based upon detailed engineering designs. The design and specifications will be included in bid documents that will be used in contractor procurement. The design and construction specifications will address the following:

- Site Plan
- E&S Plan
- Storm Water Control Plan
- Phasing Plans
- Construction Details
- Material Specifications
- Installation Specifications

9.2.2 H&S Plans

The contractor will complete an H&S Plan for its activities. These plans will assure management of H&S at the site and conform with Fansteel's H&S Plan.

9.2.3 E&S Plan

An E&S Plan will be completed for the project. The goal of the E&S Plan is to minimize off-site transport of sediment. Elements of the E&S Plan will be included in the construction specifications.

9.2.4 Contractor Work Plan

The selected contractor will submit a work plan that will outline and describe the sequence of construction activities including the following:

- Mobilization
- Site access
- Haul roads
- Equipment
- Decontamination of personnel and equipment
- Control of water
- Environmental monitoring
- Excavation
- Dust control
- Soil segregation
- Management of intermodal containers or gondola cars
- Backfill
- Site grading
- Site restoration
- Site security
- Radioactive waste and material management
- Material and equipment monitoring and release
- Effluent monitoring and sampling
- Personnel monitoring
- Sample analysis (on- and off-site laboratory support)
- ALARA review and approval
- Personnel training
- Development of RWPs for new tasks
- Radioactive waste and material packaging in accordance with DOT regulations
- Compliance with the waste acceptance criteria of disposal sites
- Demobilization

The work plan will be reviewed and approved by Fansteel and will be used to manage contractor activities throughout the project.

9.2.5 QA/QC Plan

A QA/QC Plan will be established for the site. The QA/QC Plan will be used in conjunction with the FSSP to ensure that decommissioning goals are achieved. In addition to radiological concerns, the QA/QC Plan will address civil engineering and site restoration issues such as the following:

- Fill material and placement
- Channel and culvert materials and construction
- Seeding

- Construction monitoring
- Site restoration

9.2.6 FSSP

An FSSP will be completed for the decommissioning activities. The purpose of the FSSP will be to demonstrate that remaining uranium, thorium, and radium levels are at or below the release criteria established in this DP.

9.2.7 Other Plans and Permits

Other plans and permits will likely be required by local and state authorities. These requirements will be addressed as the design proceeds.

9.3 Decommissioning Management Functions and Function Qualifications

Duties and reporting responsibilities of each function in the management organization are described above. The minimum qualifications for each function are described in the following subsections.

9.3.1 PRSO

The PRSO will be selected by Fansteel, based on experience, advanced education, and industry reputation. The PRSO will:

- have at least 1 year of "hands on" work experience in applied health physics, industrial hygiene, or similar work relevant to radiological hazards associated with site remediation; and

- have a thorough knowledge of the proper application and use of all health physics equipment used for the radionuclides present at the site, the chemical and analytical procedures used for radiological sampling and monitoring, and methodologies used to calculate personnel exposure to the radionuclides present at the site.

9.3.2 SPM

The SPM will be an experienced environmental professional and meet Fansteel's internal requirements. The SPM will possess a minimum of a B.S. in Science or Engineering and have 2 years of management experience, or equivalent experience.

9.3.3 HPS

The HPS will possess a combination of education, training, and experience commensurate with the responsibilities of this position.

9.3.4 CS

The CS will possess a combination of education, training, and experience commensurate with the responsibilities of this position.

9.3.5 QCO

The QCO will possess a combination of education, training, and experience commensurate with the responsibilities of this position.

9.3.6 HPT

The HPT will possess a combination of education, training, and experience commensurate with the responsibilities of this position.

9.3.7 DM

The DM will possess a combination of education, training, and experience commensurate with the responsibilities of this position.

9.4 Training

Training focused on the objectives of the DP will be required. Annual training and refresher training, as needed, will also be required (in order to comply with 10 CFR 19 and 10 CFR 20). A training program will be established to meet the following goals:

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

The training program will include general radiation safety training/monitoring, site orientation, site- and job-specific training, and training verification and documentation. These aspects of the training program are discussed in the following subsections.

9.4.1 General Radiation Safety Training

At a minimum, all site personnel will be required to have appropriate radiation safety training and to wear radiation-monitoring devices. The radiation safety training that will be provided to each employee will include pre-employment, annual/periodic training, and specialized training to comply with 10 CFR 19.

9.4.2 Site Orientation

Prior to entry into any radiological restricted area of the Fansteel site, personnel and visitors will be given a site and radiological orientation. Objectives of this orientation will be to familiarize personnel and visitors to:

- recognize labeled or posted radioactive materials and understand the meaning of radiological warning signs;
- understand that as long as radiological control procedures and limits are followed, harmful effects to personnel and the environment from radioactivity will be minimized; and
- recognize and understand the meaning of, and proper response to, emergency signals.

9.4.3 Site- and Job-Specific Training

Site- and job-specific training will be required of all contractor personnel involved in day-to-day operations of the remediation project, project and management personnel who visit the site regularly, and other personnel identified by Fansteel's SPM. Prior to being allowed unescorted access to the site and issuance of radiation dosimetry, each person shall demonstrate a basic knowledge of radiation worker training. Periodic worker jobsite or tailgate training will be provided to familiarize workers with job-specific procedures or safety requirements.

9.4.4 Training Verification and Documentation

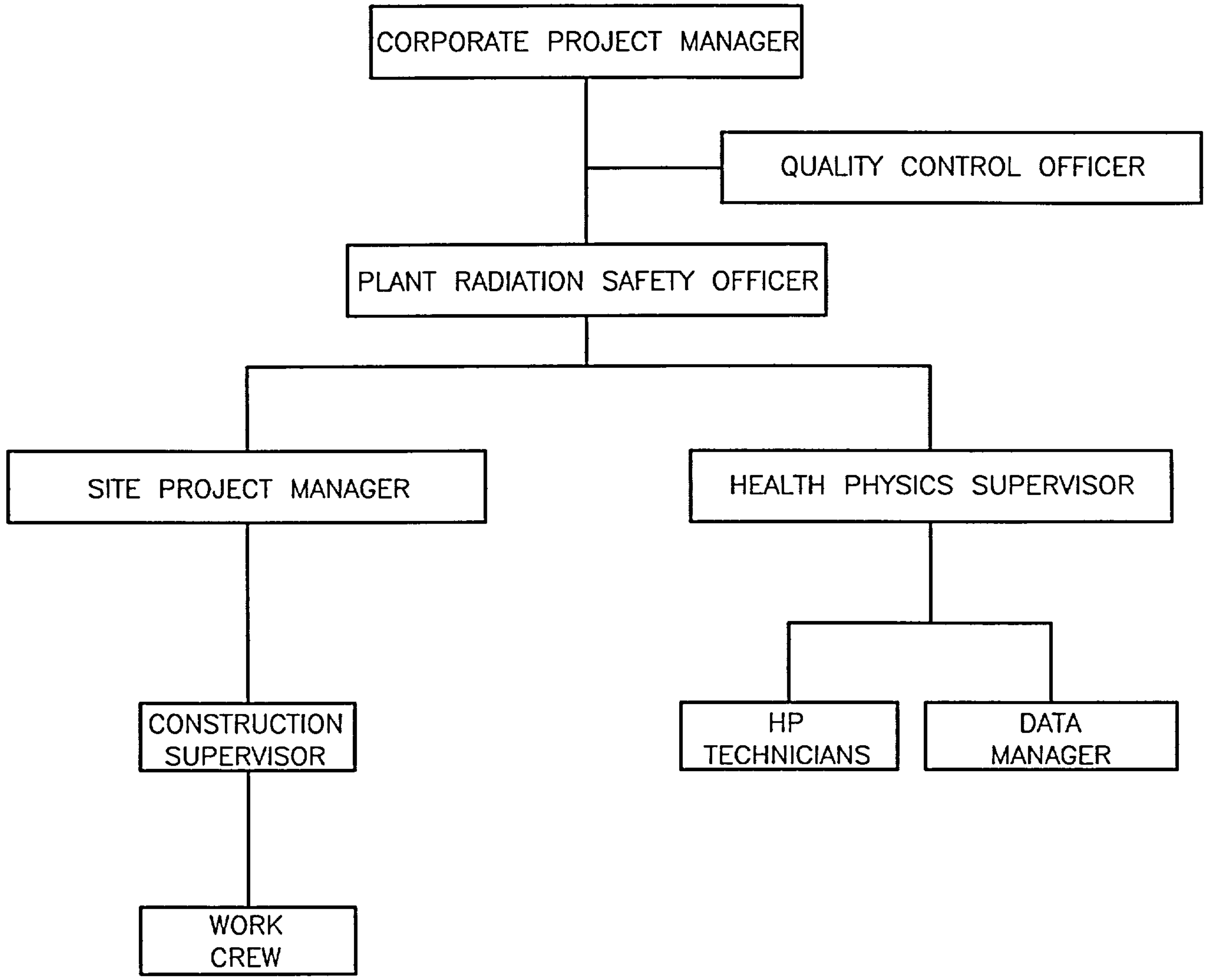
Personnel working on site will present evidence of general radiation safety training as required by 10 CFR 20 and pertinent refresher training (e.g., training certificates and letter of certification) prior to being permitted to perform in a restricted area. All contractor personnel will be required to have OSHA 1910.120 training, and the contractor shall meet all the requirements in OSHA 1910.120. The contractor shall provide evidence of this training. In addition, all site personnel shall sign a statement certifying and acknowledging that they have received site-specific training and that they understand the potential site hazards and the necessary control measures to reduce and/or eliminate those hazards. Training documentation, including the content of site-specific training and any other subsequent training (e.g., periodic safety meetings and specific task safety meetings), will be submitted to Fansteel's SPM and will be maintained over the course and completion of all remediation activities. This information will be available for inspection by Fansteel.

9.5 Contractor Support

Fansteel will utilize qualified contractors and consultants to implement this DP in accordance with the written plans and procedures. At this time, contractor selections have not been made. Fansteel will provide the NRC with the following information when the selection process is concluded:

- A description of the management interfaces that will be in place between the licensee's management and on-site supervisors, and contractor management and on-site supervisors.
- A description of the oversight responsibilities and authority that the licensee will exercise over contractor personnel.
- A description of the training that will be provided to contractor personnel by the licensee, and training that will be provided by the contractor.
- A commitment that the contractor will comply with all radiation safety and license requirements at the facility.

Figure



NOTES
1. ORGANIZATION CHART DEPICTS JOB FUNTIONS NEEDED TO SUPPORT DECOMMISSIONING ACTIVITIES.
2. ONE PERSON MAY HAVE MORE THAN ONE FUCTION.

FIGURE 9–1
DECOMMISSIONING MANAGEMENT ORGANIZATION
DECOMMISSIONING PLAN
FANSTEEL INC.
MUSKOGEE, OKLAHOMA

PREPARED FOR
FANSTEEL INC.
MUSKOGEE, OKLAHOMA

APPROVED 1/13/03
CHECKED 1/14/03
DRAWN DEB 08/28/02
DRAWING NUMBER
6473004

Earth Sciences Consultants, Inc.

10.0 Radiation Health and Safety Program

The Fansteel Radiation Health and Safety Program (RHASP) planned for implementation at the Muskogee site during the decommissioning and FSS phases is designed to conform to the following two fundamental performance objectives:

- Compliance with the regulatory requirements in 10 CFR Parts 19 and 20 as required by NRC materials license conditions, thus assuring adequate protection of workers from ionizing radiation during decommissioning activities.
- Radiological safety measures (controls and monitoring) for workers will be commensurate with the risks associated with licensed activities at the Muskogee decommissioning site as required by 10 CFR 20.1101.

The information presented in this chapter is a description of the radiation safety controls and types of monitoring to be used to ensure that internal and external exposures to workers are ALARA (including use of administrative controls). These controls and types of monitoring will be implemented using written procedures including a process for managing procedure changes. Audits and inspections (including performance-based oversight) will be conducted periodically by Fansteel and/or the decommissioning contractor to assess the effectiveness of RHASP implementation. Deficiencies and proficiencies identified by audit or inspection will be documented and resolved promptly. Lastly, a record generation and archival program will document RHASP implementation.

The following features of the Muskogee site decommissioning RHASP are discussed separately in this chapter:

Section 10.1 – Workplace Air Sampling Program
Section 10.2 – Respiratory Protection Program
Section 10.3 – Internal Exposure Determination
Section 10.4 – External Exposure Determination
Section 10.5 – Summation of Internal and External Exposures
Section 10.6 – Contamination Control Program
Section 10.7 – Instrumentation Program
Section 10.8 – Nuclear Criticality Safety Program
Section 10.9 – Health Physics Audits, Inspections, and Record Keeping Program

The current site RHASP and implementing procedures used to conduct licensed activities is compliant with NRC requirements and will be revised as necessary to include decommissioning activities outside of the current scope of site activity.

10.1 Workplace Air Sampling Program

The air sampling program will encompass routine, anticipated off normal, and unanticipated conditions. It will be designed to comply with the dose assessment requirements of 10 CFR 20.1204, the survey requirements in 10 CFR 20.1501(a)-(b), and the requirements in 10 CFR 20.1703(a)(3)(i)-(ii), when respirators are worn. Unless otherwise specified, the NRC guidance published in Regulatory Guide 8.25 will be used to specify needed performance and surveillance aspects of the air sampling program.

10.1.1 Sampling Requirements

Air sampling representative of workers' breathing zones will be required when a worker's intake is likely to exceed the criteria in 20.1502(b) in any work areas in which a potential exists for airborne radioactive materials, as indicated in Regulatory Position 3 of Regulatory Guide 8.25. The bases for designation of air sampler locations in all work areas in which a potential exists for airborne radioactivity will be as indicated in Regulatory Position 2 of Regulatory Guide 8.25. Sampler selection (low or high volume, general area, or breathing zone air), use (run time), and filter analysis (field screening with periodic laboratory confirmation) will provide sufficient sensitivity to detect air concentrations of nuclides of concern or surrogates over the ranges of concentrations encountered in the work areas, as indicated in Regulatory Position 1 of Regulatory Guide 8.25. Sampler flowmeter calibration will be performed as recommended by the equipment manufacturer or Regulatory Position 5 of Regulatory Guide 8.25, whichever is more frequent. Continuous air monitors (CAM) are not planned for use at the Muskogee site.

Action levels for air sampling results, including actions to be taken when they are exceeded and their technical bases, will be as indicated in Regulatory Position 6.1 of Regulatory Guide 8.25. The minimum detectable activity (MDA) for each nuclide of concern or surrogate that may be collected in air samples will be calculated in accordance with Regulatory Position 6.3 of Regulatory Guide 8.25.

10.2 Respiratory Protection Program

The purpose of the respiratory protection program is to adequately limit intakes of airborne radioactive materials for workers in restricted areas and to keep the TEDE ALARA. The program will meet the requirements of 10 CFR 20.1101(b), 20.1701-20.1704, Appendix A of 10 CFR Part 20, and the applicable guidance in Regulatory Guide 8.15, "Acceptable Programs for Respiratory Protection," and NUREG-0041, Rev. 1, "Manual of Respiratory Protection Against Airborne Radioactive Material."

The respiratory protection program for workers in restricted areas will be as follows:

- Apply process controls, engineering controls, or procedures to control concentrations of radioactive materials in air as required by 10 CFR 20.1702 when practical.
- When it is not practical to apply engineering controls or procedures, an evaluation will be performed to show the use of respiratory equipment is ALARA, as indicated in Regulatory Guide 8.15.
- Consider which respiratory protection equipment is appropriate for a specific task based on the guidance on airborne protection factors in Regulatory Guide 8.15.
- Require medical screening and fit testing before workers will use any respirator that is assigned a protection factor, as indicated in Regulatory Guide 8.15.
- Be implemented using written procedures to address all the elements of the respiratory protection program as required by 10 CFR 20.1703 and as identified in Regulatory Guide 8.15.
- Use, maintain, and store respiratory protection devices in such a manner that they are not modified and are in like-new condition at the time of issue, as indicated in Regulatory Guide 8.15.
- Establish and implement a program to train respirator users, as indicated in Regulatory Guide 8.15.
- Comply with the safety concerns, as indicated in Regulatory Guide 8.15.
- Require review of OSHA regulations when selecting respiratory protection equipment to mitigate existing chemical or other respiratory hazards instead of (or in addition to) radioactive hazards, as required by Footnote (a) of Appendix A of 10 CFR Part 20.

10.3 Internal Exposure Determination Method

The purpose of the internal exposure determination method is to assign a worker's internal exposure in compliance with 10 CFR 20.1101(b), 20.1201(a)(1), 20.1201 (d) and (e), 20.1204, 20.1502(b), and NRC guidance documents. The NRC guidance documents that will be used to specify the determination method include the following:

- Regulatory Guide 8.9, Rev. 1, "Acceptable Concepts, Models Equations, and Assumptions For A Bioassay Program."
- Regulatory Guide 8.25, "Air Sampling in the Workplace."

- Regulatory Guide 8.34, "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses."
- Regulatory Guide 8.36, "Radiation Dose to the Embryo/Fetus."

The internal exposure determination method will specify how estimates of intake of radionuclides by workers will be made including the calculations necessary for the conversion of an intake either to a committed effective dose equivalent or to a total organ dose equivalent (TODE).

The internal exposure determination method will be as follows:

- Monitor workers who meet the criteria in 10 CFR 20.1502(b)(1) and (2) for potential internal exposures during routine operations, special operations, maintenance, and cleanup activities.
- Determine worker intake by measurements of quantities of radionuclides excreted from, or retained in, the human body by the following:
  - Assigning frequencies for bioassay measurements for baseline, periodic, special, and termination assays, as indicated in Regulatory Position 2 in Regulatory Guide 8.9, Rev. 1.
  - Converting radioactivity measured in the human body by bioassay techniques into worker intake, as indicated in Regulatory Position 4 of Regulatory Guide 8.9, Rev. 1.
  - Providing action levels for bioassay samples, actions to be taken when they are exceeded, and their technical bases as indicated in Regulatory Position 2.3 of Regulatory Guide 8.9, Rev. 1.
- In lieu of bioassay measurements, determine worker intakes by measurements of the concentrations of airborne radioactive materials in the workplace by the following:
  - Measuring airborne concentrations of radioactivity.
  - Converting airborne concentrations to intakes, as indicated in Regulatory Position 3.3 of Regulatory Guide 8.34.
  - Providing action levels for a worker's intake based on dose, and actions to be taken when they are exceeded (these will be found in Section 17.3.3.1 of this guidance).
  - Providing action levels for a worker's intake based on chemical toxicity, if soluble uranium is present in the work area, as indicated in 10 CFR 20.1201(e).
- Determine worker intake for an adult, a minor, and a declared pregnant woman (DPW) by any combination of the measurements above as may be necessary, as required by 10 CFR 20.1204(a)(1)-(4).

- Convert worker intakes into committed effective dose equivalent (and organ-specific committed dose equivalent), as indicated in Regulatory Positions 4, 5, and 6 of Regulatory Guide 8.34. The intake of radioactivity by a DPW shall be converted into a dose to the embryo/fetus, as identified in Regulatory Position 2 (or 3) of Regulatory Guide 8.36.
- Maintain worker internal exposures ALARA, as required by 10 CFR 20.1101(b).

10.4 External Exposure Determination Method

The purpose of the external exposure determination method is to assign a worker's external exposure in compliance with 10 CFR 20.1101(b), 20.1201, 20.1203, 20.1501(a)(2)(i), and (c), 20.1502(a), 20.1601, and NRC guidance documents. The NRC guidance documents that will be used to specify the determination method include the following:

- Regulatory Guide 8.4, "Direct-reading and Indirect-reading Pocket Dosimeters."
- Regulatory Guide 8.28, "Audible-Alarm Dosimeters."
- Regulatory Guide 8.34, "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses."

The determination method will measure worker external exposure using direct (dosimeters worn by workers) and/or inferred (calculated from measurements with appropriate instruments during surveys in areas where decommissioning activities are carried out) techniques.

The external exposure determination method for workers will be as follows:

- Provide individual monitoring devices to workers who meet the criteria in 10 CFR 20.1502(a) and 20.1601 for external exposures.
- Provide a description of the type, range, sensitivity, and accuracy of each individual monitoring device.
- Require that individual monitoring devices be worn near the location on the human body that is expected to receive the highest dose, as required by 10 CFR 20.1201(c), and as indicated in Regulatory Positions C2.1 and C2.2 of Regulatory Guide 8.34.
- Require that all personnel dosimeters, which require processing to determine radiation dose, be processed and evaluated by a dosimetry processor that meets the criteria in 10 CFR 20.1501(c).
- Use extremity monitors when the external radiation field is nonuniform, as indicated in Regulatory Position C2.3 of Regulatory Guide 8.34.

- Use only audible-alarm dosimeters and pocket dosimeters that meet the performance specifications identified in Regulatory Guide 8.28 and Regulatory Guide 8.4 respectively.

- Determine external dose from airborne radioactive material, as required by 10 CFR 20.1203.

- Conduct a reasonable number of surveys to supplement personnel monitoring, as required by Section 20.1501(a)(2)(i).

- Provide action levels for workers' external exposure including actions to be taken when they are exceeded.

10.5 Summation of Internal and External Exposures

The purpose of the exposure summation method is to calculate summed (external and internal) doses in compliance with 10 CFR 20.1202, 20.1208(c)(1) and (2), 20.2106, and NRC guidance documents. The NRC guidance documents that will be used to specify the summation method include the following:

- Regulatory Guide 8.7, "Instructions for Recording and Reporting Occupational Radiation Exposure Data."

- Regulatory Guide 8.34, "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses."

- Regulatory Guide 8.36, "Radiation Dose to the Embryo/Fetus."

The exposure summation method will be as follows:

- Use the results of internal and external monitoring to calculate TODE and TEDE to occupational workers, as indicated in Regulatory Positions 7.1-C7.3 of Regulatory Guide 8.34.

- Sum the internal exposure to the embryo/fetus, which is based on the intake of an occupationally exposed DPW, as indicated in Regulatory Positions C1 to C3 of Regulatory Guide 8.36, with external dose to the DPW to obtain the "dose equivalent" to the embryo/fetus.

- Monitor the intake of a DPW if her internal exposure is likely to exceed the intake criteria indicated in Regulatory Position C1.1 of Regulatory Guide 8.36.

- Follow the program for the preparation, retention, and reporting of records for occupational radiation exposures, as indicated in Regulatory Guide 8.7.

10.6 Contamination Control Program

The purpose of the contamination control program is to monitor and control radioactive contamination during decommissioning operations (prior to the FSS phase) in compliance with the requirements of 10 CFR 20.1501(a); 20.1702; 20.1906 (b), (d), and (f); and NRC guidance documents. The NRC guidance documents that will be used to specify the contamination control program include the following:

- Information Notice No. 97-55, "Calculation of Surface Activity for Contaminated Equipment and Materials."
- Regulatory Guide 8.21, "Health Physics Surveys for Byproduct Material at NRC-Licensed Processing and Manufacturing Plants."
- Regulatory Guide 8.25, "Air Sampling in the Workplace."
- NUREG-1660, "Specific Schedules of Requirements for Transport of Specified Types of Radioactive Material Consignments."
- NRC FC 83-23 or Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use
- NRC Information Notice No.7-55.

The focus of the contamination control program is on surveys of skin, protective and personal clothing, fixed and removable surface contamination, transport vehicles, equipment (including ventilation surveys), and packages. The contamination control program will be as follows:

- Control both access to, and stay time in, contaminated areas by workers, if they are needed, as required by 10 CFR 20.1702.
- Perform surveys to supplement personnel monitoring for workers during routine operations, maintenance, cleanup activities, and special operations.
- Perform surveys to determine the baseline of background radiation levels and radioactivity from natural sources for areas where decommissioning activities will take place.
- Follow the procedures for surveys as indicated in Regulatory Position C.1, Types of Surveys, in Regulatory Guide 8.21.
- Specify removable surface contamination action limits (i.e., actions taken either to decontaminate a person, place, or area, or to restrict access, or to modify the type or frequency of radiological monitoring) for restricted and unrestricted areas. The applicable limits for contamination of surfaces and clothing included in Regulatory Position C.1 of Regulatory Guide 8.21, NRC FC 83-23, and NUREG-1660 will be considered.

- Specify that calculations of the surface activity of contaminated materials use a 4π surface-efficiency factor for gamma emitters, and a 2π surface-efficiency factor for beta emitters as required by NRC Information Notice No. 7-55.

- Require surveys of air quality based on Regulatory Guide 8.25.

- Test sealed sources and ensure that sealed sources are leak tested at appropriate intervals in accordance with the guidance in Annex A.2.1 of ANSI/HPS N43.6-1997 (for Part 70 licenses, as indicated in NRC's Branch Technical Positions for Leak Testing, April 1993).

10.7 Instrumentation Program

The purpose of the instrumentation program is to provide operable instruments and equipment to make quantitative radiation measurements during decommissioning operations and FSSs in compliance with 10 CFR 20.1501(b) and (c) and NRC guidance documents. The NRC guidance documents that will be used to specify the instrumentation program include the following:

- NUREG-1506, "Measurement Methods for Radiological Surveys in Support of New Decommissioning Criteria."

- NUREG-1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions."

- NUREG-1549, "Decision Methods for Dose Assessment to Comply With Radiological Criteria for License Termination."

- NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM).

- Table 10.1 of National Council on Radiation Protection and Measurements Report 127, "Operational Radiation Safety Program," 1998.

Instrumentation will be used to conduct radiation and contamination surveys, sample airborne radioactivity, monitor radiation levels in work areas, monitor airborne radionuclides in effluents, monitor personnel dose, and analyze environmental media samples. The instrumentation program will include the following:

- Specify instruments to be used as recommended in Sections 6.1-6.5.3 and Appendix H of NUREG-1575 including the manufacturer's name, the intended use of the instrument, the number of units available for the intended use, the ranges on each scale, the counting mode, and alarm set points.

- Maintain instrumentation storage, calibration, and maintenance facilities for instruments used in field surveys including on-site facilities used for laboratory analyses of samples collected during surveys.

- Specify the method used to estimate the minimum detectable concentration (MDC) or MDA (at the 95 percent confidence level) for each type of radiation to be detected. This method will be consistent with the recommendations in Section 6.7 of NUREG-1575. MDC/MDA shifts caused by covered contamination will be anticipated as necessary using the additional information contained in Chapters 4 and 5 of NUREG-1507.

- Specify instrument operability criteria and QA procedures in compliance with Table 10.1 of NCRP Report 127.

- Specify methods used to estimate uncertainty bounds for each type of instrumental measurement as indicated in Section 6.8 of NUREG-1575.

- Specify air sampling equipment calibration procedures when an accredited laboratory does not perform such calibrations.

10.8 Nuclear Criticality Safety

Protection of public H&S from the risk of nuclear criticality during decommissioning is not required at the Muskogee site since source materials requiring nuclear criticality safety (NCS) controls do not exist.

10.9 Health Physics Audits, Inspections, and Record Keeping Program

The purpose of the health physics audits, inspections, and record keeping assurance program is to evaluate, control, and monitor H&S procedures to ensure timely identification and correction of H&S issues. The frequency and scope of such activities will be sufficient to ensure uninterrupted compliance with NRC's requirements for the protection of the public H&S and the environment. This health physics assurance program will comply with 10 CFR 20.1101, 20.2102, and incorporate the following NRC guidance:

- Information Notice 96-28, "Suggested Guidance Relating to Development and Implementation of Corrective Action," dated May 1, 1996.

- NUREG-1460, "Guide to NRC Reporting and Recordkeeping Requirements," Rev. 1, July 1994.

The health physics assurance program will be endorsed by Fansteel's executive management and the Radiation Safety Officer (RSO) and will include the following:

- Be established to ensure compliance with license conditions, commitments, and regulatory requirements.
- Specify an annual program review conducted by Fansteel's executive management.
- Specify that records be maintained of the annual program review and other executive audits.
- Specify the types and frequencies of radiological surveys and audits to be performed by the RSO and RSO's staff. The frequency of these surveys and audits (including routine unannounced inspections) will be sufficient to ensure close communications and proper surveillance of individual radiation workers, as well as commensurate with the risks posed by the audited activity. The maximum survey or audit frequency will be semiannual.
- Specify the conduct of operations for evaluating and dealing with violations of NRC requirements or license commitments identified during audits.
- Specify that records be maintained of RSO audits including the date of each audit, name of person(s) who conducted the audit, persons contacted by the auditor(s), areas audited, audit findings, corrective actions, and follow up.

11.0 Environmental Monitoring Program

Fansteel will implement an Environmental Monitoring Program (EMP) during site decommissioning activities for the specific purpose of evaluating whether the decommissioning activities comply with the regulatory requirements in 10 CFR Part 20 and are adequate to protect workers, the public, and the environment from radiation during decommissioning activities. The current site EMP used to conduct licensed activities is compliant with regulatory requirements and will be revised as necessary to include decommissioning activities outside of the current EMP scope.

11.1 Environmental ALARA Evaluation Program

Every reasonable effort will be made to limit radiation exposures and releases of radioactive materials in effluents in unrestricted areas as ALARA. The environmental monitoring and control program will include management of surface water and groundwater encountered in excavations as well as monitoring for airborne particulates. Periodic sampling (frequency and method of sampling described in Section 11.2) will be conducted to verify that effluent concentrations in the water and air are below the values listed in 10 CFR 20 Appendix B, Table 2 and Table 3 limits for releases to sewers. In addition, the guidance in NRC Regulatory Guide 4.20 "Constraint on Releases of Airborne Radioactive Materials from Materials Facilities" will be used to demonstrate compliance with the NRC 10 mrem dose constraint for individual members of the public from air emissions.

A description of engineering controls to maintain doses ALARA is provided in Section 11.3. Water and air sampling results will be evaluated by the RSO. In addition, quarterly summary reports will be prepared evaluating the data of EMP activities and be submitted to the RSO. A post-remedial monitoring report will be completed to document all monitoring activities and results during and subsequent to remediation. Evaluation of air sample results, water sample results and reports by the RSO will be conducted to ensure that the EMP is maintaining its commitment of ALARA.

11.2 Effluent Control Program

11.2.1 Effluent Concentrations

Fansteel currently has an NPDES permit in place for four outfall locations (Permit No. OK0001643). Outfall 001 discharge consists of process wastewater from the processing operation, wastewater from site remediation activities, groundwater from the french drain system associated with Pond No. 3, and storm water runoff from the residue processing area. Outfalls 002, 003, and 005 discharge consists of storm water runoff from the southeastern portion of the facility (002), the northern portion of the facility (003), and the southwestern portion of the facility (005). The locations of the four outfalls are shown in Figure 4-1. The results of recent effluent sampling events will be used for baseline effluent concentrations to the Arkansas River.

Outfalls are sampled and analyzed for gross alpha and beta radioactivity concentrations. If the gross results exceed 15 (alpha) or 50 (beta), an isotopic analysis is performed.

Outfall Monitoring Results Summary, June 2000 – June 2002 (pCi/L)

	Outfall 001[1]	Outfall 002[2]	Outfall 003[2]	Outfall 005[2]
Gross Alpha	16.38	3.6	6.86	3.04
Gross Beta	69.17	23.42	47.32	11.25
Th-232	0.17	0.216*	No data	0.396*
Th-230	0.31	0.960*	No data	0.490*
Th-228	0.21	0.063*	No data	0.445*
U-238	4.34	7.77*	No data	1.06*
U-235	0.33	0.786*	No data	0.065*
U-234	4.12	8.17*	No data	1.25*

*Isotopic U/Th ran for one time during review period.
Outfall 002 – Sample Date 12/18/00, gross alpha = 10, gross beta = 418
Outfall 005 – Sample Date 05/11/01, gross alpha = 59, gross beta = 116
[1]All results were averaged through review period.
[2]Only data to average is gross alpha/gross beta.

Background concentrations for air monitoring will be established prior to remediation activities. Recent air radioactivity concentration measurements showed that the average gross alpha/beta radioactivity concentration is 3.45×10^{-5} pCi/L.

11.2.2 Effluent Sample Collection

Storm water and groundwater collected within an excavation or decontamination area will be contained. Within an excavation, the construction of trenches or berms may be used to isolate storm water and infiltrating groundwater, thereby reducing the potential for contamination of these waters. Collected water will be sampled and analyzed for radiological contamination. If activity concentration levels are below the appropriate 10 CFR 20, Appendix B limit (Table 2 or 3), the water will either be released to a permitted outfall or taken off site. Sampling frequency will be established in site procedures.

The frequency of air monitor sampling during remediation will be determined by the RSO. Up to four monitoring stations will be established to evaluate off-site releases. Samples for laboratory analysis will be collected in accordance with site procedures. If required, standard chain of custody protocol will be strictly adhered to during all phases of sample collection, transport, and delivery to the laboratory. MDCs for laboratory analysis will depend on laboratory analysis, instrumentation, and laboratory procedures. MDC concentration will be based on approved release criteria and will be a fraction of the accepted limits. The guidance for calculation of the MDC values for air samples is contained in Section 10.1.1.

11.2.3 EMP Reporting

Quarterly reports will be prepared summarizing the air monitoring results and the groundwater and surface water sampling results. These analytical results will be compared to the baseline sampling results and the required regulatory limits for effluent sampling. In addition, a post-remedial monitoring report will be completed to document all monitoring activities during and after remediation.

11.2.4 EMP QA/QC Program

A QA/QC Program will be implemented as part of the EMP. The quality of data obtained as a result of the implementation of the EMP will be determined primarily on how well procedures were followed and whether or not the instruments used were functioning properly and adequately calibrated prior to use. To ensure that procedures are followed, personnel making measurements in the field or in the laboratory must review and understand procedures prior to the initiation of field and laboratory work.

11.3 Effluent Control Program

Site procedures will be established to ensure releases to permitted outfalls are controlled and maintained to meet the requirements of 10 CFR 20.2003. The procedures will address discharge to sewer systems in accordance with the following requirements: the material is water soluble in accordance with NRC Information Notice 94-07 (engineering controls will be maintained to ensure that only the liquid portion of the effluent and soluble materials are released); and known or expected discharges meet the effluent limits of 10 CFR 20 Appendix B, Table 3. Commonly accepted and well-established procedures, engineering controls, and process controls to achieve ALARA goals for effluent minimization will be implemented.

11.3.1 Construction Management for E&S Control

The following techniques will be utilized to minimize E&S transport away from affected areas:

Interim stabilization measures such as:

- temporary seeding,
- straw mulch application,
- erosion control mat,
- cover barriers (such as plastic sheeting), and
- an erosion control surfactant (Soil Master).

Permanent stabilization measures may include:

- top soil placement and grading,
- seeding and mulching,
- sod matting, and
- gravel or riprap placement.

Erosion control measures must be in place and operational before excavation, backfilling, or grading operations can begin. E&S control measures shall be properly constructed and maintained until the disturbed areas are adequately stabilized. These measures may include:

- diversion channels and berms,
- sediment traps,
- temporary covers (such as plastic sheeting),
- silt fence and/or hay bale barriers,
- riprap linings,
- vegetative strips, and
- surface coatings.

An inspection schedule and reporting protocol shall be prescribed in the contractor's work plan. A record of inspection and all repairs made will be noted and kept on site by the SPM. At a minimum, all E&S control measures will be inspected weekly during soil remediation activities, every 2 weeks during inactive periods, and within 24 hours after each rainfall event exceeding 0.5 inch. During periods when rain is occurring daily, or continuously for days, control measures will be inspected at least daily. Repairs and maintenance will be performed as soon as practical.

11.3.2 EMP Action Level

Airborne radioactivity monitoring will be conducted to confirm the effectiveness of radioactive material control practices during work activities. Laboratory results will be compared to the appropriate 10 CFR Part 20 Appendix B, Table 1, derived air concentration (DAC) limit. If it is determined that air concentrations exceed a small fraction of the DAC (e.g., 10 percent), increased dust control and an evaluation of current engineering controls will occur.

In an instance where engineering controls are not practical (i.e., excessive watering of material prior to loading for transportation which may cause free liquids during shipping or handling), an evaluation will be performed to demonstrate that utilization of respiratory controls (air filters) will maintain ALARA. However, no such instance is expected to occur during decommissioning activities at the facility.

If personal exposure to more than 40 DAC hours in 1 day is suspected, the RSO will evaluate the possibility of an uptake. Evaluation will include, but not be limited to, bioassay measurements to determine exposures due to an uptake of licensed radioactive material.

11.3.3 Leak Detection Systems

Water (groundwater and/or surface water) that infiltrates the excavation areas may be collected and temporarily stored for settling in holding tanks. This system would likely consist of a liner on top of a sand berm around the holding tanks. Any water that collects (due to rain event or leak from holding tank) in the containment system would be characterized and compared to the criteria outlined in Section 11.1 prior to discharge to the surface drainage or the facility WWTP.

11.3.4 Estimated Public Dose

No measurable doses to the public from effluents are anticipated from decommissioning activities. This expectation is based on the dilution factor for water discharges to the Arkansas River. Likewise, doses due to airborne effluents are expected to be so low as to challenge the measuring capability of commercial radioactivity detection equipment. These TEDE estimates will be updated periodically using field data reported per Section 11.2.3.

12.0 Radioactive Waste Management Program

The Fansteel Radioactive Waste Management Program (RWMP) planned for implementation at the Muskogee site during the decommissioning and FSS phases is designed to control radioactive waste generated as part of the decommissioning process in accordance with NRC, USEPA, and DOT requirements. The RWMP will be implemented using appropriate methods and procedures based upon recognized NRC and other professional health physics or industry organizations' guidance documents.

The information presented in this chapter describes practices to ensure that the radioactive waste streams (i.e., types, volumes, and activities) generated by decommissioning operations are properly identified and controlled up through final disposal and/or reclamation at a facility licensed/permitted to receive the material. This information will be used, among other things, to fully configure the radiological H&S program (Chapter 10.0), to evaluate potential accident impacts, and to prepare cost estimates for decommissioning.

The following features of the Muskogee site RWMP are discussed separately in this chapter:

Section 12.1 – Solid Waste Management Program
Section 12.2 – Liquid Waste Management Program
Section 12.3 – Mixed Waste Management Program

The current site RWMP used to conduct licensed activities is compliant and will be revised as necessary to include decommissioning activities outside of the current scope.

12.1 Solid Waste Management Program

The purpose of the solid waste management program is to ensure that controls on solid waste stream generation, storage, handling, and disposal and/or reclamation will be protective of the public H&S and in accordance with NRC requirements. The applicable NRC requirements are 10 CFR Part 20 (Subpart K), 10 CFR 61.55, 61.56, 61.57, and 71.5.

The solid waste management program will include the following:

- Specify the types of solid radioactive waste that are expected to be generated during decommissioning operations including (but not limited to) soil, structural and component metal, concrete, activated components, contaminated piping, wood, and plastic.

- Specify the estimated volume, in cubic feet, of each solid radioactive waste type expected to be generated during decommissioning operations.
- Specify the radionuclides (including the estimated activity of each radionuclide) in each estimated solid radioactive waste type expected to be generated during decommissioning operations.
- Summarize the volumes of Classes A, B, C, and Greater-than-Class-C solid radioactive waste that will be generated by decommissioning operations.
- Specify on-site storage (prior to disposal and/or reclamation) requirements for each solid radioactive waste type expected to be generated during decommissioning operations.
- Describe treatment and packaging activities for stored wastes to conform to the waste acceptance criteria (WAC) for the intended disposal and/or reclamation facility.
- Describe T&D requirements to conform to DOT requirements.
- Describe controls for volumetrically contaminated material (if required).
- Specify measures to prevent contaminated soil, or other loose solid radioactive waste, from being redisbursed after excavation and collection.
- Specify the name and location of the intended disposal and/or reclamation facility for each solid radioactive waste type expected to be generated during decommissioning operations.

12.2 Liquid Waste Management Program

The purpose of the liquid waste management program is to ensure that controls on liquid waste stream generation, storage, and disposal and/or reclamation will be protective of the public H&S and in accordance with NRC requirements. The applicable NRC requirements are 10 CFR Part 20 (Subpart K), 10 CFR 61.55, 61.56, 61.57, and 71.5.

The liquid waste management program will include the following:

- Specify the types of liquid radioactive waste that are expected to be generated during decommissioning operations.
- Specify the estimated volume, in liters, of each liquid radioactive waste type expected to be generated during decommissioning operations.
- Specify the radionuclides (including the estimated activity of each radionuclide) in each liquid radioactive waste type expected to be generated during decommissioning operations.
- Summarize the estimated volumes of Class A, B, C, and Greater-than-Class-C liquid radioactive waste that will be generated by decommissioning operations.

- Specify on-site storage (prior to disposal and/or reclamation) requirements for each liquid radioactive waste type expected to be generated during decommissioning operations.
- Describe treatment and packaging activities for liquid wastes to conform to the WAC for the intended disposal and/or reclamation facility.
- Describe the T&D requirements to conform to DOT requirements.
- Specify the name and location of the intended disposal and/or reclamation facility for each solid radioactive waste type expected to be generated during decommissioning operations.

12.3 Mixed Waste Management Program

The purpose of the mixed waste management program is to ensure that controls on mixed waste stream generation, storage, and disposal and/or reclamation will be protective of the public H&S and in accordance with NRC and USEPA requirements. The applicable NRC requirements are 10 CFR Part 20 (Subpart K), 10 CFR 61.55, 61.56, 61.57, and 71.5. The applicable USEPA requirements are 40 CFR 260-270.

The mixed waste management program will include the following:

- Specify the types of solid and liquid mixed waste that are expected to be generated during decommissioning operations.
- Specify the estimated volumes, in cubic feet, of each solid mixed waste type expected to be generated during decommissioning operations.
- Specify the radionuclides (including the estimated activity of each radionuclide) in each type of mixed waste type expected to be generated during decommissioning operations.
- Summarize the estimated volumes of Class A, B, C, and Greater-than-Class-C mixed waste that will be generated by decommissioning operations.
- Specify on-site storage (prior to disposal and/or reclamation) requirements for each mixed radioactive waste type expected to be generated during decommissioning operations.
- Describe treatment and packaging activities for mixed wastes to conform to the WAC for the intended disposal and/or reclamation facility.
- Describe the T&D requirements to conform to DOT requirements.
- Specify the name and location of the intended disposal and/or reclamation facility for each mixed radioactive waste type expected to be generated during decommissioning operations.
- Describe the requirements of all other regulatory agencies having jurisdiction over the mixed waste expected to be generated during decommissioning operations.

- Provide evidence that Fansteel possesses the appropriate USEPA or state permits to generate, store, and/or treat the mixed wastes expected to be generated during decommissioning operations.

- If appropriate and as applicable, incorporate USEPA conditional exemptions (40 CFR 266 Subpart N and 40 CFR 261.3[h]) for certain low-level mixed waste storage, treatment, transportation, and disposal and/or reclamation activities.

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13.0 QA Program

13.1 Organization

Responsibility for the development, implementation, and revision of the QA program for the Fansteel DP is shared by corporate and on-site personnel as delineated below. This organizational structure may be revised by the Fansteel CPM as deemed appropriate to facilitate execution of the project. Any revisions will be documented by the CPM. The current site QA program used to conduct licensed activities is compliant with regulatory requirements and will be revised as necessary to include decommissioning activities outside of the current scope.

13.1.1 Fansteel CPM

The CPM has the direct responsibility for operational oversight of remediation activities and for submitting license documentation. The CPM has overall responsibility for planning and management of the decommissioning activities. The CPM will ensure that remediation activities meet the established environmental, H&S, QA requirements, and technical performance, in accordance with written procedures. The CPM has authority to make necessary changes to the contractor's work and to stop any activity.

13.1.2 PRSO

The PRSO will be responsible for the radiological H&S of all license activities involving radioactive materials. In addition, the PRSO will review the implementation and documentation of all work activities involving radioactive materials including surveying, dosimetry, compliance issues, instrumentation, audits, data interpretation, training, wastes, shipping and receiving, decommissioning, decontamination, and emergency response.

13.1.3 SPM

The SPM has the direct responsibility for planning and managing remediation activities. The SPM is responsible for ensuring that the remediation project activities meet the established environmental, H&S, and QA requirements; technical performance; budgeting; and scheduling criteria. In addition, the SPM has the authority to make appropriate changes to the QA Plan deemed necessary, as the remediation activities progress.

13.1.4 HPS

The HPS is responsible for directing the DM and HPTs in their assigned work activities. In addition, the HPS assists in maintaining proper radiological controls on the project. The HPS has the authority to make appropriate changes to the FSSP deemed necessary, as remediation activities progress. The HPS will oversee all HPTs working at the site. The HPS reports to the PRSO and has the authority to stop work that may be unsafe due to radiological exposure considerations.

13.1.5 CS

The CS is responsible for overseeing site remediation activities and day-to-day administration of contractor performance to assure that remediation activities are performed safely, in accordance with approved plans, design specifications, and government permits and regulations. The CS has the authority to stop work that may be unsafe or that may violate an approved plan, design specification, government permit, or regulation. The CS reports to the SPM.

13.1.6 QCO

The QCO has the responsibility and authority to assure that QC objectives are met. Responsibilities of the QCO include overseeing that appropriate quality management, policy, training, and verification controls are present. Additional QCO responsibilities include conducting QC audits relating to remediation activities and surveillance of contractor activities. The QCO will be allowed to inspect the work at any time and provide all reasonable facilities and equipment necessary to inspect the work. The QCO is not authorized to revoke, alter, or waive any requirements of this plan. The QCO has the authority to suspend work until any quality-related issues can be resolved and to initiate, recommend, or provide solutions and to verify implementation of solutions.

13.1.7 HPTs

The HPTs will ensure all necessary sampling and scanning required in the FSSP are performed in accordance with such plan and written procedures. The HPT is also responsible for sampling of soil stockpiles, off-site borrow material, and transportation containers, and will perform the preliminary review of survey data and analytical results.

Individuals who collect samples and/or operate survey instruments or analytical counting systems will be trained accordingly and such training documented. Training will be commensurate with the education, experience, and proficiency of the individual and the scope, complexity, and nature of the assigned activity.

Individuals who collect samples and/or operate survey instruments or analytical counting systems will be qualified and such qualification documented. Qualification requirements will be commensurate with the scope, complexity, and nature of the assigned activity.

13.1.8 DM

The DM will ensure that all required surveys and sampling are performed in accordance with the FSSP and applicable written procedures. Data will be reviewed by the DM to ensure that the requirements stated in the FSSP are implemented as prescribed and that the results of the data collection activities support the objectives of the survey, or permit a determination that these objectives should be modified. The DM will determine if the data are of the right type, quality, and quantity to demonstrate compliance with the plan objective. The DM reports to the HPS.

Data quality evaluation will be performed by the DM using the Data Quality Objectives (DQO) and Data Quality Assessment (DQA) process and recommendations in MARSSIM. During the course of remediation activities, a DQA will be conducted to verify and validate the survey data and assessment of the quality of the data. Data verification is used to ensure that the requirements stated in the planning documents are implemented as prescribed. Data validation is used to ensure that the results of the data collection activities support the objectives of the survey as documented in Chapter 14.0.

13.2 QA Program

It is Fansteel's intention to implement appropriate QA program controls for work related to remediation and final radiological survey activities that may affect the H&S of the public and personnel at the site, or the quality of the final survey data. A written QA/QC Program will be developed to guide the performance of the FSS to assure that the results are accurate and that uncertainties have been considered adequately. This program will operate in all stages of the survey through final validation of the data and interpretation of results. The program will be consistent with guidance contained in the following document: NRC Regulatory Guide 4.15, Quality Assurance for Radiological Monitoring Program--Effluent Streams and the Environment (NRC, 1979).

The QA/QC Plan will address the following areas:

- Selection of instruments. Fansteel will select instruments for various surveying and screening activities that have sensitivities sufficient to produce data that satisfy the applicable study objectives.

- Sensitivity of measurements. The QA/QC Plan will establish required detection limits for various measurements. The QA/QC process will ensure that any measurement technique, laboratory analysis, or instrumentation is capable of generating data at the required limit of detection.

- Recording and management of data. The QA/QC Plan will specify the forms and methods for recording calibrations, performance checks, corrective actions, reports to management, exceptional circumstances, and all other information gathered during the decommissioning activity relating to data quality. The QA/QC officer for the project will be responsible for producing a complete documentary record of the quality aspects of the decommissioning operation.

- Data validation requirements. The QA/QC Plan will specify the frequency and quantity of data validation to be performed. Data validation will be performed by a third party not otherwise involved in the generation or interpretation of the data.

- QA/QC organizational structure. The QA/QC function will operate independently of the data gathering and interpretation operations. Specific persons with QA/QC responsibility and their reporting relationships to the entire decommissioning staff organization will be specified in the QA/QC Plan.

- Audits and inspections. The QA/QC Plan will have a specified schedule of required audits and inspections. In addition, the QA/QC Plan will specifically empower the QA/QC Officer to conduct other audits and inspections at his sole discretion. Persons performing self-assessment activities are not to have direct responsibilities in the area they are assessing.

- Reporting requirements. The QA/QC Officer will be required to submit periodic reports to project management and others involved in the conduct of the decommissioning operation. These reporting requirements will be specified in the QA/QC Plan.

- Corrective actions. The QA/QC process is expected to identify data, procedures, and practices that are unsatisfactory for purposes of meeting the decommissioning objections. The QA/QC Plan will specify procedures for correcting or discarding data, recommending procedural changes, and modifying work practices that impact on overall data quality. Follow up and evaluation of modifications will be required in the QA/QC Plan which also will specify how these evaluations will be conducted and documented.

- Certification. The QA/QC Plan will provide for the QA/QC Officer to certify all final reports and determinations relating to satisfaction of specific decommissioning criteria as based on data that have been collected, managed, reviewed, and validated in accordance with the QA/QC Plan.

- Training. The QA/QC Plan will provide for instruction of personnel responsible for performing activities affecting quality pertaining to the purpose, scope, and implementation of the quality-related manuals, instructions, and procedures. Provision will also be made for training and qualification of personnel verifying activities affecting quality in the principles, techniques, and requirements of the activity being performed. Formal training and qualification program documentation will include the objectives and content of the program, attendees, and date of attendance.

- Individuals who collect samples and/or operate survey instruments or analytical counting systems will be trained accordingly and such training documented. Training will be commensurate with the education, experience, and proficiency of the individual and the scope, complexity, and nature of the assigned activity.

- Qualification. Individuals who collect samples and/or operate survey instruments or analytical counting systems will be qualified and such qualification documented. Qualification requirements will be commensurate with the scope, complexity, and nature of the assigned activity.

- Documentation. Steps of the process including, but not limited to, training, calibration of the instrumentation, daily checks, surveys, sampling, and results analysis and interpretation will be documented such that the records will stand up to audits. Records will be kept as part of the Fansteel project file.

A QA/QC program for sample collection and analysis will be implemented and address the following areas:

- Procedure. Soil samples will be collected in accordance with written procedures. Sampling tools will be cleaned and monitored, as appropriate, after each use. Samples will be collected in clean/unused sealable containers.

- Documentation. Sample containers will be permanently labeled/marked in the field at the time of collection by the technician collecting the sample. At a minimum, the following information will be recorded on the sample container: sample date/time, sample identification number, sample location, and name of person collecting the sample. Samples which may contain radionuclide levels in excess of 100 times the baseline concentration or which, because of their form, may be a potential laboratory contamination concern will be identified on the outside of the container with a "radioactive material" caution label. Written documentation on sample collection, analysis, and audits will be kept as part of the Fansteel project file.

- Chain of Custody. An approved procedure will be used for strict chain of custody to ensure that the integrity of the sample is maintained throughout sampling, transportation, analysis, and archiving.

- Analysis Requirements. For each type of laboratory analysis requested, a specification for the following (at a minimum) will be made: required analysis and/or analytical methodology, the required MDC value for each radionuclide, any result presentation requirements, sample disposition, and turnaround time require to support the project.

- Analytical Laboratory. For all analytical laboratories (vendors) used, at a minimum, the following QA/QC principles will be applied: proper maintenance, storage, and archiving of samples after transfer to laboratory will be practiced; and an approved internal QA program will be in place.

These elements, and any other requirements for a QA/QC program that may be in effect at the time of the plan's generation, will be included in the final document. The QA/QC program will be finalized by Fansteel's management and provided to the NRC prior to implementation. No decommissioning activities subject to certification requirements will be performed prior to implementation of the QA/QC program.

The NRC will be notified of changes in procedures and personnel that would impact the commitments of the DP before implementation of the changes. Changes in organizational elements will require NRC notification within 30 days of implementation. Editorial changes or personnel reassignments of a nonsubstantive nature will not require NRC notification.

The goal of the QA program is to identify and implement sampling and analytical methodologies that limit the introduction of error into analytical data. This section establishes the system necessary to ensure that radiation surveys produce results that are of the type and quality needed and expected for their intended use. The QA program covers all aspects of data collection, including field surveys, soil sampling, and laboratory analyses, through the preparation of the documentation of the results. Plans and procedures associated with radiation exposure will be developed and implemented in accordance with the ALARA principle.

13.3 Document Control

Preparation, review, approval, distribution, and revisions of the QA/QC Plan and procedures and technical reports will be controlled in a manner which will allow for documents to be revised, as needed, following review and approval. Superceded copies of revised documents will be voided by written notification. Distribution of approved documents will be controlled to ensure that those persons responsible for implementing written project plans and procedures have a current approved copy before work commences. Approved documents will be available at the location where the activity will be performed prior to work commencing.

Aspects of the DP including, but not limited to, training, calibration of the instrumentation, daily checks, surveys, sampling, and results analysis and interpretation will be documented and maintained in a timely manner. QA/QC records will be maintained by Fansteel's QCO. Other DP documentation will be maintained by the DM.

13.4 Control of Measuring and Testing Equipment

A summary of the test and measuring equipment used during decommissioning is provided in Chapter 14.0. For all counting systems and instruments used as part of analytical analyses, at a minimum, the following QA/QC principles will be applied.

13.4.1 Procedures

Counting systems and instruments will be used in accordance with approved procedures.

13.4.2 Source and Instrument Checks

Each day that a counting system and instrument are used, the response will be checked using an appropriate source before initial use. Additional response checks may be necessary depending on the counting system used. In addition:

- For laboratory counting systems, source check acceptance criteria (e.g., +2 σ of the average response determined after the most recent calibration or otherwise linking the response to the current calibration) will be established prior to using the counting system. Control charts will be used to evaluate the data.
- For field instrumentation, source check acceptance criteria (e.g., +2 σ for direct [integrated] measurements and +20 percent for rate measurements) will be established.
- For field instruments of increased complexity (e.g., single-channel analyzers), additional checks such as energy calibration and efficiency checks will be performed and documented.
- All source check results will be documented. Source check records will be traceable to specific measuring and test equipment.
- Failed source checks will be repeated. Consecutive failure will result in additional testing of the counting system in accordance with the applicable procedure and ultimately removing the counting system from service.
- Survey data acquired prior to an instrument failing a source check will be reviewed by the DM to determine the validity of the data. This review will be documented.
- The HPS will notify the DM of any instrument failure and corrective actions that were taken.
- Instrument failures in the field will be followed by an investigation by the DM of suspect data. Investigations will be documented.
- The DM will notify the CPM and QCO of any corrective actions that were taken.

- Deficiencies will be corrected in a timely manner.
- Documentation of daily source checks will be maintained by the QCO and/or the DM.

13.4.3 Background Determination

Each day that an analysis is performed, the ambient background will be determined and documented at least once daily, depending on the counting system and instrument used and the variability in the background.

13.4.4 Calibration

Counting systems and instruments will be calibrated with a NIST-traceable source at intervals not exceeding 12 months. The source used will be appropriate for the type and the energy of the radiation to be detected. Calibrations will be documented and include the source data. Calibration records will be maintained by the QCO. Measuring and test equipment will be labeled or tagged to indicate due date of next calibration. Calibration records will be traceable to specific measuring and test equipment.

13.5 Corrective Action

A deficiency or nonconformance that potentially invalidates the quality of measurement subject to this plan or that is an exception to this plan will be reported to the DM, QCO, HPS, or SPM. Any appropriate person may report a deficiency or nonconformance. Identified exceptions to this plan and the reason for them will be documented and retained with project quality records.

Nonconformances shall be investigated and resolved. The investigation report will identify any substantial undesirable impact caused by the nonconformance, the resolution, and recommended measure(s) to reduce the likelihood or preclude the same or similar nonconformance in the future. An informational copy of the investigation report will be provided to the SPM, the HPS, and affected contractors.

The resolution of the nonconformance shall include, when applicable, an evaluation of the validity and acceptability of measurements performed since the last acceptable calibration or source check and the need for repeating original activity measurements or tests using calibrated equipment. The calibration system shall provide for recall of equipment for recalibration and confirm that the required recalibration is performed. Out-of-calibration devices shall be tagged or removed from service. The HPS will notify the DM of nonconformances relating to radioactivity measurements and any corrective actions taken. The DM will notify the SPM and the QCO of corrective actions taken relating to survey/testing instrument failures. The QCO will verify proper implementation of corrective action, closing out the corrective action in a timely manner.

Fansteel's Project Manager (PM) will notify the NRC by telephone in the event that a deficiency cannot be corrected in a timely manner. Telephone notification will be followed by written notification. The decision to stop work will be evaluated on a case-specific basis by the PM.

The QCO is responsible for investigating deficiencies and nonconformances. The SPM will determine the appropriate directive needed to correct the violation. The directive will be reviewed and implemented by the QA Officer. Documentation will be maintained by the QCO.

13.6 QA Records

Records will be maintained to confirm that actions essential to meeting quality objectives were performed. Calibration records, corrective action reports, audit records, training certifications, and log books and/or forms used to document field activities (plans, technical procedures, survey results, analytical data, and survey data) will be retained and managed as quality records. Data subject to this plan will be recorded in an orderly and verifiable way. Written instructions will designate documents that must be retained as quality records and maintained on site.

13.7 Audits and Surveillance

13.7.1 Maintenance of the QA Plan

Quality assessments will be preformed to provide assurance that quality-related activities meet applicable requirements. This QA Plan will be the basis for quality assessments and for necessary response actions. Quality assessments will evaluate whether technical and regulatory requirements are met as well as procedural conformance. Changes in QA policy and procedures will be documented in a timely fashion. Active contractors and affected personnel performing remediation work will be given timely notification of changes to the QA Plan to keep them appraised of the current requirements.

13.7.2 Quality Assessments

The QCO will determine:

- assessment method(s),
- assessment schedule, and
- planning and implementation process.

Assessment methods may include:

- readiness review,
- data quality evaluation,
- surveillance or performance evaluation,
- management review,
- technical review, and
- periodic audit.

The SPM will decide:

- responsibilities, authorities, participants, and roles of persons performing quality assessments;
- how the organization will respond to the need for changes;
- how, when, and by whom actions will be taken in response to assessment findings and findings and/or directives; and
- whether the response has been effective.

Audits and surveillances will be conducted by trained personnel not having direct responsibilities for the achievement of quality in the areas being audited. Persons conducting quality assessments will have the authority and access to managers, documents, and records to:

- identify quality-related problems,
- make findings and/or directives to resolve quality-related problems,
- confirm implementation and effectiveness of corrective responses, and
- report deficiencies or nonconformances to the SPM in accordance with the outlined Section 13.5, Corrective Action.

14.0 Facility Radiation Surveys

14.1 Release Criteria

The site will be remediated in accordance with decommissioning criteria of Subpart E, Radiological Criteria for License Termination of 10 CFR Part 20, Standards of Protection Against Radiation. Specifically, Subpart E, 10 CFR 20.1402, Radiological Criteria for Unrestricted Use, allows release of a site for unrestricted use if the residual radioactivity distinguishable from background results in a TEDE to an average member of the critical group not exceeding 25 mrem/yr, and the residual radioactivity has been reduced to levels that are ALARA.

14.1.1 Building Release Criteria

As described in Chapter 5.0, a dose assessment for the Fansteel site was conducted to determine dose-based decommissioning acceptance criteria for building and component surfaces. Radionuclide-specific $DCGL_W$ values corresponding to the radiological criteria of 10 CFR 20 Subpart E have been derived using the computer code RESRAD-Build. The $DCGL_W$ values were derived for 25 mrem/yr TEDE for the industrial worker scenario and are presented below.

Table 14-1 Industrial Worker Building Occupancy $DCGL_W$s (dpm/100 cm^2)

Scenario	U-238	U-234	U-235	Pa-231	Ac-227	Th-232	Th-230	Th-228	Ra-226	Ra-228	Bi-210
Industrial Worker Building Occupancy	58,140	54,349	48,076	4,032	1,087	4,545	22,727	15,625	20,833	31,646	15,625

14.1.2 Soil Release Criteria

As described in Chapter 5.0, a dose assessment for the Fansteel site was conducted to determine dose-based decommissioning acceptance criteria for soil. Radionuclide-specific $DCGL_W$ values corresponding to the radiological criteria of 10 CFR 20 Subpart E have been derived using the computer code RESRAD. The $DCGL_W$ values were derived for 25 mrem/yr TEDE for the industrial worker scenario and are presented below.

Table 14-2 Industrial Worker Scenario Soil $DCGL_W$s (pCi/g)

Scenario	U-238	U-234	U-235	Pa-231	Ac-227	Th-232	Th-230	Th-228	Ra-226	Ra-228	Bi-210
Industrial Worker Soils	967	7,915	211	251	54.6	255	3,300	19.2	14.7	22.8	799

14.1.2.1 DCGL$_{EMC}$

Area factors (based on MARSSIM guidance) have been developed to be used for elevated measurement comparisons (EMC) and to determine sampling requirements in situations where the scan instrument's MDC is greater than the appropriate DCGL$_w$. The appropriate DCGL$_{EMC}$ values are calculated by multiplying the appropriate DCGL$_w$ by the area factors presented below.

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

Table 14-3 Floor Area Factors

Radionuclide	1 m^2	2 m^2	3 m^2	5 m^2	10 m^2	15 m^2	30 m^2
U-238	163	84	59	36	19	13.2	6.9
U-234	22	110	74	44	22	15	7.5
U-235	85	46	33	23	12.9	9.6	5.6
Pa-231	216	109	72	44.6	22.1	14.9	7.4
Ac-227	212	101	70	42	21.2	14.7	7.4
Th-232	220	112	75	44	22	15	7.5
Th-230	224	110	75	44	22	15	7.5
Th-228	50.6	28.2	20.5	14.1	9	7	4.4
Ra-226	29.8	16.8	12	8.6	5.8	4.5	3.2
Ra-228	34.8	19.9	14.5	10.1	6.6	5.1	3.5
Pb-210	218	109	70.4	43.5	21.8	14.7	7

Table 14-4 Wall Area Factors

Radionuclide	1 m^2	2 m^2	3 m^2	5 m^2	10 m^2	15 m^2	20 m^2
U-238	224	114	75.7	44.7	22.4	15.1	11.4
U-234	221	112	75.4	46	22.1	15.1	11.2
U-235	229	119	79	47.8	25	16	12.1
Pa-231	226	112	74.4	44.6	22.6	15.1	11.2
Ac-227	221	110	74.5	45.1	22.1	14.7	11
Th-232	220	112	74.8	44	22	15	11.2
Th-230	224	114	74.8	44	22.4	15	11.4
Th-228	256	128	83.2	51.8	26.2	17.9	13.4
Ra-226	293	144	96	57.6	30.7	21.1	15.8
Ra-228	278	139	94.8	56.9	29.1	19.6	15.2
Pb-210	218	109	70.4	43.5	21.8	14.7	10.9

Table 14-5 Land (Soil) Area Factors

Radio-nuclide	1 m²	5 m²	10 m²	25 m²	50 m²	75 m²	100 m²	250 m²	500 m²	750 m²	1,000 m²
U-238	8.9	3.3	2.2	1.7	1.5	1.4	1.3	1.2	1.2	1.1	1.1
U-234	6.1	5.0	4.5	3.9	3.5	3.3	3.1	2.4	1.9	1.6	1.3
U-235	8.8	3.0	2.0	1.6	1.3	1.3	1.2	1.1	1.1	1.1	1.1
Pa-231	10.9	5.6	4.1	3.2	2.8	2.6	2.4	1.9	1.5	1.3	1.1
Ac-227	7.8	3.6	2.5	2.0	1.7	1.6	1.6	1.4	1.3	1.2	1.2
Th-232	7.7	3.6	2.6	2.0	1.7	1.7	1.6	1.4	1.3	1.2	1.2
Th-230	5.7	4.5	3.9	3.4	3.1	2.9	2.7	2.2	1.8	1.6	1.4
Th-228	10.2	3.3	2.2	1.6	1.4	1.3	1.3	1.2	1.1	1.1	1.1
Ra-226	9.9	3.2	2.1	1.6	1.4	1.3	1.2	1.2	1.1	1.1	1.1
Ra-228	9.9	3.2	2.1	1.6	1.4	1.3	1.3	1.2	1.1	1.1	1.1
Pb-210	131	54	35	21	13	10	8.0	3.7	2.0	1.3	1.0

14.2 Characterization Surveys

Radiological characterization surveys of the site were performed in 1993. A detailed discussion of the 1993 characterization surveys and results is summarized in Chapter 4.0.

NUREG-1575 (MARSSIM) defines areas that have no reasonable potential for residual contamination as "non-impacted." These areas have no radiological impact from site operations. Areas with some potential for residual contamination are defined as "impacted." Impacted areas are further divided into Class 1, 2, or 3 areas based on the potential for contamination.

14.2.1 Building Classification

14.2.1.1 Definitions

Class	Definition	Survey Unit Size
1 Structural Surfaces	Areas known or expected to have radionuclide concentrations above the $DCGL_W$	Up to 100 m² of floor area
2 Structural Surfaces	Areas known or expected to have radionuclide concentrations above normal background concentrations but that are not expected to be above the $DCGL_W$	100 to 1,000 m²
3 Structural Surfaces	Areas that are not expected to have radionuclide concentrations detectable above normal background concentrations	No limit

14.2.2 Land Area Classification

All land areas have been designated as impacted for purposes of classification of survey.

14.2.2.1 Definitions

Class	Definition	Survey Unit Size
1 Land Areas	Areas known or expected to have radionuclide concentrations above the $DCGL_W$	Up to 2,000 m^2
2 Land Areas	Areas known or expected to have radionuclide concentrations above normal background concentrations but that are not expected to be above the $DCGL_W$	2,000 to 10,000 m^2
3 Land Areas	Areas that are not expected to have radionuclide concentrations detectable above normal background concentrations	No limit

The areas surrounding Pond Nos. 2 and 3 and Chemical "A" and Chemical "C" buildings are classified as Class 1 areas. These areas have the highest potential for contamination based on historical process operations. The remaining operational areas of the site and Pond Nos. 5, 6, 7, 8, and 9 are classified as Class 2 areas. The northernmost and westernmost sections of the site are classified as Class 3 areas, as no historical process operations occurred in these areas of the site.

Radiological characterization surveys performed in 1993 have identified the nature, depth, and extent of licensed radioactive material at the Fansteel site. It is highly unlikely that significant quantities of residual radioactivity have gone undetected. Contaminant migration since 1993 is estimated to be minimal based on the conservative partition coefficient (K_d) values used in the RESRAD analysis (see Chapter 5.0) which generally overestimate contaminant migration.

14.3 Remedial Action Support Surveys

14.3.1 Building and Component Surveys

Many of the radionuclides of concern and/or their progeny emit alpha and/or beta particles that are easily detected using survey instruments equipped with gas proportional detectors and scalers. Scanning for gross alpha or gross beta activity will be used as part of status surveys of structural surface survey units to ensure elevated areas of activity are not missed. In addition, static counts of surfaces at predetermined sample points are used to access total contamination of surfaces. The following survey instruments (or equivalents) will be used to scan surfaces:

Manufacturer and Meter	Manufacturer and Detector Model	Detector Type	Use
Ludlum 2224	Ludlum 43-89 Dual Phosphor Alpha/Beta Detector	Zinc Sulfide Scintillator	Scans and Static Counts for Alpha and Beta Emitting Radionuclides
Ludlum 2221	Ludlum 43-68 Gas Proportional	Gas Proportional	Scans and Static Counts for Alpha and Beta Emitting Radionuclides

Use of these field instruments or acceptable equivalents is evaluated against the goal of achieving MDCs of less than the $DCGL_{WS}$ for direct measurements and/or scanning measurements. MDCs were calculated for scanning instruments using the method provided in MARSSIM for calculating MDC that controls both Type I and Type II errors (i.e., elimination of false negatives and false positives) as follows.

14.3.1.1 Beta Ratemeter Scanning

Beta scanning MDC at a 95 percent confidence level is calculated using the following equation which is a combination of MARSSIM Equations 6-8, 6-9, and 6-10:

$$MDC_{scan} = \frac{d'\sqrt{b_i}\left(\frac{60}{i}\right)}{\sqrt{p}\cdot E_{tot}\cdot\frac{A}{100\,cm^2}}$$

where:

MDC_{scan} = MDC level in dpm/100 cm^2,
d' = desired performance variable (usually 1.38 corresponding to alpha and beta errors of 0.05),
b_i = background counts during the residence interval,
i = residence interval in seconds,
ρ = surveyor efficiency (0.5 – 0.75, 0.5 is conservative),
A = detector probe physical (active) area in cm^2, and
E_{tot} = total detector efficiency for radionuclide emission of
= $E_i \times E_s$,
where:
E_i = 2π instrument efficiency in counts per disintegration (cpd) and
E_s = source (or surface contamination) efficiency.

Note: Es values can be determined or the default values provided in NUREG-1507 can be used as follows: 0.25 for all alpha energies and beta maximum energies between 0.15 and 0.4 MeV, 0.5 for all beta maximum energies greater than 0.4 MeV.

14.3.1.2 Alpha Ratemeter Scanning

There are two equations used to determine the alpha scanning DCGL depending on the background level.

For a background level of less than 3 cpm, the probability of detecting a single count while passing over the contaminated area is:

$$P(n \geq 1) = 1 - e^{\frac{-GEd}{60v}}$$

where:

$P(n \geq 1)$	= probability of observing a single count,
G	= activity (dpm),
E	= 4π detector efficiency (cpd),
d	= width of detector in direction of scan (cm), and
v	= scan speed (cm/s).

Increase the value of G until the corresponding probability equals the desired confidence level, e.g., 95 percent. For a background level of 3 cpm to about 10 cpm, the probability of detecting two or more counts while passing over the contaminated area is:

$$P(n \geq 2) = 1 - \left(1 + \frac{(GE + B)d}{60v}\right)\left(e^{-\frac{(GE+B)d}{60v}}\right)$$

where:

$P(n \geq 2)$	= probability of observing two or more counts,
G	= activity (dpm),
E	= 4π detector efficiency (cpd),
B	= background count rate (cpm),
d	= width of detector in direction of scan (cm), and
v	= scan speed (cm/s).

Increase the value of G until the corresponding probability equals the desired confidence level, e.g., 95 percent.

14.3.1.3 Static Counting Times Calculation

Minimum counting times for background determinations and counting times for measurement of total and removable contamination will be chosen to provide an MDC that is a fraction (25 to 75 percent) of the survey unit-specific acceptance criteria. MARSSIM equations have been modified to convert to units of dpm/100 cm^2. Count times are determined using the following equation. Static counting MDCs at a 95 percent confidence level are calculated using the following equation which is an expansion of NUREG-1507, "*Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions,*" Equation 6-7 (Strom & Stansbury, 1992):

$$MDC_{static} = \frac{3 + 3.29\sqrt{B_r \cdot t_s \cdot (1 + \frac{t_s}{t_b})}}{t_s \cdot E_{tot} \cdot \frac{A}{100}}$$

where:

MDC_{static} = minimum detectable concentration level in dpm/100 cm^2,
B_R = background count rate in cpm,
t_B = background count time in minutes,
t_S = sample count time in minutes,
A = detector probe physical (active) area in cm^2, and
E_{tot} = total detector efficiency for radionuclide emission of
= E_i x E_s,
where:
E_i = 2π instrument efficiency in counts per disintegration (cpd) and
E_s = source (or surface contamination) efficiency.

Note: Es values can be determined or the default values provided in NUREG-1507 can be used as follows: 0.25 for all alpha energies and beta maximum energies between 0.15 and 0.4 MeV, 0.5 for all beta maximum energies greater than 0.4 MeV.

14.3.2 Open Land Areas Survey Instrumentation

Many of the radionuclides of concern and/or their progeny emit high-energy photons and are easily detected using survey instruments equipped with NaI scintillation crystal detectors. Scanning for gross gamma activity will be used as part of status survey of open land area survey to ensure elevated areas of activity are not missed. The following survey instruments (or equivalents) will be used to scan soil:

Manufacturer and Meter	Manufacturer and Detector Model	Detector Type	Use
Ludlum 2221	Ludlum 44-10 2" × 2" NaI scintillator	NaI	Scans for Gamma-Emitting Radionuclides

Use of these field instruments or acceptable equivalents is evaluated against the goal of achieving MDCs of less than the $DCGL_W$s for direct measurements and/or scanning measurements. MDCs were calculated for scanning instruments using the method provided in MARSSIM for calculating MDC that controls both Type I and Type II errors (i.e., elimination of false negatives and false positives) as follows:

$$\text{Scan MDCR}_{\text{surveyor}} = \frac{\text{MDCR}}{\sqrt{p}\,\epsilon_i}$$

where MDCR is the minimum detectable count rate in cpm, ϵ_i is the instrument efficiency (cpm/μR/hour), and p is the surveyor efficiency. Based on laboratory studies documented in References 2 and 3, the value of p has been estimated to be between 0.5 and 0.75. The value of 0.5 is conservative. Values for ϵ are radionuclide specific and are provided by MARSSIM for 2-inch-by-2-inch NaI detectors. Some of the values are listed in the table below. In addition:

$$\text{MDCR} = s_i \times (60/i)$$

where s_i is the minimal number of net source counts required for a specified level of performance for the interval i, in seconds, and:

$$s_i = d'\sqrt{b_i}$$

where d' is the value selected from MARSSIM Table 6.5 based on the required true positive and false positive rates and b_i is the number of background counts in the interval$_i$. The value of d' used to calculate the detector sensitivity values listed in Table 1 is 1.38, corresponding to an alpha of 0.05 and beta of 0.40. This value of d' will result in less than 5 percent false negatives and about 40 percent false positives. MDC calculations are summarized in Table 14.6 for increasing background count rates. The scan MDC value in μR/hr can be converted to pCi/g for specific radionculides using a conversion factor derived using the guidance provided in MARSSIM and the shielding code Microshield. Some of the values are provided in the following table.

Radionuclide	ϵ_i (cpm/ μR/hr)	CF (pCi/g / μR/h)
U-nat*	3990	211
Ra-226*	760	1.41
Th-232*	830	0.99

*In equilibrium with all progeny.

14.4 FSS Design

An FSSP will be prepared (in accordance with MARSSIM) to support remediation activities for the Fansteel site.

14.4.1 Nonparametric Statistical Test

A nonparametric statistical test will be applied to the sampling data taken at distinct survey locations in each survey unit to determine whether the release criteria have been met. The advantage to a non-parametric test is that it does not require assumptions about the data distribution (e.g., normal, log-normal). The nonparametric tests recommended in MARSSIM are the WRS test and the Sign test.

14.4.2 Null Hypothesis

The null hypothesis (H_o) to be tested is that the residual contamination is equal to or greater than the acceptance criteria and the alternative hypothesis (H_A) is that the residual contamination is less than the acceptance criteria.

14.4.3 Decision Error Rates

There are two types of decision errors as shown below.

		DECISION/OUTCOME OF STATISTICAL TEST	
		Reject H_o	**Accept H_O**
TRUE CONDITION OF SURVEY UNIT	Survey results meet (less than) the acceptance criteria	No decision error (probability = 1 -α)	Incorrectly fail to release survey unit Type II error (probability = β)
	Survey results exceed (equal to or greater than) the acceptance criteria	**Incorrectly release survey unit** Type I error (probability = α)	No decision error (probability = 1 - β)

Examination of this table highlights the importance of limiting the Type I error rate (or α) in terms of protection of human health and the environment. The DQO selected for α is 0.05. The DQO selected for β will be between 0.05 and 0.4.

14.4.4 Survey Measurements

A combination of scanning measurements and discrete measurements and/or samples is used to determine the average radionuclide concentration in a survey unit and screen the area for elevated areas.

14.4.4.1 Open Land Area – Discrete Sampling

The results of discrete sampling will be used to verify that the average soil concentration is less than the $DCGL_w$. Regardless of the survey unit classification (Class 1, Class 2, or Class 3), a predetermined number of samples will be collected in each survey unit. A random-start triangular grid pattern will be used since it is the most efficient means of identifying small areas of elevated activity.

14.4.4.2 Open Land Area – Scanning

Radiological scanning is performed by slowly walking over the excavated surface of the survey unit while swinging the NaI detector in a serpentine pattern close (within 2 inches) to the soil surface. For Class 1 areas, 100 percent coverage scanning surveys are designed to detect small areas of elevated activity that are not detected by measurements using the systematic pattern. For this reason, the measurement locations and the number of measurements may need to be adjusted based on the sensitivity of the scanning technique.

Scanning surveys in Class 2 areas are also primarily performed to find areas of elevated activity not detected by measurements using the systematic pattern. However, the measurement locations are not adjusted based on the sensitivity of the scanning technique and scanning may be performed only in portions of the survey unit. A larger portion of the survey unit would be scanned in Class 2 survey units that have residual radioactivity close to the DCGLs but, for survey units that are closer to background scanning, a smaller portion of the survey unit may be appropriate. The recommended coverage for Class 2 areas is 10 percent to 100 percent systematic and/or judgmental scanning.

Class 3 areas have the lowest potential for areas of elevated activity. For this reason, scanning surveys are recommended for areas with the highest potential for contamination based on professional judgment. This provides a qualitative level of confidence that no areas of elevated activity were missed by the random measurements or that there were no errors made in the classification of the area. The recommended coverage for Class 3 areas is judgmental.

14.4.4.3 Structural Surfaces – Discrete Sample Point Measurements

The results of discrete sample point measurements will be used to verify that the average total and removable activity concentrations are less than the appropriate $DCGL_w$ value. Regardless of the survey unit classification (Class 1, Class 2, or Class 3), a predetermined minimum number of sample points will be measured in each survey unit. A random-start triangular grid pattern will be used.

14.4.4.4 Structural Surfaces – Scanning

Radiological scanning of structural surfaces is performed by slowly moving the detector face over the structure surface of the survey unit. For Class 1 areas, 100 percent coverage scanning surveys are designed to detect small areas of elevated activity that are not detected by measurements using the systematic pattern. For this reason, the measurement locations and the number of measurements may need to be adjusted based on the sensitivity of the scanning technique.

Scanning surveys in Class 2 areas are also primarily performed to find areas of elevated activity not detected by measurements using the systematic pattern. However, the measurement locations are not adjusted based on the sensitivity of the scanning technique and scanning may be performed only in portions of the survey unit. A larger portion of the survey unit would be scanned in Class 2 survey units that have residual radioactivity close to the DCGLs but, for survey units that are closer to background scanning, a smaller portion of the survey unit may be appropriate. The recommended coverage for Class 2 areas is 10 percent to 100 percent systematic and/or judgmental scanning.

Class 3 areas have the lowest potential for areas of elevated activity. For this reason, scanning surveys are recommended for areas with the highest potential for contamination based on professional judgment. This provides a qualitative level of confidence that no areas of elevated activity were missed by the random measurements or that there were no errors made in the classification of the area. The recommended coverage for Class 3 areas is judgmental.

14.4.5 Method to Determining Number of Samples

Paramount to determining the number of samples is the determination of the relative shift (Δ/σ). Delta is equal to the DCGL minus the lower-bound gray region (LBGR) value. The LBGR value is arbitrarily set at one-half the DCGL value to start the determination. Since unity is the $DGCL_w$ when multiple radionuclides are present, Δ is equal to 1.0 – 0.5, or 0.5. Sigma for multiple radionuclides is calculated from the expression:

$$\sigma = \sqrt{(\sigma_1 / D_1)^2 + (\sigma_2 / D_2)^2 + (\sigma_3 / D_3)^2 + ... + (\sigma_n / D_n)^2}$$

where σ_i is the expected standard deviation of the radionuclide i and D_i is the calculated $DCGL_W$ for the radionuclide i. The estimated standard deviations for the radionuclides are derived from characterization or remedial action support survey data as appropriate. Delta divided by the weighted sigma results in a relative shift value which is rounded down to two significant figures for the purpose of determining the required number of samples. The determination of the required number of samples differs depending on the statistical test required, Sign or WRS test.

14.4.6 Number of Samples – WRS Test

The number of samples (N/2) required from the survey unit and the reference area (WRS test) can be calculated using the following formula (MARSSIM 5-1), escalated by the factor 1.2 and rounded up, or N/2 can be looked up in Table 5.3 of MARSSIM. The 20 percent escalation factor is used to account for uncertainty in the parameters used to calculate N/2 and to allow flexibility to account for lost or unusable data.

$$N/2 = \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{3(P_r - 0.5)^2}$$

where:

$N/2 =$ the minimum number of samples required per survey unit and reference area;
$Z_{1-\alpha} =$ percentile represented by selected value of α, Table 5.2 of MARSSIM;
$Z_{1-\beta} =$ percentile represented by selected value of β, Table 5.2 of MARSSIM; and
$P_r =$ value obtained from Table 5.1 of MARSSIM.

For example, based on a relative shift of 2.0, 13 samples (N/2) are required to meet the DQOs.

14.4.7 Number of Samples – Sign Test

The number of samples (N) can be calculated using the following formula (MARSSIM 5-2), escalated by the factor 1.2 and rounded up, or looked up in Table 5.5 of MARSSIM. The 20 percent escalation factor is used to account for uncertainty in the parameters used to calculate N and to allow flexibility to account for lost or unusable data.

$$N = \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{4(\mathit{Sign}\,P - 0.5)^2}$$

where:

$N =$ the minimum number of samples required per survey unit,
$Z_{1-\alpha} =$ percentile represented by selected value of α,
$Z_{1-\beta} =$ percentile represented by selected value of β, and
Sign P = value obtained from Table 5.4 of MARSSIM.

14.4.8 Method for Determining Grid Spacing

A systematic triangular sampling grid pattern with a random starting point will be used to establish the sampling points within each Class 1 or Class 2 survey unit. This sampling pattern is generally the most efficient means of identifying small areas of elevated activity. The distance between the grid nodes (L) will be determined by:

$$L = [A/(0.866 \times n)]^{1/2}$$

where A is the area to be covered by the grid and n is the number of samples. Solving for L, the following table illustrates typical grid spacing required for specified example areas:

Area (m^2)	No. of Samples	Distance between Grid Nodes (m)	Size of "Hot Spot" (m^2)
10	13	1	1
100	13	3	7
500	13	7	35
1,000	13	9	70
1,500	13	12	105
2,000	13	13	140
5,000	13	21	349
10,000	13	30	698

The starting point and locations of soil samples will be determined by use of either a MARSSIM-based computer program or the methodology outlined in Section 5.5.2.5 of MARSSIM.

Samples within a Class 3 survey unit will be taken at locations based on a systematic grid system, as described above, or will be taken at random locations determined by the DM.

14.4.9 Adjustment of Number of Samples/Grid Spacing Based on Scan MDC

The triangular grid pattern has approximately a 90 percent chance of detecting a circular hot spot of radius equal to one-half the grid spacing. The surface area of the corresponding hot spot is included in the above table. The hot spot size indicates the appropriate area factor for calculating the $DCGL_{EMC}$ from the $DCGL_w$. Area factors are presented in Section 14.1.

The scanning instrument required scan MDC able to detect an area of elevated activity is given by:

$$\text{Scan MDC (required)} = DCGL_w \times A_m.$$

where the A_m is the area factor corresponding to the elevated area detected by the systematic triangular grid.

If the instrument scan MDC (actual) is less than scan MDC (required), then the survey instrument will be sufficient to detect areas of elevated activity. If not, then it is necessary to calculate the area factor that corresponds to the actual scan MDC:

$$\text{Area Factor} = \text{Scan MDC (actual)} / DCGL_w$$

The corresponding size of an area of elevated activity is then obtained from the appropriate area factor table presented in Section 14.1. The number of samples is now calculated by dividing the survey unit area by the area of elevated activity that can be detected by the scanning instrument, and the grid spacing is recalculated as in Section 14.4.8

14.4.10 Structural Surface Area Smear Sample Laboratory Analysis

All smear (swipe) samples collected for the assessment of removable contamination during the final survey will be analyzed for gross alpha and gross beta activity. The minimum MDCs required for analytical analyses are a fraction (usually 25 to 75 percent) of the applicable $DCGL_W$ values for the survey unit.

14.4.11 Open Land Area Soil Sample Laboratory Analysis

Soil samples collected (for final survey) will be analyzed by gamma spectroscopy and/or alpha spectroscopy as required to compare to the applicable survey unit acceptance criteria. All of the radionuclides will be identified directly or inferred from identified progeny or on the basis of secular equilibrium relationships when applicable. The MDCs required for the analyses are 25 to 75 percent of the $DCGL_W$ values.

14.5 FSS Report

A report will be prepared to document the final conditions of the site. The report will include information concerning the following:

- An overview of the results of the survey.
- A discussion of any changes that were made in the survey from what was proposed in the Soil Remediation Plan.
- A description of the method by which the number of samples was determined for each survey unit.
- A summary of the values used to determine the number of samples and justification for these values.
- The survey results for each survey unit including the following:
  - The number of samples taken for the survey unit.
  - A map or drawing of the survey unit showing the reference system and random-start systematic sample locations.
  - The measured sample concentrations.

- The statistical evaluation of measured concentrations.

- Judgmental and miscellaneous sample data sets reported separately from those samples collected for performing the statistical evaluation.

- A discussion of anomalous data including any areas of elevated direct radiation detected during scanning that exceeded the investigation level or measurement locations in excess of the $DCGL_W$.

- A statement that a given survey unit satisfied the $DCGL_W$ and the elevated measurement comparison, if any sample points exceeded the $DCGL_W$.

• A description of any changes in initial survey unit assumptions relative to the extent of residual radioactivity.

• If a survey unit fails, a description of the investigation conducted to ascertain the reason for the failure and a discussion of the impact that the failure has on the conclusion that the facility is ready for final radiological surveys.

• If a survey unit fails, a discussion of the impact that the reason for the failure has on other survey unit information.

References

(1) EPA 402-R-97-016, December 1997, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG-1575.

(2) Nuclear Regulatory Commission (NRC), 1997, Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions, NUREG/CR-1507, Final, NRC, Washington, DC.

(3) Nuclear Regulatory Commission (NRC), 1998, Human Performance of Radiological Survey Scanning, NUREG/CR-6364, NRC, Washington, DC.

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15.0 Financial Assurance Demonstration

This section is the financial assurance demonstration supporting the decommissioning of the Muskogee facility. The demonstration includes a detailed cost estimate for decommissioning and an explanation of key assumptions supporting the cost estimate. In addition, an independent estimation of costs is included in Appendix 15-1 using the forms provided in NUREG-1727. Since Fansteel is not proposing license termination under restricted conditions, the financial assurance demonstration does not include estimated costs for control and maintenance of the site, along with financial assurance coverage for these costs.

Fansteel's decommissioning cost estimate is presented in Section 15.1, key supporting assumptions in Section 15.2, and the independent estimation of costs via NUREG-1727 forms in Appendix 15-1. The financial assurance mechanism (Section 15.3), the comparison of the cost estimate to the current level of financial assurance (Section 15.4), and the means for adjusting the cost estimate and associated funding level (Section 15.5) will be set forth in a Plan of Reorganization that Fansteel currently intends to file with the Bankruptcy Court on or before February 17, 2003.

15.1 Decommissioning Cost Estimate

The cost estimate presented in this section does not utilize the NUREG-1727 forms. The estimates of costs associated with each subset of materials on site (residues, soils, or structures) are based on the projected volume of materials to be removed from the site. The estimates have been made consistent with the acceptance criteria and planned decommissioning activities presented in this DP. The cost estimate addresses all of the items detailed in NUREG-1527. Appendix 15-1 contains an independent estimation of cost based on the NUREG-1527 forms completed for each of the subsets of materials on site.

The decommissioning cost estimate has been developed pursuant to 10 CFR 40.36(d), 40.42(e), and 40.42(g)(4)(v) for decommissioning the Muskogee facility based on documented and reasonable assumptions. An alternative schedule greater than 24 months is proposed. The labor estimates, material costs, and other factors of the cost estimate are tractable and have a reasonable basis. Where necessary, Fansteel has considered information found in NUREG/CR-6477 and other industrial cost estimating references during preparation of the cost estimate. A discussion of the key assumptions used to prepare the decommissioning cost estimate is found in Section 5.2.

In the following sections, cost estimates are provided for completing key elements of the decommissioning of the site. Costing for the completion of these key elements is based on a contractor to Fansteel completing the work.

15.1.1 Planning and Preparation

The cost of preparing site plans and other required documents in support of decommissioning activities on site has been estimated as $324,000. This cost includes the following:

- Preparation of Work Plans (Second Tier Documents) – Preparation of documentation in addition to the DP may include the FSSP, ALARA Analysis Plan, Rad-Waste Plan, Effluent Monitoring Plan, Construction Work Plans, and other implementing procedures. Estimated at $250,000.

- Procurement of Special Equipment – The costs of "routine" equipment such as trucks and excavators are included in the estimation of costs in Sections 15.1.2 through 15.1.6. It is not anticipated that special (i.e., nonroutine) equipment will be required during the remediation of the site.

- Training – In addition to task-specific training, workers on site for decommissioning activities will receive instruction based on their potential exposure to radioactive material. The instruction provided will be commensurate with the potential exposure present at the site in accordance with 10 CFR Part 19. Estimated cost of $50,000.

- Radiological Characterization – No additional large-scale characterization of the site is planned prior to the onset of decommissioning activities on site. Sampling and analysis in support of remediation planning is estimated at $24,000.

15.1.2 Pond Nos. 2 and 3 WIP Residues

Tables 15-1 and 15-2 summarize the costs associated with the excavation and loading, hauling, drying, transportation, and reclamation of the residues. Reclamation as used in reference to WIP residues is the acceptance and processing of the material at a licensed uranium-bearing material recycling facility. Table 15-1 estimates the quantity of WIP residues present in Pond Nos. 2 and 3. The residues in these two ponds are estimated from information gathered during a review of the following documents:

- "A Chemical Comparison of Pond Residues with Estimates of Resources and Suggested Mining Methods," Mr. Dennis J. LaPoint, PMET, September 12, 2000.

- "Remediation Assessment," Earth Sciences Consultants, Inc., December 1993.

- "Construction Certification Report, Excavation and On-Site Management of Radiologically Affected Soils and Construction of Groundwater Collection Trench," Earth Sciences Consultants, Inc., December 15, 1999.

- Pond No. 3 Contour Map, Fansteel Inc., September 11, 1978.

The formula for calculating the volume of residues in Pond Nos. 2 and 3 multiplies the average length in feet by the average width in feet by the average depth in feet and divides the total by 27 cubic feet per cubic yard. The pond length and pond width are the approximate pond dimensions at the surface of the residue. As indicated on the pond design drawing, the sidewall slope for Pond No. 3 is 3 horizontal to 1 vertical. Therefore, the width and length are reduced by six times the residue depth in order to calculate the average length and width. Pond No. 2 was assumed to have a 3:1 slope since design drawings for Pond No. 2 were not available. The formula for calculating the residue volume of Pond Nos. 2 and 3 is as follows:

Residue volume (cu. yd.) = ((pond width + (pond width – (6 x pond depth)))/2) x pond depth x ((pond length + (pond length – (6 x pond depth)))/2)/27

As indicated in Table 15-1, the total estimated residue volume associated with Pond Nos. 2 and 3 is 25,449 cubic yards. Utilizing the solids specific gravity and the pond percent solids from the aforementioned PMET report, the estimated residue wet weight for Pond Nos. 2 and 3 is 29,683 tons with an estimated residue dry weight of 13,038 tons. Although this estimated residue dry weight is higher than the Pond Nos. 2 and 3 residue dry weight of 10,800 tons presented in Table 15 of the PMET report, the percent difference between these two estimates is 21 percent. Based on this comparison, an estimated residue dry weight of approximately 13,000 tons provides a conservative engineering estimate for the development of costs. Drying is estimated at approximately 80 percent solids.

Table 15-2 provides costs associated with the excavation and loading, hauling, drying, transportation, and reclamation of the Pond Nos. 2 and 3 WIP residues. The table also includes site restoration (backfilling) costs. Costs associated with each of the activities presented in Table 15-2 were developed from costing information presented in the RSMeans 2002 Heavy Construction and/or Site Worker Cost Data and from engineering and construction experiences. The transportation and reclamation costs were estimated based on shipping by MHF Logistical Solutions (MHF) the pond residues to the International Uranium Corporation (IUC) for reclamation. (Reference MHF Letter Quote, February 16, 2001 and IUC Letter Quote, March 16, 2001.) The total estimated remediation cost associated with the 80 percent solids residues and reclamation at IUC is $3,878,930.

15.1.3 Pond Nos. 5, 6, 7, 8, and 9 Residues

Tables 15-3 and 15-4 summarize the costs associated with the excavation and loading, hauling, backfilling, drying, transportation, and disposal of the residues associated with Pond Nos. 5, 6, 7, 8, and 9. Table 15-3 estimates the quantity of residues present in Pond Nos. 5, 6, 7, 8, and 9. The residues in these five ponds are estimated from information gathered during a review of the following documents:

- "A Chemical Comparison of Pond Residues with Estimates of Resources and Suggested Mining Methods," Mr. Dennis J. LaPoint, PMET, September 12, 2000.
- "Remediation Assessment," Earth Sciences Consultants, Inc., December 1993.
- "Construction Certification Report, Excavation and On-Site Management of Radiologically Affected Soils and Construction of Groundwater Collection Trench," Earth Sciences Consultants, Inc., December 15, 1999.
- Pond No. 6 Design Drawing, Fansteel Inc., March 7, 1972.
- Pond No. 8 Liner Layout Drawing, Fansteel Inc., August 3, 1976.
- Pond No. 9 Boring Location Drawing, Fansteel Inc, October 30, 1989.

The formula for calculating the volume of residues in Pond Nos. 5, 6, 7, 8, and 9 multiplies the average length in feet by the average width in feet by the average depth in feet and divides the total by 27 cubic feet per cubic yard. The pond length and pond width are the approximate pond dimensions at the surface of the residue. As indicated on the pond design drawing, the sidewall slope for Pond Nos. 5, 6, and 7 is 1.67 horizontal to 1 vertical. Therefore, the width and length are reduced by 3.34 times the residue depth in order to calculate the average length and width. As indicated on the pond design drawing, the sidewall slopes for Pond Nos. 8 and 9 are 2:1 and 1.5:1 respectively. Therefore, the width and length are reduced by four times the residue depth for Pond No. 8 and by three times the residue depth in Pond No. 9 in order to calculate the average length and width. The formula for calculating the residue volume of Pond Nos. 5, 6, 7, 8, and 9 is as follows:

Residue volume (cu. yd.) = ((pond width + (pond width – (2 x slope x pond depth)))/2) x pond depth x ((pond length + (pond length – (2 x slope x pond depth)))/2)/27

As indicated in Table 15-3, the total estimated residue volume associated with Pond Nos. 5, 6, 7, 8, and 9 is 173,072 cubic yards. Utilizing the solids specific gravity and the pond percent solids from the aforementioned PMET report, the estimated residue wet weight for Pond Nos. 5, 6, 7, 8, and 9 is 179,108 tons with an estimated residue dry weight of 54,173 tons. Drying is estimated at approximately 80 percent solids. In comparison, the PMET report provided an estimated dry weight of residues associated with Pond Nos. 8 and 9 of approximately 60,000 tons. Table 15-3 provides an estimated dry weight of residues for Pond Nos. 8 and 9 of approximately 54,163 tons. As indicated by these numbers, these two separate estimates match closely with a percent difference of 10 percent. Based on this comparison, an estimated residue dry weight of approximately 54,163 tons provides a reasonably acceptable engineering estimate for the development of costs.

Table 15-4 provides costs associated with the excavation and loading, hauling, drying, and transportation and disposal of the Pond Nos. 5, 6, 7, 8, and 9 residues. The table also includes site restoration (backfilling) costs. Costs associated with each of the activities presented in Table 15-4 were developed from costing information presented in the RSMeans 2002 Heavy Construction and/or Site Worker Cost Data and from engineering and construction experiences. The total estimated remediation cost associated with the 80 percent solids residues is approximately $14,044,002 for transportation by MHF and disposal at Waste Control Specialists of Texas (WCS). (Reference MHF Letter Quote, February 8, 2001 and WCS Letter Quote, December 4, 2000. The WCS quote was updated by WCS Letter Quote, December 3, 2002.)

15.1.4 Radiologically Impacted Soils

Tables 15-5 and 15-6 summarize the costs associated with the excavation and loading, hauling, transportation, and disposal of the radiologically affected soils delineated previously during prior site activities. Table 15-5 estimates the quantity of radiologically affected soils. The volumes of radiologically affected soils are estimated from information gathered during a review of the following documents:

- "Remediation Assessment," Earth Sciences Consultants, Inc., December 1993.
- "Construction Certification Report, Excavation and On-Site Management of Radiologically Affected Soils and Construction of Groundwater Collection Trench," Earth Sciences Consultants, Inc., December 15, 1999.
- William P. Duggan, Ph.D., P.E. letter to Mr. John Englert dated June 26, 1986.

The radiologically affected soils have been divided into five areas. The five areas are described in the table below. The volume of soils associated with each of the areas is estimated based on the soil DCGL values, soil core boring analytical results, and physical boundaries as presented in Table 15-5. Table 15-6 also includes the cost for disposal for the soils currently stored in the Super Sacks in the Sodium Reduction Building. The quantity of soils assumed to be stored in this manner is approximately 1,000 tons.

Soil Areas	Description	Dimensions (ft)
Area 1 (Former Area III a and b)	Impacted soil surrounding Boring B-36. Bounded by the Chemical "C" building south, Pond No. 3 west, Pond No. 2 east, Boring B-38, and MW-72S north.	110 x 210 x 10 ft deep
Area 2 (portion of Former Area II)	Impacted soil surrounding Borings B-55 and 56, north of the Bertha Building, shallow contamination.	50 x 75 x 2.5 ft deep
Area 3 (Former Area VII a)	Impacted soil surrounding Boring B-73, east of the Bertha Building, 10' deep contamination.	20 x 20 x 10 ft deep
Area 4	Impacted soil surrounding Boring B-51, south of the Bertha Building, 4' deep contamination.	20 x 20 x 4 ft deep
Area 5 (Former Area VI b)	Impacted soil surrounding Boring B-65, south of the Bertha Building, 20' deep contamination.	20 x 20 x 20 ft deep

Table 15-6 provides costs associated with the excavation and loading, hauling, transportation, and disposal of the radiologically affected soils in their existing state. The table also includes site restoration (backfilling) costs. Costs associated with each of the activities presented in this table were developed from costing information presented in the RSMeans 2002 Heavy Construction and/or Site Worker Cost Data and from engineering and construction experiences. The total estimated cost for performing the remediation of the radiologically affected soils and disposal at WCS is $2,145,288. (Reference MHF Letter Quote, February 8, 2001 and WCS Letter Quote, December 4, 2000. The WCS quote was updated by WCS Letter Quote, December 3, 2002.)

15.1.5 Pond Nos. 2 and 3 Contaminated Soils

Tables 15-7 and 15-8 summarize the costs associated with the excavation and loading, hauling, transportation, and disposal of the contaminated soils associated with Pond Nos. 2 and 3. Table 15-7 estimates the potential quantity of soils that may have been contaminated by Pond Nos. 2 and 3. The volumes of contaminated soils are estimated from information gathered during a review of the following documents:

- "A Chemical Comparison of Pond Residues with Estimates of Resources and Suggested Mining Methods," Mr. Dennis J. LaPoint, PMET, September 12, 2000.
- "Remediation Assessment," Earth Sciences Consultants, Inc., December 1993.
- "Decommissioning Plan," Earth Sciences Consultants, Inc., November, 2002.
- "Construction Certification Report, Excavation and On-Site Management of Radiologically Affected Soils and Construction of Groundwater Collection Trench," Earth Sciences Consultants, Inc., December 15, 1999.
- Pond No. 3 Contour Map, Fansteel Inc., September 11, 1978.

The soils associated with the bottom of the pond are found by multiplying the length of the pond by the width of the pond by the estimated depth of contamination. Since the slope of both ponds is estimated to be 3:1, the calculation of volume based on the maximum length and width at the surface is conservative. The volume of contaminated soils has been estimated assuming that 6 inches of the soil material beneath the bottom of each of the ponds would need to be removed. Based on these engineering judgments, the estimated volume of contaminated soil associated with Pond Nos. 2 and 3 is 1,597 cubic yards. Using an estimated soil density of 100 pounds per cubic foot, the estimated contaminated soil weight is 2,156 tons.

Table 15-8 provides costs associated with the excavation, loading, hauling, transportation, and disposal of the Pond Nos. 2 and 3 contaminated soils in their existing state. The table also includes site restoration (backfilling) costs. Costs associated with each of the activities presented in this table were developed from costing information presented in the RSMeans 2002 Heavy Construction and Site Worker Cost Data and from engineering and construction experiences. Drying of the soils, as considered with the residues, was not included in this cost estimate. Unsaturated soil has a typical moisture content of 10 to 20 percent. Based on this information, the soils would not produce free liquid during shipping and drying and would not be a cost-effective technique for managing these soils. The total estimated cost for performing the remediation of the Pond Nos. 2 and 3 contaminated soils is approximately $339,595 for disposal at WCS. (Reference MHF Letter Quote, February 8, 2001 and WCS Letter Quote, December 4, 2000. The WCS quote was updated by WCS Letter Quote, December 3, 2002).

15.1.6 Radiologically Impacted Structures

15.1.6.1 Buildings

All of the floor and wall internal surfaces will be wiped down at a cost of \$0.05 per square foot (ft^2). Approximately 186,860 ft^2 of floor and wall surface area will be wiped at a cost of \$14,587. In addition, 10 percent of the floor surface (9,580 ft^2) is assumed to require more aggressive decontamination effort. Scabbling and scraping one-quarter to one-half inch of concrete costs \$78.84 per ft^2 and results in an additional \$755,233 in cost and 3,592 ft^3 of construction debris. The small volume of debris could be shipped with soils at \$141.26 per ton to WCS resulting in an additional cost of \$28,191. (Reference MHF Letter Quote, February 8, 2001 and WCS Letter Quote, December 4, 2000. The WCS quote was updated by WCS Letter Quote, December 3, 2002.) The cost to remediate building structures is approximately \$798,011.

15.1.6.2 Equipment

Equipment that has not been used to process radioactive material but is located in impacted structures will require wipe down and final survey of exterior surfaces as part of decommissioning. Exterior surfaces will be decontaminated by the performance of wipe downs and/or more aggressive remediation efforts when required. The majority of site equipment falls in this category. The remaining equipment has been used to process radioactive material and may have internal contamination. Internally contaminated plant equipment will require deconstruction prior to wipe down and survey. Some equipment used in the processing of radioactive material may have inaccessible areas and require disposal as LLR waste. Cost for the decontamination and/or disposal of equipment is estimated at \$880,000.

15.1.6.3 Structures Cost Summary

The total cost of decontamination and/or disposal of impacted structures is estimated as \$1,678,011.

15.1.7 Facility Radiological Survey and HP Support

A list of the tasks associated with the facility radiological survey and general HP support is provided in Table 15-9. A facility radiological FSS is required in conjunction with the remediation activities to determine if residual radiation met the requirements of the DP. A site survey using the guidance of NUREG-1575, MARSSIM is costed in Table 15-9 for open land areas and structures. The cost for structure surveys includes the surveys of remaining plant equipment. Based on this information, the anticipated cost of the facility radiological FSS is approximately \$830,000. The cost includes analytical analysis and HPT support. In addition, HPT support during decommissioning activities, including remediation surveys, radiological H&S functions, and transportation and shipping of radioactive material, is estimated over a 10-year time period. The cost of a full-time HPT over a 10-year time period is estimated as $900,000. The total cost is estimated as $1,730,000.

15.1.8 MISC Costs

MISC costs are an estimation of additional costs required in NUREG-1727 not captured in the previous sections of this report. MISC costs include the following:

- Insurance – The annual cost of insurance for the site is estimated at $87,500.
- License Fees – Annual license fees (does not include additional NRC on-site oversight of decommissioning activities) estimated at $70,000.
- Taxes – The annual cost of taxes is estimated as $40,000.

The sum of the annual costs is approximately $197,500 per year. Assuming a 10-year schedule, the total of these annual costs would be $1,975,000. In addition, the cost of NRC oversight of decommissioning activities has been estimated and included as an MISC cost. The total NRC oversight cost is estimated as $350,000 based on $100,000 to review the DP and approximately $25,000 per year for on-site inspections of decommissioning activities over a 10-year time period. The total MISC cost is $2,325,000.

15.1.9 Summary of Costs

The total estimated cost for decommissioning of the Fansteel facility based on the available information at the time of this report has been summarized in Table 15-10. The total estimated cost is $26.5 million.

15.2 Key Assumptions

Fansteel has assumed the following when preparing the decommissioning activity cost schedules:

- Costing data for excavation and loading are based on information provided in the RSMeans 2002 Heavy Construction Cost Data and engineering/construction experiences. The estimated cost is $7.94 per cubic yard of residue material as mined.
- Costing data for hauling are based on information provided in the RSMeans 2002 Site Worker Construction Cost Data and engineering/construction experiences. The estimated cost is $5.29 per cubic yard of residue material as mined.
- Costing data for backfilling are based on information provided in the RSMeans 2002 Site Worker Construction Cost Data and engineering/construction experiences. The estimated cost is $8.70 per cubic yard of residue material as mined.

- Costing for drying is based on engineering/construction experiences using air drying, transport equipment, and the appropriate manpower ($8.65 per cubic yard, American Waste Services Remediation, 2002).

- Costing data for transportation and reclamation of Ponds Nos. 2 and 3 residues are based on pricing provided by IUC to Fansteel to recycle and dispose of CaF, WIP, and soil. The cost has been quoted at $190.25 per ton. The residues to be shipped have been dried to 80 percent solids. (Reference MHF Letter Quote, February 8, 2001 and IUC Letter Quote, March 16, 2001.)

- The specific gravity of the solids and the pond percent solids for Ponds Nos. 2, 3, 8, and 9 were taken from the report completed by Mr. Dennis J. LaPoint for PMET dated September 12, 2000. The specific gravity and percent solids for Pond Nos. 5, 6, and 7 were assumed to be similar to the values for Pond Nos. 8 and 9.

- The average depth of the Pond Nos. 2, 3, 5, 6, 7, 8, and 9 was based on the results of the pond sampling events performed as part of the 1993 RA.

- The average length and average width of Pond No. 3 were based on the Pond No. 3 contour map dated September 11, 1978 and the site drawings provided in the Construction Certification Report dated December 15, 1999.

- The calculations for the volume of residues in Pond No. 3 utilize a slope for the sidewalls of 3:1 as indicated on the Pond No. 3 contour map dated September 11, 1978.

- The calculations for the volume of residues in Pond No. 2 utilize a slope for the sidewalls of 3:1 assuming that Pond No. 2 would have a construction similar to Pond No. 3. No drawings were available for Pond No. 2.

- The average width, average length, and 1.67H:1.00V slope of Pond No. 6 were based on the Pond No. 6 Design Drawing dated March 7, 1972 and the site drawings provided in the Construction Certification Report dated December 15, 1999.

- The average width and average length of Pond Nos. 5 and 7 were based on the site drawings provided in the Construction Certification Report dated December 15, 1999 with a slope equal to Pond No. 6. No drawings were available for these ponds.

- The average width, average length, and 2.0H:1.0V slope of Pond No. 8 were based on the Pond No. 8 Liner Layout Drawing dated August 3, 1976 and the site drawings provided in the Construction Certification Report dated December 15, 1999.

- The average width, average length, and 1.5H:1.0V slope of Pond No. 9 were based on the Pond No. 9 Boring Location Drawing dated October 30, 1989 and the site drawings provided in the Construction Certification Report dated December 15, 1999.

- Costing data for transportation and disposal based on pricing provided by WCS to Fansteel for CaF (exempt quantities). The cost has been quoted at $129.26 per ton and includes MHF transportation and state tax. The residues to be shipped have been dried to 80 percent solids. (Reference MHF Letter Quote, February 8, 2001 and WCS Letter Quote, December 4, 2000. The WCS quote was updated by WCS Letter Quote, December 3, 2002.) Estimated cubic yards of soil for Areas 1 through 5 were based on the projected volume of radiologically affected soils from core boring data and physical boundaries. Soil weight is calculated assuming a soil density of 100 pounds per cubic foot.

- Estimated tons of Super Sack Soils are taken from current site information provided by Fansteel. Estimated cubic yards of these soils assume a density of 100 pounds per cubic feet.
- Costing data for transportation and disposal of soil were based on pricing provided by WCS to Fansteel for soil (exempt quantities). The cost has been quoted at $141.26 per ton. (Reference MHF Letter Quote, February 8, 2001 and WCS Letter Quote, December 4, 2000. The WCS quote was updated by WCS Letter Quote, December 3, 2002.)
- The average depth of affected soils beneath the ponds is estimated based on facility observations, groundwater sampling data, and engineering judgment.
- The estimation of open land areas to be surveyed are based on Figure 4-1 and include anticipated walls of excavated areas and areas beneath existing ponds.
- Soil survey costs were based on gross gamma scans of open land surface areas at $1 per m^2, $200 per soil sample including analytical analyses and 11 samples per survey unit.
- Structure survey costs were based on gross alpha and gross beta scans of structural surfaces at $27 per m^2, $20 per smear sample analysis, 14 samples per unit.
- Assume 50 percent of Class 2 survey unit area will be surveyed.
- Assume 10 percent resurveys of open land and structures.
- Decommissioning activities take place over a 10-year period.
- An independent third-party contractor will <u>not</u> perform decommissioning activities.
- Decommissioning activities that are not necessary to terminate the materials license (e.g., removal or disposal of nonradioactive structures and materials) will not be conducted.
- The cost estimate does not take credit for any salvage value that might be realized from the sale of potential assets (e.g., recovered materials or decontaminated equipment) during or after decommissioning.

15.3 Financial Assurance Mechanism

The amount and type of financial assurance to be provided in connection with the DP described herein will be set forth in a Plan of Reorganization that Fansteel currently intends to file with the Bankruptcy Court on or before February 17, 2003. The Plan of Reorganization, among other things, will set forth with particularity the terms and conditions of the financial instruments proposed to be given in satisfaction of Fansteel's financial assurance requirements under the proposed DP. Fansteel will continue its efforts to negotiate acceptable terms of such financial assurance. However, in the event that an acceptable

Decommissioning Funding Plan cannot be developed, Fansteel reserves all of its rights and remedies under applicable law.

15.4 Comparison of the Cost Estimate to the Current Level of Financial Assurance

Refer to Section 15.3.

15.5 Means for Adjusting the Cost Estimate and Associated Funding Level

Refer to Section 15.3.

References

1. Bierschbach, M. C., D. R. Haffner, K. J. Schneider, and S. M. Short, "Revised Analyses of Decommissioning Reference Non-Fuel-Cycle Facilities," NUREG/CR-6477, July 1998.

2. NUREG/CR-2241, "Technology and Costs of Termination Surveys Associated with Decommissioning of Nuclear Facilities."

3. NUREG-1307, "Report on Waste Burial Charges," Revision 8, December 1998.

4. Policy and Guidance Directive FC 90-2, "Standard Review Plan for Evaluating Compliance with Decommissioning Requirements for Source, Byproduct, and Special Nuclear Material License Applications," April 1991.

5. Witherspoon, J., "Technology and Cost of Termination Surveys Associated with Decommissioning of Nuclear Facilities," NUREG/CR-2241, February 1982.

6. Hochstein, R. F., Proposal to Recycle and Dispose of Fansteel Muskogee Acidic Residues ("WIP") Alternate Feed Materials, March 16, 2001.

7. LeClaire, P., Transportation of 12,000 – 15,000 tons of Low-Level Radioactive Soil from Muskogee, Oklahoma, to IUC in Blanding, Utah, February 8, 2001.

8. Dornsife, W. P., Letter Quote, December 4, 2000.

9. LeClaire, P., Transportation of approximately 7,000 tons of Low-Level Radioactive Soil from Muskogee, Oklahoma, to WCS in Andrews, Texas, February 8, 2001.

10. Dornsife, W. P., Letter Quote, December 3, 2002.

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Tables

Table No. 15-1
Fansteel Inc. - Muskogee Facility
Estimated Volumes and Quantities
of Residues Associated with Pond Nos. 2 and 3

Pond	Specific Gravity of Solids	Pond - % Solids by Weight	Average Residue Depth (ft)	Average Pond Width (ft)	Average Pond Length (ft)	Residue Volume (cu yd)	Material - Wet Weight (tons)	Material - Dry Weight (tons)
No. 2	2.72	50	11	120	300	9,464	11,653	5,826
No. 3	2.73	40	13	158	318	15,986	18,030	7,212
TOTALS						25,449	29,683	13,038

Notes:
1) The specific gravity of the solids and the pond percent solids were taken from the report completed by Mr. Dennis J. LaPoint for PMET dated September 12, 2000.
2) The average depth of the ponds was based on the results of the pond sampling events performed as part of the 1993 Remedial Assessment.
3) The average length and average width of the ponds were based on the Pond No. 3 contour map dated September 11, 1978 and the site drawings provided in the Construction Certification Report dated December 15, 1999.
4) The calculations for the volume of residues in Pond No. 3 utilize a slope for the sidewalls of 3:1 as indicated on the Pond No. 3 contour map dated September 11, 1978.
5) The calculations for the volume of residues in Pond No. 2 utilize a slope for the sidewalls of 3:1 assuming that Pond No. 2 would have a construction similar to Pond No. 3. No drawings were available for Pond No. 2.

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Table No. 15-2
Fansteel Inc. - Muskogee Facility
Costs Associated with Disposal (at IUC)
of Pond Nos. 2 and 3 Residues Dry (80% Solids by Weight)

Pond	Residue Volume (cu yd)	Material - Dry Weight (tons)	Excavation and Loading	Hauling	Backfilling	Drying	Transport and Reclamation	Total Cost per Pond
No. 2	9,464	5,826	$75,142	$50,063	$82,334	$81,861	$1,385,574	$1,674,972
No. 3	15,986	7,212	$126,926	$84,564	$139,075	$138,276	$1,715,116	$2,203,957
TOTALS	25,449	13,038	$202,068	$134,627	$221,409	$220,137	$3,100,689	**$3,878,930**

Cost per Cubic Yard : $152

Notes:

1) Costing data for excavation and loading are based on information provided in the RSMeans 2002 Heavy Construction Cost Data and engineering/construction experiences. The estimated cost is $7.94/cubic yard of residue material as mined.
2) Costing data for hauling are based on information provided in the RSMeans 2002 Site Worker Construction Cost Data and engineering/construction experiences. The estimated cost is $5.29/cubic yard of residue material as mined.
3) Costing data for backfilling are based on information provided in the RSMeans 2002 Site Worker Construction Cost Data and engineering/construction experiences. The estimated cost is $8.70/cubic yard of residue material as mined.
4) Costing for drying is based on engineering/construction experiences using air drying, transport equipment, and the appropriate manpower ($8.65/cu yd, AWSR).
5) Costing data for transportation and reclamation based on pricing provided by IUC to Fansteel to recycle CaF, WIP and soil. The cost has been quoted at $190.25/ton. The residues to be shipped have been dried to 80 percent solids.

Table No. 15-3
Fansteel Inc. - Muskogee Facility
Estimated Volumes and Quantities
of Residues Associated with Pond Nos. 5, 6, 7, 8, and 9

Pond	Specific Gravity of Solids	Pond - % Solids	Average Residue Depth (ft)	Average Width (ft)	Average Length (ft)	Residue Volume (cu yd)	Material - Wet Weight (tons)	Material - Dry Weight (tons)
No. 5	2.8	30	4.5	75	130	1,378	1,437	431
No. 6	2 8	30	3.0	100	160	1,636	1,706	512
No. 7	2 8	30	3 0	120	205	2,555	2,666	800
No. 8	2.8	30	25	350	350	83,333	86,932	26,079
No. 9	2.8	30	24	215	565	84,170	87,804	26,341
TOTALS						**173,072**	**179,108**	**54,163**

Notes·

1) The specific gravity of the solids and pond percent solids were taken from a report completed by Mr. Dennis J. LaPoint for PMET dated September 12, 2000.
2) The specific gravity and percent solids for Pond Nos 5, 6, and 7 were assumed to be similar to the values for Pond Nos. 8 and 9 as provided in the previously mentioned report by Mr. Dennis J. LaPoint.
3) The average width, average length, and 1.67H:1.00V slope of Pond No. 6 were based on the Pond No. 6 Design Drawing dated March 3, 1972 and the site drawings provided in the Construction Certification Report dated December 15, 1999
4) The average width and average length of Pond Nos. 5 and 7 were based on the site drawings provided in the Construction Certification Report dated December 15, 1999 with a slope equal to Pond No 6. No drawings were available for these ponds.
5) The average width, average length, and 2.0H:1.0V slope of Pond No. 8 were based on the Pond No. 8 Liner Layout Drawing dated August 3, 1976 and the site drawings provided in the Construction Certification Report dated December 15, 1999.
6) The average width, average length, and 1.5H:1.0V slope of Pond No. 9 were based on the Pond No. 9 Boring Location Drawing dated October 30, 1989 and the site drawings provided in the Construction Certification Report dated December 15, 1999.
7) The average depth of the ponds was based on the results of the pond sampling events performed as part of the 1993 Remediation Assessment.

Table No. 15-4
Fansteel Inc. - Muskogee Facility
Costs Associated with Disposal (at WCS)
of Pond Nos. 5, 6, 7, 8, and 9 Residues Dry (80% Solids)

Pond	Residue Volume (cu yd)	Material - Dry Weight (tons)	Excavation and Loading	Hauling	Backfilling	Drying	Transport and Disposal	Total Cost per Pond
No. 5	1,378	431	$10,939	$7,288	$11,986	$11,917	$69,662	$111,790
No. 6	1,636	512	$12,989	$8,654	$14,232	$14,150	$82,717	$132,741
No. 7	2,555	800	$20,288	$13,517	$22,230	$22,103	$129,205	$207,343
No. 8	83,333	26,079	$661,667	$440,833	$725,000	$720,833	$4,213,794	$6,762,127
No. 9	84,170	26,341	$668,308	$445,258	$732,277	$728,069	$4,256,089	$6,830,001
TOTALS	173,072	54,163	1,374,190	915,550	1,505,725	1,497,071	8,751,467	**$14,044,002**

Cost per Cubic Yard : $81

Notes:
1) Costing data for excavation and loading are based on information provided in the RSMeans 2002 Heavy Construction Cost Data and engineering/construction experiences. The estimated cost is $7.94/cubic yard of residue material as mined.
2) Costing data for hauling are based on information provided in the RSMeans 2002 Site Worker Construction Cost Data and engineering/construction experiences. The estimated cost is $5.29/cubic yard of residue material as mined.
3) Costing data for backfilling are based on information provided in the RSMeans 2002 Site Worker Construction Cost Data and engineering/construction experiences. The estimated cost is $8.70/cubic yard of residue material as mined.
4) Costing for drying is based on engineering/construction experiences using air drying, transport equipment, and the appropriate manpower ($8.65/cubic yard, AWSR).
5) Costing data for transportation and disposal based on pricing provided by WCS to Fansteel for CAF (exempt quantities). The cost has been quoted at $129.26/ton and includes MHF transportation and state tax. The residues to be shipped have been dried to 80 percent solids.

Table No. 15-5
Fansteel Inc. - Muskogee Facility
Estimated Volumes and Quantities
of Radiologically Affected Soil Areas

Soil Areas	Description	Dimensions (ft)	Soil Volume (cu yd)	Soil Weight (tons)
Area 1 (Former Area III a and b)	Impacted soil surrounding Boring B-36 Bounded by the Chemical "C" building south, Pond No. 3 west, Pond No 2 east, and Boring B-38 and MW-72S north	110 x 210 x 10 ft deep	8,556	11,550
Area 2 (portion of Former Area II)	Impacted soil surrounding Borings B-55 and 56, north of the Bertha Building, shallow contamination	50 x 75 x 2 5 ft deep	347	469
Area 3 (Former Area VII a)	Impacted soil surrounding Boring B-73, east of the Bertha Building, 10' deep contamination.	20 x 20 x 10 ft deep	148	200
Area 4	Impacted soil surrounding Boring B-51, south of the Bertha Building, 4' deep contamination	20 x 20 x 4 ft deep	59	80
Area 5 (Former Area VI b)	Impacted soil surrounding Boring B-65, south of the Bertha Building, 20' deep contamination.	20 x 20 x 20 ft deep	296	400
Super Sack Soils	----		741	1,000
TOTALS			**10,147**	**13,699**

Notes:
1) Estimated cubic yards of soil for Areas 1 through 5 based on the projected volume of radiological affected soils from core boring data and physical boundaries Soil weight is calculated assuming a soil density of 100 pounds per cubic foot
2) Estimated tons of Super Sack Soils are taken from current site information provided by Fansteel Estimated cubic yards of these soils assume a density of 100 pounds per cubic feet.

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Table No. 15-6
Fansteel Inc. - Muskogee Facility
Costs Associated with Disposal (at WCS) of Radiologically Affected Soil Areas

Radiologically Affected Soils	Soil Volume (cu yd)	Soil Weight (tons)	Excavation and Loading	Hauling	Backfilling	Transport and Deposal	Total Cost per Area
Area 1	8,556	11,550	$67,931	$45,259	$74,433	$1,631,553	$1,819,176
Area 2	347	469	$2,757	$1,837	$3,021	$66,216	$73,830
Area 3	148	200	$1,176	$784	$1,289	$28,252	$31,501
Area 4	59	80	$471	$313	$516	$11,301	$12,600
Area 5	296	400	$2,353	$1,567	$2,578	$56,504	$63,002
Super Sacks	741	1,000	$0	$3,919	$0	$141,260	$145,179
TOTALS	10,147	13,699	$74,687	$53,679	$81,836	$1,935,085	**$2,145,288**

Cost per Cubic Yard : $211

Notes:

1) Costing data for excavation and loading are based on information provided in the RSMeans 2002 Heavy Construction Cost Data and engineering/construction experiences. The estimated cost is $7.94/cubic yard of residue material as mined.
2) Costing data for hauling are based on information provided in the RSMeans 2002 Site Worker Construction Cost Data and engineering/construction experiences. The estimated cost is $5.29/cubic yard of residue material as mined.
3) Costing data for backfilling are based on information provided in the RSMeans 2002 Site Worker Construction Cost Data and engineering/construction experiences. The estimated cost is $8.70/cubic yard of residue material as mined.
4) Costing data for transportation and disposal of soil based on pricing provided by WCS to Fansteel for soil (exempt quantities). The cost has been quoted at $141.26/ton.

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Table No. 15-7
Fansteel Inc. - Muskogee Facility
Estimated Volumes and Quantities of Contaminated Soils Associated with Pond Nos. 2 and 3

Pond	Average Pond Depth (ft)	Average Depth of soil on bottom (ft)	Average Pond Width (ft)	Average Pond Length (ft)	Estimated Volume of Soil (cu yd)	Soil Weight (tons)
No. 2	11	0.5	120	300	667	900
No. 3	13	0.5	158	318	930	1,256
TOTALS					**1,597**	**2,156**

<u>Notes</u>:

1) The average depth of the ponds was based on the results of the pond sampling events performed as part of the 1993 Remedial Assessment.
2) The average depth of affected soils beneath the ponds is estimated based on facility observations, groundwater sampling data, and engineering judgment.
3) The average length and average width of the ponds were based on the Pond No. 3 contour map dated September 11, 1978 and the site drawings provided in the Construction Certification Report dated December 15, 1999.
4) The calculations for the volume of soils associated with Pond No. 3 utilize a slope for the sidewalls of 3:1 as indicated on the Pond No. 3 contour map dated September 11, 1978.
5) The calculations for the volume of soils associated with Pond No. 2 utilize a slope for the sidewalls of 3:1 assuming Pond No. 2 would have a construction similar to Pond No. 3. No drawings were available for Pond No. 2.
6) The soil weight was calculated assuming a soil density of 100 pounds per cubic feet.

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Table No. 15-8
Fansteel Inc. - Muskogee Facility
Costs Associated with Disposal (at WCS) of Pond No. 2 and Pond No. 3 Contaminated Soils

Pond	Soil Volume (cu yd)	Soil Weight (tons)	Excavation and Loading	Hauling	Backfilling	Transport and Disposal	Total Cost per Pond
No. 2	667	900	$5,293	$3,527	$5,800	$127,134	$141,754
No. 3	930	1,256	$7,388	$4,922	$8,095	$177,437	$197,841
TOTALS	1,597	2,156	$12,681	$8,449	$13,895	$304,571	$339,595

Cost per Cubic Yard : $213

Notes:
1) Costing data for excavation and loading are based on information provided in the RSMeans 2002 Heavy Construction Cost Data and engineering/construction experiences. The estimated cost is $7.94/cubic yard of residue material as mined.
2) Costing data for hauling are based on information provided in the RSMeans 2002 Site Worker Construction Cost Data and engineering/construction experiences. The estimated cost is $5.29/cubic yard of residue material as mined.
3) Costing data for backfilling are based on information provided in the RSMeans 2002 Site Worker Construction Cost Data and engineering/construction experiences. The estimated cost is $8.70/cubic yard of residue material as mined.
4) Costing data for transportation and disposal of soil based on pricing provided by WCS to Fansteel for soil (exempt quantities). The cost has been quoted at $141.26/ton.

Table No. 15-9
Fansteel Inc. - Muskogee Facility
Costs Associated with Survey of Properties
for Release including Pond Areas and Buildings and Additional Health Physics Support

No.	Site Survey Tasks	Total Area (m^2)	Area (m^2)			Number of Survey Units			Estimated Cost
			Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	
1	Open Land Area Surveys	291,500	60,232	124,901	79,833	41	13	2	$278,183
3	Structure Surveys	37,104	29,683	7,421	0	150	6	0	$475,483
4	Resurvey of Open Land Areas								$27,818
5	Resurvey of Structures								$47,548
6	General HP Support								$900,000
	TOTAL COST :								$1,730,000

Notes:
1) Costs do not include surveying of the Northwest properties.
2) The open land areas are based on Figure X of the 2002 DP and include anticipated walls of excavated areas and areas beneath existing ponds.
3) Soil survey costs based on $1/m^2 to survey and $200/soil sample including analytical analyses, 11 samples per unit.
4) Structure survey costs based on $27/m^2 to survey and $20/smear sample analysis, 14 samples per unit.
5.) Assume 50 percent of Class 2 survey unit area will be surveyed.
6.) Assume 10 percent resurveys of open land and structures.
7.) General HP Support includes 1 HPT for a 10-year time period.

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Table No. 15-10
Fansteel Inc. - Muskogee Facility
Summary of Total Estimated Decommissioning Costs

No.	Remediation Items	Cost
1	Planning and Preparation	$324,000
2	Pond Nos. 2 and 3 Residues	$3,878,930
3	Pond Nos. 5, 6, 7, 8, and 9 Residues	$14,044,002
4	Radiologically Affected Soils Areas	$2,145,288
5	Pond Nos. 2 and 3 Contaminated Soils	$339,595
6	Structures	$1,678,011
7	Facility Radiological Survey	$1,730,000
8	MISC Cost	$2,325,000
	TOTAL COST :	$26,464,826

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Appendix 15-1

NUREG-1727 Appendix F Cost Estimate

Appendix 15-1
NUREG-1727 Appendix F Cost Estimate

An independent estimate of decommissioning costs for the Fansteel Muskogee site was prepared using the guidance of NUREG-1727 Appendix F. Cost tables for the following areas are included in this appendix:

- Impacted Soil
- Pond Nos. 2 and 3
- Pond Nos. 5, 6, 7, 8, and 9
- Chem A Building 1st Floor
- Chem A Building 3rd Floor
- Chem A Building 4th Floor
- Chem C Building
- Bertha Building
- Weir Building
- R&D Building 1st Floor
- R&D Building 2nd Floor
- Thermite Building
- Sodium Reduction Building Concrete Pad
- Groundwater Treatment Building

The estimated costs for each area are summarized in the following table. The total cost estimated using the cost forms is $26.4 million.

Area	Cost ($)	Area	Cost ($)
Impacted Soil	4,207,275	Bertha Building	47,813
Pond Nos. 2 and 3	5,847,859	Weir Building	54,478
Pond Nos. 5, 6, 7, 8 and 9	14,944,624	R&D Building 1st Floor	114,262
Chem A Building 1st Floor	349,812	R&D Building 2nd Floor	59,527
Chem A Building 3rd Floor	174,337	Thermite Building	75,176
Chem A Building 4th Floor	286,997	Na Reduction Building Pad	47,647
Chem C Building	161,382	GW Treatment Building	72,382

Fansteel Inc., Muskogee, Oklahoma
Bertha Building

Table 1. Bertha Building - General Description

NRC Materials License No. SMB-911 (§40)
Types and Quantities of Materials Authorized 1) 43,000 Kg natural uranium & 71,000 Kg natural thorium Source material possessed as tin slags, ores, process residues and oxides and 2) 4,000 Kg of U and 2,500 Kg of Th as a contaminant in soils and sediment on site.
Description of Licensed Material Use Possession, use, short term storage, and transfer of U and Th and their progenies contained in processing residues including residue processing, metal reclamation, decommissioning and site restoration.
Facility Description The Bertha Building was constructed in 1999 and has one room that was used for a mini laboratory for pilot projects. The building is constructed of wood with corrugated metal.
Quantities of Licensed Materials or Waste Accumulated Before Shipping and Disposal

Table 2. Bertha Building - Component Inventory

Level of Radioactive Contamination Average total alpha contamination is 396 dpm/100 cm2 with maximum of 2,136 dpm/100 cm2.
Level of Non-Radioactive Contamination N/A

	Component	Number of Components	Component Dimensions ( )	Total Dimensions (ft2)
1.	Floor			660
2.	Walls and Horizontals			2725
3.				
4.				
5.				
6.				
	Total Area			3385

Fansteel Inc., Muskogee, Oklahoma
Bertha Building

Table 3. Bertha Building - Planning and Preparation

Activity	HPS/DM	Industrial Hygiene/ Safety/RSO	Corporate and Site Project Mngr	Const. Supervisor	HP Tech & Laborer	Clerical/ Production	DM & CPM Multiplier Manual Entry
Preparation of Documentation for Regulatory Agencies	15	2	2			2	2
Submittal of DP to NRC	10	2	3	5		2	
Development of Work Plans	40	10	10	25		6	
Procurement of Special Equipment							
Staff Training	15	4	2				
Radiological Characterization	1						
Other							
TOTAL	81	17	16	30	0	10	

Table 4. Bertha Building - Component Decontamination and Dismantling

	Component	Decon Method	HP	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician & Laborer	Clerical/ Production
1.	Floor	Wipe Down	1.3	1.3	1.3	2.0	6.6	1.3
2.	Walls and Horizontals	Wipe Down	5.5	5.5	5.5	8.2	27.3	5.5
3.								
4.								
5.								
6	Floor (10%)	Scabble	0.0	0.0	0.0	0.0	0 0	0 0
TOTAL			6.8	6 8	6.8	10 2	33.9	6.8

Fansteel Inc., Muskogee, Oklahoma
Bertha Building

Table 5. Bertha Building - Restoration of Contaminated Areas on Facility Grounds

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician& Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0.0	0 0	0 0	0 0	0.0

Table 6. Bertha Building - Final Radiation Survey

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician& Laborer	Clerical/ Production
Area Prep & Set-up (Grid, Maps, Scaffold)	4 5	3.0	3 0	4.5	15.0	3.0
Survey and Sampling Surfaces & Compnts	6.8	4.5	4.5	6 8	22.6	4.5
TOTAL	11.3	7.5	7.5	11.3	37.6	7.5

Fansteel Inc., Muskogee, Oklahoma
Bertha Building

Table 7. Bertha Building - Stabilization and Long-Term Surveillance

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician& Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0

Table 8. Bertha Building - Labor Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician& Laborer	Clerical/ Production
Planning and Preparation	81.0	17.0	16.0	30.0	0.0	10.0
Decon/Dismantlement	6.8	6.8	6 8	10.2	33.9	6.8
Restoration of Grounds	0.0	0.0	0.0	0.0	0.0	0.0
Final Radiation Survey	11.3	7.5	7.5	11.3	37.6	7.5
Site Stabilization/Surveillance	0.0	0.0	0.0	0 0	0.0	0.0
TOTAL	99.1	31.3	30.3	51.4	71.5	24.3

Table 9. Bertha Building - Worker Unit Cost Schedule

Labor Cost Component	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician& Laborer	Clerical/ Production
Loaded Salary ($/Hour)	$80	$70	$85	$85	$70	$20
Overhead Rate (%)						
Total Annual Cost						
Total Workday Cost (__ workdays/year)						

Fansteel Inc., Muskogee, Oklahoma
Bertha Building

Table 10. Bertha Building - Labor Cost Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician & Laborer	Clerical/ Production	Total Cost
Planning and Preparation	$6,480	$1,190	$1,360	$2,550	$0	$200	$11,780
Decon/Dismantlement	$542	$474	$575	$863	$2,370	$135	$4,959
Restoration of Grounds	$0	$0	$0	$0	$0	$0	$0
Final Radiation Survey	$903	$527	$639	$959	$2,633	$150	$5,811
Site Stabilization/Surveillance	$0	$0	$0	$0	$0	$0	$0
TOTAL	$7,924	$2,190	$2,575	$4,372	$5,002	$486	$22,550

Table 11. Bertha Building - Radioactive Waste Packaging Costs

Waste Type	Volume (m^3)	Number of Containers	Type of Container	Unit Cost of Container	Total Packaging Cost
DAW/PPE/Rags/Debris	0.7	0 2	B-25	$600	$145
					$0
					$0
					$0
					$0
TOTAL	0.7	N/A	N/A	N/A	$145

Table 12. Bertha Building - Radioactive Waste Shipping Costs

Waste Type	Number of Loads	Unit Cost ($/mile/load)	Surcharges ($/mile)	Overweight Charges ($/mile)	Distance Shipped (miles)	Total Shipping Cost
DAW/PPE/Rags/Debris	0.03	$0	$1	$1	$1	$0
						$0
						$0
						$0
						$0
TOTAL	N/A	N/A	N/A	N/A	N/A	$0

Fansteel Inc., Muskogee, Oklahoma
Bertha Building

Table 13. Bertha Building - Radioactive Waste Shipping and Disposal Costs

Waste Type	Disposal Volume (m^3)	Unit Cost ($/$m^3$)	Surcharges ($/$m^3$ or $/container)	Total Disposal Cost
DAW/PPE/Rags/Debris	0.7	$100	$1	$68
	0.0			$0
	0.0			$0
	0.0			$0
	0.0			$0
TOTAL	N/A	N/A	N/A	$68

Table 14. Bertha Building - Equipment/Supply Costs (excluding containers)

Equipment/Supplies	Quantity/Crew	Unit Cost	Total Cost	
Direct Alpha & Gamma NaI	1.0	$350	$350	
Removable Alpha	1.0	$350	$350	
PPE/Ras-1/Personal Pump	1.0	$400	$400	
Scabbler, HEPA Vac	0.0	$500	$0	Rent/Buy
Rolling Scaffold	1.0	$200	$200	
TOTAL	N/A	N/A	$1,300	

Table 15. Bertha Building - Independent Third-Party Laboratory Costs

Activity	Total Cost	
Sampling		
Transport of Samples		
Testing/Analyses-	$500	per Floor
TOTAL	$500	

Table 16. Bertha Building - Miscellaneous Costs

Cost Item	Total Cost
License Fees	$7,000
Insurance	$8,750
Taxes	$4,000
NRC Oversight	$3,500
TOTAL	$23,250

Fansteel Inc., Muskogee, Oklahoma
Bertha Building

Table 17. Bertha Building - Total Decommissioning Costs Rollup

Task/Component	Cost	Percentage
Planning and Preparation	$11,780	25%
Decontamination/Dismantlement	$4,959	10%
Grounds Restoration	$0	0%
Final Radiation Survey	$5,811	12%
Site Stabilization and Surveillance	$0	0%
Waste Packaging	$145	0%
Waste Shipment	$0	0%
Waste Shipment and Disposal	$68	0%
Equipment/Supplies	$1,300	3%
Independent Third-Party Laboratory	$500	1%
Miscellaneous	$23,250	49%
Total Decommissioning Cost Estimate	$47,813	100%

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Fansteel Inc., Muskogee, Oklahoma
Chem A Building

Table 1. Chem A Building - General Description

NRC Materials License No. SMB-911 (§40)
Types and Quantities of Materials Authorized 1) 43,000 Kg natural uranium & 71,000 Kg natural thorium Source material possessed as tin slags, ores, process residues and oxides and 2) 4,000 Kg of U and 2,500 Kg of Th as a contaminant in soils and sediment on site.
Description of Licensed Material Use Possession, use, short term storage, and transfer of U and Th and their progenies contained in processing residues including residue processing, metal reclamation, decommissioning and site restoration.
Facility Description The Chemical A Building contains equipment used for ore processing activities including scrubbers, heaters, boilers, piping, air compressors, tanks, vessels, laboratories, and electrical control panels. Former operations included electron beam melting of uranium, chemical purification of tantalum, and storage of feed material. The Building is constructed of concrete brick walls with a 10" gap to the outside brick wall and has a concrete floor and roof.
Quantities of Licensed Materials or Waste Accumulated Before Shipping and Disposal

Table 2. Chem A Building - First Floor Component Inventory

Level of Radioactive Contamination
Highest average total alpha contamination of 305 dpm/100 cm2 with maximum of 1,924 dpm/100 cm2 per room or component on the first floor.

Level of Non-Radioactive Contamination
N/A

	Component	Number of Components	Component Dimensions ( )	Total Dimensions (ft2)
1.	Floor			10179
2.	Walls and Horizontals			38489
3.	Compressors	2		792
4.	Boilers	3		1912
5.	Tanks, Cylinders, Silos, Cylindrical Equip	81		29557
6.				
	Total Area			80929

Fansteel Inc., Muskogee, Oklahoma
Chem A Building

Table 3. Chem A Building - First Floor Planning and Preparation

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Corporate and Site Project Mngr	Const. Supervisor	HP Technician & Laborer	Clerical/ Production	DM & CPM Multiplier Manual Entry
Preparation of Documentation for Regulatory Agencies	15.0	1.5	1.5			2.0	1.5
Submittal of DP to NRC	10.0	1.5	3 0	5 0		2.0	
Development of Work Plans	40.0	10.0	10.0	25 0		6.0	
Procurement of Special Equipment							
Staff Training	15 0	4.0	1.5				
Radiological Characterization	1.0						
Other							
TOTAL	81.0	17.0	16.0	30.0	0.0	10 0	

Table 4. Chem A Building - First Floor Component Decontamination and Dismantling

	Component	Decon Method	HP	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician& Laborer	Clerical/ Production
1.	Floor	Wipe Down	20 4	20.4	20.4	30.5	101.8	20.4
2.	Walls and Horizontals	Wipe Down	77.0	77.0	77.0	115.5	384.9	77.0
3.	Compressors	Wipe Down	1.6	1.6	1.6	2.4	7.9	1.6
4.	Boilers	Wipe Down	3.8	3.8	3 8	5.7	19.1	3.8
5.	Tanks/Cylinders/Silos	Wipe Down	59.1	59.1	59.1	88.7	295.6	59.1
6.	Floor (10%)	Scabble	4.5	4.5	4.5	6.8	22.6	4.5
	TOTAL		166.4	166 4	166 4	249.6	831.9	166.4

Fansteel Inc., Muskogee, Oklahoma
Chem A Building

Table 5. Chem A Building - First Floor Restoration of Contaminated Areas on Facility Grounds

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician& Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0.0	0 0	0 0	0.0	0.0

Table 6. Chem A Building - First Floor Final Radiation Survey

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician& Laborer	Clerical/ Production
Area Prep & Set-up (Grid, Maps, Scaffold)	107.9	71.9	71.9	107.9	359.7	71.9
Survey and Sampling Surfaces & Compnts	161.9	107.9	107.9	161.9	539.5	107.9
TOTAL	269.8	179.8	179 8	269.8	899.2	179.8

Fansteel Inc., Muskogee, Oklahoma
Chem A Building

Table 7. Chem A Building - First Floor Site Stabilization and Long-Term Surveillance

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician& Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0.0	0.0	0 0	0.0	0 0

Table 8. Chem A Building - First Floor Labor Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician& Laborer	Clerical/ Production
Planning and Preparation	81.0	17.0	16.0	30.0	0.0	10.0
Decon/Dismantlement	166 4	166.4	166.4	249.6	831.9	166.4
Restoration of Grounds	0.0	0 0	0.0	0.0	0.0	0.0
Final Radiation Survey	269 8	179.8	179 8	269 8	899.2	179.8
Site Stabilization/Surveillance	0.0	0.0	0.0	0 0	0.0	0.0
TOTAL	517.1	363 2	362.2	549.3	1731.1	356.2

Table 9. Chem A Building - (First Floor) Worker Unit Cost Schedule

Labor Cost Component	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician& Laborer	Clerical/ Production
Loaded Salary ($/Hour)	$80	$70	$85	$85	$70	$20
Overhead Rate (%)						
Total Annual Cost						
Total Workday Cost (__ workdays/year)						

Fansteel Inc., Muskogee, Oklahoma
Chem A Building

Table 10. Chem A Building - (First Floor) Labor Cost Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician & Laborer	Clerical/ Production	Total Cost
Planning and Preparation	$6,480	$1,190	$1,360	$2,550	$0	$200	$11,780
Decon/Dismantlement	$13,311	$11,647	$14,142	$21,214	$58,234	$3,328	$121,875
Restoration of Grounds	$0	$0	$0	$0	$0	$0	$0
Final Radiation Survey	$21,581	$12,589	$15,287	$22,930	$62,945	$3,597	$138,928
Site Stabilization/Surveillance	$0	$0	$0	$0	$0	$0	$0
TOTAL	$41,372	$25,426	$30,789	$46,694	$121,178	$7,124	$272,583

Table 11. Chem A Building - (First Floor) Radioactive Waste Packaging Costs

Waste Type	Volume (m^3)	Number of Containers (Drums)	Type of Container	Unit Cost of Container	Total Packaging Cost
DAW/PPE/Rags/Debris	16.6	5.9	B-25	$600	$3,565
					$0
					$0
					$0
					$0
TOTAL	16.6	N/A	N/A	N/A	$3,565

Table 12. Chem A Building - (First Floor) Radioactive Waste Shipping Costs

Waste Type	Number of Loads	Unit Cost ($/mile/load)	Surcharges ($/mile)	Overweight Charges ($/mile)	Distance Shipped (miles)	Total Shipping Cost
DAW/PPE/Rags/Debris	0.67	$0	$1	$1	$1	$0
						$0
						$0
						$0
						$0
TOTAL	N/A	N/A	N/A	N/A	N/A	$0

Fansteel Inc., Muskogee, Oklahoma
Chem A Building

Table 13. Chem A Building - (First Floor) Radioactive Waste Shipping and Disposal Costs

Waste Type	Disposal Volume (m^3)	Unit Cost ($/$m^3$)	Surcharges ($/$m^3$ or $/container)	Total Disposal Cost
DAW/PPE/Rags/Debris	16 6	$100	$1	$1,664
	0.0			$0
	0.0			$0
	0 0			$0
	0.0			$0
TOTAL	N/A	N/A	N/A	$1,664

Table 14. Chem A Building - (First Floor) Equipment/Supply Costs (excluding containers)

Equipment/Supplies	Quantity	Unit Cost	Total Cost	
Direct Alpha & Gamma NaI	1.0	$350	$350	
Removable Alpha	1.0	$350	$350	
PPE/Ras-1/Personal Pump	1.0	$350	$350	
Scabbler, HEPA Vac	1.0	$500	$500	Rent/Buy
Rolling Scaffold	1.0	$200	$200	
TOTAL			$1,750	

Table 15. Chem A Building - (First Floor) Independent Third-Party Laboratory Costs

Activity	Total Cost
Sampling	
Transport of Samples	
Testing/Analyses	$500
TOTAL	$500

Table 16. Chem A Building - (First Floor) Miscellaneous Costs

Cost Item	Total Cost
License Fees	$21,000
Insurance	$26,250
Taxes	$12,000
NRC Oversight	$10,500
TOTAL	$69,750

Fansteel Inc., Muskogee, Oklahoma
Chem A Building

Table 17. Chem A Building - (First Floor) Total Decommissioning Costs Rollup

Task/Component	Cost	Percentage
Planning and Preparation	$11,780	3%
Decontamination/Dismantlement	$121,875	35%
Grounds Restoration	$0	0%
Final Radiation Survey	$138,928	40%
Site Stabilization and Surveillance	$0	0%
Waste Packaging	$3,565	1%
Waste Shipment	$0	0%
Waste Shipment and Disposal	$1,664	0%
Equipment/Supplies	$1,750	1%
Independent Third-Party Laboratory	$500	0%
Miscellaneous	$69,750	20%
Total Decommissioning Cost Estimate	$349,812	100%

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Fansteel Inc., Muskogee, Oklahoma
Chem A Building 3rd Floor

Table 1. Chem A Building - General Description

NRC Materials License No. SMB-911 (§40)
Types and Quantities of Materials Authorized 1) 43,000 Kg natural uranium & 71,000 Kg natural thorium Source material possessed as tin slags, ores, process residues and oxides and 2) 4,000 Kg of U and 2,500 Kg of Th as a contaminant in soils and sediment on site.
Description of Licensed Material Use Possession, use, short term storage, and transfer of U and Th and their progenies contained in processing residues including residue processing, metal reclamation, decommissioning and site restoration
Facility Description The Chemical A Building contains equipment used for ore processing activities including scrubbers, heaters, boilers, piping, air compressors, tanks, vessels, laboratories, and electrical control panels. Former operations included electron beam melting of uranium, chemical purification of tantalum, and storage of feed material. The Building is constructed of concrete brick walls with a 10" gap to the outside brick wall and has a concrete floor and roof.
Quantities of Licensed Materials or Waste Accumulated Before Shipping and Disposal

Table 2. Chem A Building - Third Floor Component Inventory

Level of Radioactive Contamination Highest average total alpha contamination is 54 dpm/100 cm2 with maximum of 435 dpm/100 cm2.				
Level of Non-Radioactive Contamination N/A				
	Component	Number of Components	Component Dimensions ( )	Total Dimensions (ft2)
1.	Floor			4173
2.	Walls and Horizontals			23423
3.	Vent Hoods	3		108
4.				
5.				
6.				
	Total Area			27704

Fansteel Inc., Muskogee, Oklahoma
Chem A Building 3rd Floor

Table 3. Chem A Building - Third Floor Planning and Preparation

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Corporate and Site Project Mngr	Const. Supervisor	HP Technician and Laborer	Clerical/ Production	DM & CPM Multiplier Manual Entry
Preparation of Documentation for Regulatory Agencies	15.0	1.5	1.5			2.0	1.5
Submittal of DP to NRC	10.0	1.5	3.0	5 0		2.0	
Development of Work Plans	40.0	10.0	10.0	25.0		6.0	
Procurement of Special Equipment							
Staff Training	15.0	4.0	1.5				
Radiological Characterization	1.0						
Other							
TOTAL	81.0	17.0	16.0	30.0	0.0	10.0	

Table 4. Chem A Building - Third Floor Component Decontamination and Dismantling

	Component	Decon Method	HP	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
1.	Floor	Wipe Down	8.3	8 3	8 3	12.5	41.7	8.3
2.	Walls and Horizontals	Wipe Down	46.8	46.8	46 8	70.3	234.2	46.8
3.	Vent Hoods	Wipe Down	0.2	0.2	0.2	0 3	1.1	0 2
4.								
5.								
6	Floor (10%)	Scabble	1.9	1.9	1.9	2.8	9.3	1.9
TOTAL			57.3	57.3	57.3	85.9	286 3	57.3

Fansteel Inc., Muskogee, Oklahoma
Chem A Building 3rd Floor

Table 5. Chem A Building - Third Floor Restoration of Contaminated Areas on Facility Grounds

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0.0	0.0	0 0	0.0	0 0

Table 6. Chem A Building - Third Floor Final Radiation Survey

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Area Prep & Set-up (Grid, Maps, Scaffold)	36.9	24.6	24.6	36.9	123.1	24.6
Survey and Sampling Surfaces & Compnts	55.4	36.9	36.9	55 4	184.7	24.6
TOTAL	92.3	61.6	61.6	92.3	307.8	49.3

Fansteel Inc., Muskogee, Oklahoma
Chem A Building 3rd Floor

Table 7. Chem A Building - Third Floor Site Stabilization and Long-Term Surveillance

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0.0	0 0	0.0	0 0	0 0

Table 8. Chem A Building - Third Floor Labor Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Planning and Preparation	81.0	17.0	16.0	30.0	0 0	10.0
Decon/Dismantlement	57.3	57.3	57.3	85.9	286 3	57.3
Restoration of Grounds	0 0	0.0	0.0	0.0	0.0	0.0
Final Radiation Survey	92.3	61.6	61.6	92.3	307.8	49.3
Site Stabilization/Surveillance	0.0	0 0	0.0	0.0	0.0	0.0
TOTAL	230.6	135.8	134 8	208.2	594.1	116.5

Table 9. Chem A Building - (Third) Worker Unit Cost Schedule

Labor Cost Component	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCO	HP Technician and Laborer	Clerical/ Production
Loaded Salary ($/Hour)	$80	$70	$85	$85	$70	$20
Overhead Rate (%)						
Total Annual Cost						
Total Workday Cost (__ workdays/year)						

Fansteel Inc., Muskogee, Oklahoma
Chem A Building 3rd Floor

Table 10. Chem A Building - (Third) Labor Cost Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/QCO	Technician and Laborer	Clerical/ Production	Total Cost
Planning and Preparation	$6,480	$1,190	$1,360	$2,550	$0	$200	$11,780
Decon/Dismantlement	$4,581	$4,008	$4,867	$7,301	$20,042	$1,145	$41,945
Restoration of Grounds	$0	$0	$0	$0	$0	$0	$0
Final Radiation Survey	$7,388	$4,310	$5,233	$7,849	$21,548	$985	$47,312
Site Stabilization/Surveillance	$0	$0	$0	$0	$0	$0	$0
TOTAL	$18,449	$9,508	$11,460	$17,700	$41,589	$2,330	$101,037

Table 11. Chem A Building - (Third Floor) Radioactive Waste Packaging Costs

Waste Type	Volume (m^3)	Number of Containers	Type of Container	Unit Cost of Container	Total Packaging Cost
DAW/PPE/Rags/Debris	5.7	2.0	B-25	$600	$1,227
					$0
					$0
					$0
					$0
TOTAL	5.7	N/A	N/A	N/A	$1,227

Table 12. Chem A Building - (Third Floor) Radioactive Waste Shipping Costs

Waste Type	Number of Loads	Unit Cost ($/mile/load)	Surcharges ($/mile)	Overweight Charges ($/mile)	Distance Shipped (miles)	Total Shipping Cost
DAW/PPE/Rags/Debris	0.23	$0	$1	$1	$1	$0
						$0
						$0
						$0
						$0
TOTAL	N/A	N/A	N/A	N/A	N/A	$0

Table 13. Chem A Building - (Third Floor) Radioactive Waste Shipping and Disposal Costs

Waste Type	Disposal Volume (m^3)	Unit Cost ($/$m^3$)	Surcharges ($/$m^3$ or $/container)	Total Disposal Cost
DAW/PPE/Rags/Debris	5.7	$100	$1	$573
	0.0			$0
	0.0			$0
	0.0			$0
	0.0			$0
TOTAL	N/A	N/A	N/A	$573

Table 14. Chem A Building - (Third Floor) Equipment/Supply Costs (excluding containers)

Equipment/Supplies	Quantity	Unit Cost	Total Cost	
Direct Alpha & Gamma NaI	1.0	$350	$350	
Removable Alpha	1.0	$350	$350	
PPE/Ras-1/Personal Pump	1.0	$350	$350	
Scabbler, HEPA Vav	0.0	$500	$0	
Rolling Scaffold	1.0	$200	$200	Rent/Buy
TOTAL	N/A	N/A	$1,250	

Table 15. Chem A Building - (Third Floor) Independent Third-Party Laboratory Costs

Activity	Total Cost
Sampling	
Transport of Samples	
Testing/Analyses	$500
TOTAL	$500

Table 16. Chem A Building - (Third Floor) Miscellaneous Costs

Cost Item	Total Cost
License Fees	$21,000
Insurance	$26,250
Taxes	$12,000
NRC Oversight	$10,500
TOTAL	$69,750

Fansteel Inc., Muskogee, Oklahoma
Chem A Building 3rd Floor

Table 17. Chem A Building - (Third Floor) Total Decommissioning Costs Rollup

Task/Component	Cost	Percentage
Planning and Preparation	$11,780	7%
Decontamination/Dismantlement	$41,945	24%
Grounds Restoration	$0	0%
Final Radiation Survey	$47,312	27%
Site Stabilization and Surveillance	$0	0%
Waste Packaging	$1,227	1%
Waste Shipment	$0	0%
Waste Shipment and Disposal	$573	0%
Equipment/Supplies	$1,250	1%
Independent Third-Party Laboratory	$500	0%
Miscellaneous	$69,750	40%
Total Decommissioning Cost Estimate	$174,337	100%

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Fansteel Inc., Muskogee, Oklahoma
Chem A Building 4th Floor

Table 1. Chem A Building - General Description

NRC Materials License No. SMB-911 (§40)
Types and Quantities of Materials Authorized 1) 43,000 Kg natural uranium & 71,000 Kg natural thorium Source material possessed as tin slags, ores, process residues and oxides and 2) 4,000 Kg of U and 2,500 Kg of Th as a contaminant in soils and sediment on site.
Description of Licensed Material Use Possession, use, short term storage, and transfer of U and Th and their progenies contained in processing residues including residue processing, metal reclamation, decommissioning and site restoration.
Facility Description The Chemical A Building contains equipment used for ore processing activities including scrubbers, heaters, boilers, piping, air compressors, tanks, vessels, laboratories, and electrical control panels. Former operations included electron beam melting of uranium, chemical purification of tantalum, and storage of feed material. The Building is constructed of concrete brick walls with a 10" gap to the outside brick wall and has a concrete floor and roof.
Quantities of Licensed Materials or Waste Accumulated Before Shipping and Disposal

Table 2. Chem A Building - Fourth Floor Component Inventory

Level of Radioactive Contamination Highest average total alpha contamination is 220 dpm/100 cm2 with maximum of 248 dpm/100 cm2.				
Level of Non-Radioactive Contamination N/A				
	Component	Number of Components	Component Dimensions ( )	Total Dimensions (ft2)
1.	Floor			19820
2.	Walls and Horizontals			42968
3.				
4.				
5.				
6.				
	Total Area			62788

Fansteel Inc., Muskogee, Oklahoma
Chem A Building 4th Floor

Table 3. Chem A Building - Fourth Floor Planning and Preparation

Activity	HP/DM	Industrial Hygiene/ Safety/HP	Corporate and Site Project Mngr	Const. Supervisor	HP Technician and Laborer	Clerical/ Production	DM & CPM Multiplier Manual Entry
Preparation of Documentation for Regulatory Agencies	15 0	1.5	1.5			2.0	1.5
Submittal of DP to NRC	10 0	1.5	3.0	5 0		2.0	
Development of Work Plans	40 0	10 0	10 0	25.0		6.0	
Procurement of Special Equipment							
Staff Training	15.0	4.0	1.5				
Radiological Characterization	1.0						
Other							
TOTAL	81.0	17.0	16.0	30.0	0.0	10.0	

Table 4. Chem A Building - Fourth Floor Component Decontamination and Dismantling

	Component	Decon Method	HP	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
1.	Floor	Wipe Down	39.6	39 6	39.6	59.5	198.2	39 6
2.	Walls and Horizontals	Wipe Down	85.9	85.9	85.9	128.9	429.7	85.9
3.								
4.								
5.								
6.	Floor (10%)	Scabble	0.0	0 0	0.0	0.0	0.0	0.0
TOTAL			125.6	125.6	125.6	188.4	627.9	125 6

Fansteel Inc., Muskogee, Oklahoma
Chem A Building 4th Floor

Table 5. Chem A Building - Fourth Floor Restoration of Contaminated Areas on Facility Grounds

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0 0	0.0	0.0	0.0	0 0

Table 6. Chem A Building - Fourth Floor Final Radiation Survey

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Area Prep & Set-up (Grid, Maps, Scaffold)	83 7	55 8	55.8	83.7	279.1	55.8
Survey and Samplıng Surfaces & Compnts	125.6	83.7	83.7	125.6	418.6	83.7
TOTAL	209.3	139.5	139.5	209 3	697.6	139.5

Fansteel Inc., Muskogee, Oklahoma
Chem A Building 4th Floor

Table 7. Chem A Building - Fourth Floor Site Stabilization and Long-Term Surveillance

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
N/A						
TOTAL	0 0	0.0	0 0	0 0	0.0	0.0

Table 8. Chem A Building - Fourth Floor Labor Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Planning and Preparation	81.0	17.0	16.0	30.0	0.0	10.0
Decon/Dismantlement	125.6	125.6	125.6	188.4	627.9	125.6
Restoration of Grounds	0 0	0 0	0.0	0.0	0 0	0.0
Final Radiation Survey	209.3	139.5	139.5	209.3	697.6	139.5
Site Stabilization/Surveillance	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	415.9	282.1	281.1	427.7	1325.5	275.1

Table 9. Chem A Building - (Fourth Floor) Worker Unit Cost Schedule

Labor Cost Component	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Loaded Salary ($/Hour)	$80	$70	$85	$85	$70	$20
Overhead Rate (%)						
Total Annual Cost						
Total Workday Cost (workdays/year)						

Fansteel Inc., Muskogee, Oklahoma
Chem A Building 4th Floor

Table 10. Chem A Building - (Fourth Floor) Labor Cost Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	Technician and Laborer	Clerical/ Production	Total Cost
Planning and Preparation	$6,480	$1,190	$1,360	$2,550	$0	$200	$11,780
Decon/Dismantlement	$10,046	$8,790	$10,674	$16,011	$43,952	$2,512	$91,984
Restoration of Grounds	$0	$0	$0	$0	$0	$0	$0
Final Radiation Survey	$16,743	$9,767	$11,860	$17,790	$48,835	$2,791	$107,786
Site Stabilization/Surveillance	$0	$0	$0	$0	$0	$0	$0
TOTAL	$33,270	$19,747	$23,894	$36,351	$92,787	$5,502	$211,550

Table 11. Chem A Building - (Fourth Floor) Radioactive Waste Packaging Costs

Waste Type	Volume (m^3)	Number of Containers	Type of Container	Unit Cost of Container	Total Packaging Cost
DAW/PPE/Rags/Debris	12.6	4.5	B-25	$600	$2,691
					$0
					$0
					$0
					$0
TOTAL	12 6	N/A	N/A	N/A	$2,691

Table 12. Chem A Building - (Fourth Floor) Radioactive Waste Shipping Costs

Waste Type	Number of Loads	Unit Cost ($/mile/load)	Surcharges ($/mile)	Overweight Charges ($/mile)	Distance Shipped (miles)	Total Shipping Cost
DAW/PPE/Rags/Debris	0.50	$0	$1	$1	$1	$0
						$0
						$0
						$0
						$0
TOTAL	N/A	N/A	N/A	N/A	N/A	$0

Fansteel Inc., Muskogee, Oklahoma
Chem A Building 4th Floor

Table 13. Chem A Building - (Fourth Floor) Radioactive Waste Shipping and Disposal Costs

Waste Type	Disposal Volume (m^3)	Unit Cost ($/$m^3$)	Surcharges ($/$m^3$ or $/container)	Total Disposal Cost
DAW/PPE/Rags/Debris	12.6	$100	$1	$1,256
	0.0			$0
	0.0			$0
	0.0			$0
	0.0			$0
TOTAL	N/A	N/A	N/A	$1,256

Table 14. Chem A Building - (Fourth Floor) Equipment/Supply Costs (excluding containers)

Equipment/Supplies	Quantity	Unit Cost	Total Cost	
Direct Alpha & Gamma NaI	1.0	$350	$350	
Removable Alpha	1.0	$350	$350	
PPE/Ras-1/Personal Pump	1.0	$350	$350	
Scabbler, HEPA Vac	0 0	$500	$0	Rent/Buy
Rolling Scaffold	1.0	$200	$200	
TOTAL	N/A	N/A	$1,250	

Table 15. Chem A Building - (Fourth Floor) Independent Third-Party Laboratory Costs

Activity	Total Cost
Sampling	
Transport of Samples	
Testing/Analyses	$500
TOTAL	$500

Table 16. Chem A Building - (Fourth Floor) Miscellaneous Costs

Cost Item	Total Cost
License Fees	$21,000
Insurance	$26,250
Taxes	$12,000
NRC Oversight	$10,500
TOTAL	$69,750

Fansteel Inc., Muskogee, Oklahoma
Chem A Building 4th Floor

Table 17. Chem A Building - (Fourth Floor) Total Decommissioning Costs Rollup

Task/Component	Cost	Percentage
Planning and Preparation	$11,780	4%
Decontamination/Dismantlement	$91,984	32%
Grounds Restoration	$0	0%
Final Radiation Survey	$107,786	38%
Site Stabilization and Surveillance	$0	0%
Waste Packaging	$2,691	1%
Waste Shipment	$0	0%
Waste Shipment and Disposal	$1,256	0%
Equipment/Supplies	$1,250	0%
Independent Third-Party Laboratory	$500	0%
Miscellaneous	$69,750	24%
Total Decommissioning Cost Estimate	$286,997	100%

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Fansteel Inc., Muskogee, Oklahoma
Chem C Building

Table 1. Chem C Building - General Description

NRC Materials License No. SMB-911 (§40)
Types and Quantities of Materials Authorized 1) 43,000 Kg natural uranium & 71,000 Kg natural thorium Source material possessed as tin slags, ores, process residues and oxides and 2) 4,000 Kg of U and 2,500 Kg of Th as a contaminant in soils and sediment on site.
Description of Licensed Material Use Possession, use, short term storage, and transfer of U and Th and their progenies contained in processing residues including residue processing, metal reclamation, decommissioning and site restoration.
Facility Description The Chemical C Building contains one large room with a concrete ceiling that formerly housed the ore digestion/extraction process within the process tanks. The process utilized hydrofluoric acid and an organic solvent. The process residues were placed in Ponds 2 and 3. The lower walls are transite, and the upper walls are corrugated fiberglass. The floor consists of a newer 8 inch concrete pour over the previous foundation.
Quantities of Licensed Materials or Waste Accumulated Before Shipping and Disposal

Table 2. Chem C Building - Component Inventory

Level of Radioactive Contamination Highest average total alpha contamination is 9490 dpm/100 cm2 with maximum of 980 dpm/100 cm2.
Level of Non-Radioactive Contamination N/A

	Component	Number of Components	Component Dimensions ( )	Total Dimensions (ft2)
1.	Floor			5225
2.	Walls and Horizontals			14171
3.	Slurry Tank 9 ft x 7 ft H	2		650
4.	Holding Tanks	7		3325
5.				
6.				
				23371

Fansteel Inc., Muskogee, Oklahoma
Chem C Building

Table 3. Chem C Building - Planning and Preparation

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor	HP Technician and Laborer	Clerical/ Production	DM & CPM Multiplier Manual Entry
Preparation of Documentation for Regulatory Agencies	15.0	1.5	1.5			2.0	1.5
Submittal of DP to NRC	10.0	1.5	3.0	5.0		2.0	
Development of Work Plans	40.0	10.0	10.0	25.0		6.0	
Procurement of Special Equipment							
Staff Training	15.0	4.0	1.5				
Radiological Characterization	1.0						
Other							
TOTAL	81.0	17.0	16.0	30.0	0.0	10.0	

Table 4. Chem C Building - Component Decontamination and Dismantling

	Component	Decon Method	HP	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
1.	Floor	Wipe Down	10.5	10.5	10.5	15.7	52.3	10.5
2.	Walls and Horizontals	Wipe Down	28.3	28.3	28.3	42.5	141.7	28.3
3.	Slurry Tanks	Wipe Down	1.3	1.3	1.3	2.0	6.5	1.3
4.	Holding Tanks	Wipe Down	6.7	6.7	6.7	10.0	33.3	6.7
5.			0.0	0.0	0.0	0.0	0.0	0.0
6.	Floor (10%)	Scabble	2.3	2.3	2.3	3.5	11.6	2.3
TOTAL			49.1	49.1	49.1	73.6	245.3	49.1

Fansteel Inc., Muskogee, Oklahoma
Chem C Building

Table 5. Chem C Building - Restoration of Contaminated Areas on Facility Grounds

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. Chem C Building - Final Radiation Survey

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Area Prep & Set-up (Grid, Maps, Scaffold)	31.2	20.8	20.8	31.2	103.9	20.8
Survey and Sampling Surfaces & Compnts	46.7	31.2	31.2	46.7	155.8	31.2
TOTAL	77.9	51.9	51.9	77.9	259.7	51.9

Fansteel Inc., Muskogee, Oklahoma
Chem C Building

Table 7. Chem C Building - Site Stabilization and Long-Term Surveillance

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0

Table 8. Chem C Building - Labor Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Planning and Preparation	81.0	17.0	16.0	30.0	0.0	10.0
Decon/Dismantlement	49.1	49.1	49.1	73.6	245.3	49.1
Restoration of Grounds	0.0	0.0	0.0	0.0	0.0	0.0
Final Radiation Survey	77.9	51.9	51.9	77.9	259.7	51.9
Site Stabilization/Surveillance	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	208.0	118.0	117.0	181.5	505.0	111.0

Table 9. Chem C Building - Worker Unit Cost Schedule

Labor Cost Component	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Loaded Salary ($/Hour)	$80	$70	$85	$85	$70	$20
Overhead Rate (%)						
Total Annual Cost						
Total Workday Cost (__ workdays/year)						

Fansteel Inc., Muskogee, Oklahoma
Chem C Building

Table 10. Chem C Building - Labor Cost Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	Technician and Laborer	Clerical/ Production	Total Cost
Planning and Preparation	$6,480	$1,190	$1,360	$2,550	$0	$200	$11,780
Decon/Dismantlement	$3,925	$3,434	$4,170	$6,256	$17,172	$981	$35,940
Restoration of Grounds	$0	$0	$0	$0	$0	$0	$0
Final Radiation Survey	$6,232	$3,635	$4,415	$6,622	$18,177	$1,039	$40,120
Site Stabilization/Surveillance	$0	$0	$0	$0	$0	$0	$0
TOTAL	$16,637	$8,260	$9,945	$15,427	$35,350	$2,220	$87,840

Table 11. Chem C Building - Radioactive Waste Packaging Costs

Waste Type	Volume (m^3)	Number of Containers	Type of Container	Unit Cost of Container	Total Packaging Cost
DAW/PPE/Rags/Debris	4.9	1.8	B-25	$600	$1,051
					$0
					$0
					$0
					$0
TOTAL	4.9	N/A	N/A	N/A	$1,051

Table 12. Chem C Building - Radioactive Waste Shipping Costs

Waste Type	Number of Loads	Unit Cost ($/mile/load)	Surcharges ($/mile)	Overweight Charges ($/mile)	Distance Shipped (miles)	Total Shipping Cost
DAW/PPE/Rags/Debris	0.20	$0	$1	$1	$1	$0
						$0
						$0
						$0
						$0
TOTAL	N/A	N/A	N/A	N/A	N/A	$0

Table 13. Chem C Building - Radioactive Waste Shipping and Disposal Costs

Waste Type	Disposal Volume (m^3)	Unit Cost ($/$m^3$)	Surcharges ($/$m^3$ or $/container)	Total Disposal Cost
DAW/PPE/Rags/Debris	4.9	$100	$1	$491
	0.0			$0
	0.0			$0
	0.0			$0
	0.0			$0
TOTAL	N/A	N/A	N/A	$491

Table 14. Chem C Building - Equipment/Supply Costs (excluding containers)

Equipment/Supplies	Quantity	Unit Cost	Total Cost	
Direct Alpha & Gamma NaI	1.0	$350	$350	
Removable Alpha	1.0	$350	$350	
PPE/Ras-1/Personal Pump	1.0	$350	$350	
Scabbler, HEPA Vac	1.0	$500	$500	Rent/Buy
Rolling Scaffold	1.0	$200	$200	
TOTAL	N/A	N/A	$1,750	

Table 15. Chem C Building - Independent Third-Party Laboratory Costs

Activity	Total Cost
Sampling	
Transport of Samples	
Testing/Analyses	$500
TOTAL	$500

Table 16. Chem C Building - Miscellaneous Costs

Cost Item	Total Cost
License Fees	$21,000
Insurance	$26,250
Taxes	$12,000
NRC Oversight	$10,500
TOTAL	$69,750

Fansteel Inc., Muskogee, Oklahoma
Chem C Building

Table 17. Chem C Building - Total Decommissioning Costs Rollup

Task/Component	Cost	Percentage
Planning and Preparation	$11,780	7%
Decontamination/Dismantlement	$35,940	22%
Grounds Restoration	$0	0%
Final Radiation Survey	$40,120	25%
Site Stabilization and Surveillance	$0	0%
Waste Packaging	$1,051	1%
Waste Shipment	$0	0%
Waste Shipment and Disposal	$491	0%
Equipment/Supplies	$1,750	1%
Independent Third-Party Laboratory	$500	0%
Miscellaneous	$69,750	43%
Total Decommissioning Cost Estimate	$161,382	100%

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Fansteel Inc., Muskogee, Oklahoma
Groundwater Treatment Building

Table 1. Groundwater Treatment Building - General Description

NRC Materials License No. SMB-911 (§40)
Types and Quantities of Materials Authorized 1) 43,000 Kg natural uranium & 71,000 Kg natural thorium Source material possessed as tin slags, ores, process residues and oxides and 2) 4,000 Kg of U and 2,500 Kg of Th as a contaminant in soils and sediment on site.
Description of Licensed Material Use Possession, use, short term storage, and transfer of U and Th and their progenies contained in processing residues including residue processing, metal reclamation, decommissioning and site restoration.
Facility Description The Groundwater Treatment Facility Building has two rooms and was formerly used to process potentially contaminated groundwater by evaporation resulting in a high concentration slurry. The structure is fabricated with corrugated metal walls with a concrete floor and is situated over the former Gunch House.
Quantities of Licensed Materials or Waste Accumulated Before Shipping and Disposal

Table 2. Groundwater Treatment Building - Component Inventory

Level of Radioactive Contamination
Average total alpha contamination is 29 dpm/100 cm2 with maximum of 29 dpm/100 cm2

Level of Non-Radioactive Contamination
N/A

	Component	Number of Components	Component Dimensions ( )	Total Dimensions (ft2)
1.	Floor			2822
2.	Walls and Horizontals			8151
3.				
4.				
5.				
6.				
	Total Area			10973

Fansteel Inc., Muskogee, Oklahoma
Groundwater Treatment Building

Table 3. Groundwater Treatment Building - Planning and Preparation

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor	HP Technician and Laborer	Clerical/ Production	DM & CPM Multiplier Manual Entry
Preparation of Documentation for Regulatory Agencies	15.0	1.5	1.5			2.0	1.5
Submittal of DP to NRC	10.0	1.5	3.0	5 0		2.0	
Development of Work Plans	40.0	10.0	10.0	25 0		6.0	
Procurement of Special Equipment							
Staff Training	15.0	4.0	1.5				
Radiological Characterization	1.0						
Other							
TOTAL	81.0	17.0	16.0	30.0	0 0	10.0	

Table 4. Groundwater Treatment Building - Component Decontamination and Dismantling

	Component	Decon Method	HP	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
1.	Floor	Wipe Down	5.6	5.6	5.6	8.5	28.2	5.6
2.	Walls and Horizontals.	Wipe Down	16.3	16 3	16 3	24.5	81.5	16.3
3.								
4.								
5.								
6.	Floor (10%)	Scabble	0.0	0 0	0 0	0.0	0.0	0.0
TOTAL			21.9	21.9	21.9	32.9	109.7	21.9

Fansteel Inc., Muskogee, Oklahoma
Groundwater Treatment Building

Table 5. Groundwater Treatment Building - Restoration of Contaminated Areas on Facility Grounds

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0 0	0 0	0.0	0.0	0 0

Table 6. Groundwater Treatment Building - Final Radiation Survey

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Area Prep & Set-up (Grid, Maps, Scaffold)	14.6	9.8	9.8	14.6	48.8	9.8
Survey and Samplıng Surfaces & Compnts	21.9	14 6	14.6	21.9	73.2	14.6
TOTAL	36 6	24.4	24.4	36 6	121.9	24.4

Fansteel Inc., Muskogee, Oklahoma
Groundwater Treatment Building

Table 7. Groundwater Treatment Building - Site Stabilization and Long-Term Surveillance

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0 0	0 0	0.0	0 0	0.0

Table 8. Groundwater Treatment Building - Labor Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Planning and Preparation	81.0	17.0	16.0	30.0	0.0	10.0
Decon/Dismantlement	21.9	21.9	21.9	32.9	109.7	21.9
Restoration of Grounds	0.0	0.0	0.0	0.0	0.0	0.0
Final Radiation Survey	36.6	24.4	24.4	36.6	121.9	24.4
Site Stabilization/Surveillance	0.0	0.0	0.0	0.0	0 0	0 0
TOTAL	139.5	63.3	62.3	99.5	231.7	56.3

Table 9. Groundwater Treatment Building - Worker Unit Cost Schedule

Labor Cost Component	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Loaded Salary ($/Hour)	$80	$70	$85	$85	$70	$20
Overhead Rate (%)						
Total Annual Cost						
Total Workday Cost (__ workdays/year)						

Fansteel Inc., Muskogee, Oklahoma
Groundwater Treatment Building

Table 10. Groundwater Treatment Building - Labor Cost Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	Technician and Laborer	Clerical/ Production	Total Cost
Planning and Preparation	$6,480	$1,190	$1,360	$2,550	$0	$200	$11,780
Decon/Dismantlement	$1,756	$1,536	$1,865	$2,798	$7,681	$439	$16,075
Restoration of Grounds	$0	$0	$0	$0	$0	$0	$0
Final Radiation Survey	$2,926	$1,707	$2,073	$3,109	$8,535	$488	$18,837
Site Stabilization/Surveillance	$0	$0	$0	$0	$0	$0	$0
TOTAL	$11,162	$4,433	$5,298	$8,457	$16,216	$1,127	$46,692

Table 11. Groundwater Treatment Building - Radioactive Waste Packaging Costs

Waste Type	Volume (m^3)	Number of Containers	Type of Container	Unit Cost of Container	Total Packaging Cost
DAW/PPE/Rags/Debris	2.2	0.8	B-25	$600	$470
					$0
					$0
					$0
					$0
TOTAL	2.2	N/A	N/A	N/A	$470

Table 12. Groundwater Treatment Building - Radioactive Waste Shipping Costs

Waste Type	Number of Loads	Unit Cost ($/mile/load)	Surcharges ($/mile)	Overweight Charges ($/mile)	Distance Shipped (miles)	Total Shipping Cost
DAW/PPE/Rags/Debris	0 09	$0	$1	$1	$1	$0
						$0
						$0
						$0
						$0
TOTAL	N/A	N/A	N/A	N/A	N/A	$0

Table 13. Groundwater Treatment Building - Radioactive Waste Shipping and Disposal Costs

Waste Type	Disposal Volume (m^3)	Unit Cost (\$/m^3)	Surcharges (\$/m^3 or \$/container)	Total Disposal Cost
DAW/PPE/Rags/Debris	2.2	$100	$1	$219
	0.0			$0
	0.0			$0
	0.0			$0
	0.0			$0
TOTAL	N/A	N/A	N/A	$219

Table 14. Groundwater Treatment Building - Equipment/Supply Costs (excluding containers)

Equipment/Supplies	Quantity	Unit Cost	Total Cost	
Direct Alpha & Gamma NaI	1.0	$350	$350	
Removable Alpha	1.0	$350	$350	
PPE/Ras-1/Personal Pump	1.0	$350	$350	
Scabbler, HEPA Vac	0.0	$500	$0	Rent/Buy
Rolling Scaffold	1.0	$200	$200	
TOTAL	N/A	N/A	$1,250	

Table 15. Groundwater Treatment Building - Independent Third-Party Laboratory Costs

Activity	Total Cost
Sampling	
Transport of Samples	
Testing/Analyses	$500
TOTAL	$500

Table 16. Groundwater Treatment Building - Miscellaneous Costs

Cost Item	Total Cost
License Fees	$7,000
Insurance	$8,750
Taxes	$4,000
NRC Oversight	$3,500
TOTAL	$23,250

Fansteel Inc., Muskogee, Oklahoma
Groundwater Treatment Building

Table 17. Groundwater Treatment Building - Total Decommissioning Costs Rollup

Task/Component	Cost	Percentage
Planning and Preparation	$11,780	16%
Decontamination/Dismantlement	$16,075	22%
Grounds Restoration	$0	0%
Final Radiation Survey	$18,837	26%
Site Stabilization and Surveillance	$0	0%
Waste Packaging	$470	1%
Waste Shipment	$0	0%
Waste Shipment and Disposal	$219	0%
Equipment/Supplies	$1,250	2%
Independent Third-Party Laboratory	$500	1%
Miscellaneous	$23,250	32%
Total Decommissioning Cost Estimate	$72,382	100%

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Fansteel Inc., Muskogee, Oklahoma
Ponds 2 and 3

Table 1. Ponds 2 and 3 - General Description

NRC Materials License No. SMB-911 (§40)
Types and Quantities of Materials Authorized 1) 43,000 Kg natural uranium & 71,000 Kg natural thorium Source material possessed as tin slags, ores, process residues and oxides and 2) 4,000 Kg of U and 2,500 Kg of Th as a contaminant in soils and sediment on site.
Description of Licensed Material Use Residues from the WIP (licensed material) were disposed in Pond Nos. 2 and 3.
Facility Description Pond Nos 2 and 3, contain 16,000 tons of residues from WIP from the digestion and liquid-liquid exchange processes that occurred in the Chem C Building
Quantities of Licensed Materials or Waste Accumulated Before Shipping and Disposal

Table 2. Ponds 2 and 3- Component Inventory

Level of Radioactive Contamination Th-232 concentration of 400 pCi/g average and 680 pCi/g maximum. U-238 concentration of 496 pCi/g average and 1100 pCi/g maximum.
Level of Non-Radioactive Contamination

	Component	Number of Components	Component Dimensions (ft2)	Total Mass (Tons)
1.	Pond 2 average depth is 11 ft by 120 ft wide by 300 ft long			16,000
2.	Pond 3 residue average depth is 13 ft by 158 ft wide by 318 ft long			
3.				
4.				
5.				
6.				
	Total Area		86244	

Fansteel Inc., Muskogee, Oklahoma
Ponds 2 and 3

Table 3. Ponds 2 and 3 - Planning and Preparation

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Corporate Manager and Site Project Mngr	Const. Supervisor	Technician/ Laborer/ Operator	Clerical/ Production	DM & CPM Multiplier Manual Entry
Preparation of Documentation for Regulatory Agencies	120	20	40			30	1.5
Submittal of DP to NRC	150	20	40	150		30	
Development of Work Plans	360	60	60	360		100	
Procurement of Special Equipment							
Staff Training	100	50	10				
Radiological Characterization	40	4	2				
Other							
TOTAL	770	154	152	510	0	160	

Table 4. Ponds 2 and 3- Component Decontamination and Dismantling

	Component	Decon Method	HP	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCO	HPT 3Laborer 2Operator	Clerical/ Production
1.	Ponds 2 and 3	Excavation	1,438	1,438	1,438	2,157	1,798	1,438
2.		Hauling						
3.		Drying						
4.								
5.								
6.								
TOTAL			1,438	1,438	1,438	2,157	1,798	1,438

Fansteel Inc., Muskogee, Oklahoma
Ponds 2 and 3

Table 5. Ponds 2 and 3 - Restoration of Contaminated Areas on Facility Grounds

Activity	HP	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCO	Soil and Labor	Clerical/ Production
Backfill	90	90	90	135	800	90
TOTAL	90	90	90	135	800	90

Table 6. Ponds 2 and 3 - Final Radiation Survey

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCO	HPT 3Laborer 2Operator	Clerical/ Production
Area Prep & Set-up (Grid, Maps)	431	287	287	431	287	287
Survey and Sampling	431	287	287	431	287	287
TOTAL	862	575	575	862	575	575

Fansteel Inc., Muskogee, Oklahoma
Ponds 2 and 3

Table 7. Ponds 2 and 3 - Site Stabilization and Long-Term Surveillance

Activity	HP	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCO	HPT Laborer Operator	Clerical/ Production
Backfill						
TOTAL	0	0	0	0	0	0

Table 8. Ponds 2 and 3 - Labor Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCO	HPT 3Laborer 2Operator	Clerical/ Production
Planning and Preparation	770	154	152	510	0	160
Decon/Dismantlement	1,438	1,438	1,438	2,157	1,798	1,438
Restoration of Grounds	90	90	90	135	800	90
Final Radiation Survey	862	575	575	862	575	575
Site Stabilization/Surveillance	0	0	0	0	0	0
TOTAL	3,161	2,257	2,255	3,665	3,173	2,263

Table 9. Ponds 2 and 3 - Worker Unit Cost Schedule

Labor Cost Component	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCO	HPT 3Laborer 2Operator	Clerical/ Production
Loaded Salary ($/Hour)	$80	$70	$85	$85	$240	$20
Overhead Rate (%)						
Total Annual Cost						
Total Workday Cost (workdays/year)						

Fansteel Inc., Muskogee, Oklahoma
Ponds 2 and 3

Table 10. Ponds 2 and 3- Labor Cost Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/QCO	HPT 3Laborer 2Operator	Clerical/ Production	Total Cost
Planning and Preparation	$61,600	$10,780	$12,920	$43,350	$0	$3,200	$131,850
Decon/Dismantlement	$115,056	$100,674	$122,247	$183,371	$431,461	$28,764	$981,573
Restoration of Grounds	$7,200	$6,300	$7,650	$11,475	$192,000	$1,800	$226,425
Final Radiation Survey	$68,995	$40,247	$48,872	$73,307	$137,990	$11,499	$380,911
Site Stabilization/Surveillance	$0	$0	$0	$0	$0	$0	$0
TOTAL	$252,851	$158,001	$191,689	$311,503	$761,451	$45,263	$1,720,759

Table 11. Ponds 2 and 3 - Radioactive Waste Packaging Costs

Waste Type	Tons	Number of Containers (Gondolas)	Type of Container	Unit Cost of Container	Total Packaging Cost
Residue from WIP	16000	160	Rail Car	N/A	N/A
(Cost included in Table 13)					
TOTAL	16000	N/A	N/A	N/A	N/A

Table 12. Ponds 2 and 3 - Radioactive Waste Shipping Costs

Waste Type	Number of Loads	Unit Cost ($/mile/load)	Surcharges ($/mile)	Overweight Charges ($/mile)	Distance Shipped (miles)	Total Shipping Cost
Residue from WIP	160	N/A	N/A	N/A	N/A	N/A
(Cost included in Table 13)						
TOTAL	N/A	N/A	N/A	N/A	N/A	N/A

Fansteel Inc., Muskogee, Oklahoma
Ponds 2 and 3

Table 13. Ponds 2 and 3 - Radioactive Waste Transport and Disposal Costs

Waste Type	Disposal (Tons)	Unit Cost ($/Ton)	Surcharges ($/$m^3$ or $/container)	Total Disposal Cost
Residue from WIP	16000	$194	$1	$3,104,000
	0			$0
	0			$0
	0			$0
	0			$0
TOTAL	N/A	N/A	N/A	$3,104,000

Table 14. Ponds 2 and 3 - Equipment/Supply Costs (excluding containers)

Equipment/Supplies	Quantity	Unit Cost	Total Cost	
Truck, Excavator and Loader	1	$240,000	$240,000	80 Wk Rental
Direct Alpha & Gamma NaI	2	$4,800	$9,600	Purchase
Removable Alpha	1	$3,000	$3,000	Purchase
PPE/Ras-1/Personal Pump	4	$2,000	$8,000	Purchase
Water Truck/Sprayer	1	$15,000	$15,000	2 yr Rental
TOTAL	N/A	N/A	$275,600	

Table 15. Ponds 2 and 3 - Independent Third-Party Laboratory Costs

Activity	Total Cost
Sampling	
Transport of Samples	
Testing/Analyses	$50,000
TOTAL	$50,000

Table 16. Ponds 2 and 3 - Miscellaneous Costs

Cost Item	Total Cost
License Fees	$210,000
Insurance	$262,500
Taxes	$120,000
NRC Oversight	$105,000
TOTAL	$697,500

Fansteel Inc., Muskogee, Oklahoma
Ponds 2 and 3

Table 17. Ponds 2 and 3 - Total Decommissioning Costs Rollup

Task/Component	Cost	Percentage
Planning and Preparation	$131,850	2%
Decontamination/Dismantlement	$981,573	17%
Grounds Restoration	$226,425	4%
Final Radiation Survey	$380,911	7%
Site Stabilization and Surveillance	$0	0%
Waste Packaging	$0	0%
Waste Shipment		0%
Waste Packaging, Shipment and Disposal	$3,104,000	53%
Equipment/Supplies	$275,600	5%
Independent Third-Party Laboratory	$50,000	1%
Miscellaneous	$697,500	12%
Total Decommissioning Cost Estimate	$5,847,859	100%

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Fansteel Inc., Muskogee, Oklahoma
Ponds 5 thru 9

Table 1. Ponds 5 thru 9 - General Description

NRC Materials License No. SMB-911 (§40)
Types and Quantities of Materials Authorized 1) 43,000 Kg natural uranium & 71,000 Kg natural thorium Source material possessed as tin slags, ores, process residues and oxides and 2) 4,000 Kg of U and 2,500 Kg of Th as a contaminant in soils and sediment on site.
Description of Licensed Material Use Residues from the WIP (licensed material) were disposed in Pond Nos. 5 thru 9.
Facility Description Pond Nos. 5 thru 9, contain 68,000 tons of residues from WIP.
Quantities of Licensed Materials or Waste Accumulated Before Shipping and Disposal

Table 2. Ponds 5 thru 9- Component Inventory

Level of Radioactive Contamination Th-232 concentration of 9.9 pCi/g average and 37 pCi/g maximum. U-238 concentration of 27.9 pCi/g average and 97 pCi/g maximum.
Level of Non-Radioactive Contamination

	Component	Number of Components	Component Dimensions (ft2)	Total Mass (Tons)
1.	Pond 5 average depth is 4.5 ft by 75 ft wide by 130 ft long			68,000
2.	Pond 6 residue average depth is 3 ft by 100 ft wide by 160 ft long			
3.	Pond 7 residue average depth is 3 ft by 120 ft wide by 205 ft long			
4.	Pond 8 residue average depth is 25 ft by 350 ft wide by 350 ft long			
5.	Pond 9 residue average depth is 24 ft by 215 ft wide by 565 ft long			
6.				
	Total Area		1,212,600	

Fansteel Inc., Muskogee, Oklahoma
Ponds 5 thru 9

Table 3. Ponds 5 thru 9 - Planning and Preparation

Activity	HPS	Industrial Hygiene/ Safety/RSO	Corporate Manager and Site Project Mngr	Const. Supervisor/QCS	Technician/ Laborer/ Operator	Clerical/ Production	DM & CPM Multiplier Manual Entry
Preparation of Documentation for Regulatory Agencies	120	20	40			30	1.5
Submittal of DP to NRC	150	20	40	150		30	
Development of Work Plans	360	60	60	360		100	
Procurement of Special Equipment							
Staff Training	100	50	10				
Radiological Characterization	40	4	2				
Other							
TOTAL	770	154	152	510	0	160	

Table 4. Ponds 5 thru 9- Component Decontamination and Dismantling

	Component	Decon Method	HPS	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCS	HPT 3Laborer 2Operator	Clerical/ Production
1.	Ponds 5,6,7,8,9	Excavation	3,886	3,886	3,886	5,829	4,857	3,886
2.		Hauling						
3.		Drying						
4.								
5.								
6.								
TOTAL			3,886	3,886	3,886	5,829	4,857	3,886

Fansteel Inc., Muskogee, Oklahoma
Ponds 5 thru 9

Table 5. Ponds 5 thru 9 - Restoration of Contaminated Areas on Facility Grounds

Activity	HPS	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCS	Soil and Labor	Clerical/ Production
Purchase Soil and Backfill	225	225	225	338	6,000	225
TOTAL	225	225	225	338	6,000	225

Table 6. Ponds 5 thru 9 - Final Radiation Survey

Activity	HPS/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCS	HPT 3Laborer 2Operator	Clerical/ Production
Area Prep & Set-up (Grid, Maps)	485	323	323	485	404	323
Survey and Sampling	728	485	485	728	606	485
TOTAL	1,213	808	808	1,213	1,011	808

Fansteel Inc., Muskogee, Oklahoma
Ponds 5 thru 9

Table 7. Ponds 5 thru 9 - Site Stabilization and Long-Term Surveillance

Activity	HP	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCS	HPT Laborer Operator	Clerical/ Production
TOTAL	0	0	0	0	0	0

Table 8. Ponds 5 thru 9 - Labor Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCS	HPT 3Laborer 2Operator	Clerical/ Production
Planning and Preparation	770	154	152	510	0	160
Decon/Dismantlement	3,886	3,886	3,886	5,829	4,857	3,886
Restoration of Grounds	225	225	225	338	6,000	225
Final Radiation Survey	1,213	808	808	1,213	1,011	808
Site Stabilization/Surveillance	0	0	0	0	0	0
TOTAL	6,093	5,073	5,071	7,889	11,868	5,079

Table 9. Ponds 5 thru 9 - Worker Unit Cost Schedule

Labor Cost Component	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCS	HPT 3Laborer 2Operator	Clerical/ Production
Loaded Salary ($/Hour)	$80	$70	$85	$85	$240	$20
Overhead Rate (%)						
Total Annual Cost						
Total Workday Cost (workdays/year)						

Fansteel Inc., Muskogee, Oklahoma
Ponds 5 thru 9

Table 10. Ponds 5 thru 9 - Labor Cost Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/QCS	HPT 3Laborer 2Operator	Clerical/ Production	Total Cost
Planning and Preparation	$61,600	$10,780	$12,920	$43,350	$0	$3,200	$131,850
Decon/Dismantlement	$310,857	$272,000	$330,286	$495,429	$1,165,714	$77,714	$2,652,000
Restoration of Grounds	$18,000	$15,750	$19,125	$28,730	$1,440,000	$4,500	$1,526,105
Final Radiation Survey	$97,008	$56,588	$68,714	$103,071	$242,520	$16,168	$584,069
Site Stabilization/Surveillance	$0	$0	$0	$0	$0	$0	$0
TOTAL	$487,465	$355,118	$431,045	$670,580	$2,848,234	$101,582	$4,894,024

Table 11. Ponds 5 thru 9 - Radioactive Waste Packaging Costs

Waste Type	Tons	Number of Containers (Gondolas)	Type of Container	Unit Cost of Container	Total Packaging Cost
Residue/Soil	68000	680	Rail Car	N/A	N/A
(Cost included in Table 13)					
TOTAL	68000	N/A	N/A	N/A	N/A

Table 12. Ponds 5 thru 9 - Radioactive Waste Shipping Costs

Waste Type	Number of Loads	Unit Cost ($/mile/load)	Surcharges ($/mile)	Overweight Charges ($/mile)	Distance Shipped (miles)	Total Shipping Cost
Residue/Soil	680	N/A	N/A	N/A	N/A	N/A
(Cost included in Table 13)						
TOTAL	N/A	N/A	N/A	N/A	N/A	N/A

Fansteel Inc., Muskogee, Oklahoma
Ponds 5 thru 9

Table 13. Ponds 5 thru 9 - Radioactive Waste Disposal Costs

Waste Type	Disposal (Tons)	Unit Cost ($/Ton)	Surcharges ($/$m^3$ or $/container)	Total Disposal Cost
Residue/Soil	68000	$129	$1	$8,772,000
	0			$0
	0			$0
	0			$0
	0			$0
TOTAL	N/A	N/A	N/A	$8,772,000

Table 14. Ponds 5 thru 9 - Equipment/Supply Costs (excluding containers)

Equipment/Supplies	Quantity	Unit Cost	Total Cost	
Truck, Excavator and Loader	1.0	$510,000	$510,000	170 wks Rent
Direct Alpha & Gamma NaI	2.0	$4,800	$9,600	Purchase
Removable Alpha	1.0	$3,000	$3,000	Purchase
PPE/Ras-1/Personal Pump	3.0	$2,000	$6,000	Purchase
Water Truck/Sprayer	1.0	$22,500	$22,500	Rent
TOTAL	N/A	N/A	$551,100	

Table 15. Ponds 5 thru 9 - Independent Third-Party Laboratory Costs

Activity	Total Cost
Sampling	
Transport of Samples	
Testing/Analyses	$30,000
TOTAL	$30,000

Table 16. Ponds 5 thru 9 - Miscellaneous Costs

Cost Item	Total Cost
License Fees	$210,000
Insurance	$262,500
Taxes	$120,000
NRC Oversight	$105,000
TOTAL	$697,500

Fansteel Inc., Muskogee, Oklahoma
Ponds 5 thru 9

Table 17. Ponds 5 thru 9 - Total Decommissioning Costs Rollup

Task/Component	Cost	Percentage
Planning and Preparation	$131,850	1%
Decontamination/Dismantlement	$2,652,000	18%
Grounds Restoration	$1,526,105	10%
Final Radiation Survey	$584,069	4%
Site Stabilization and Surveillance	$0	0%
Waste Packaging	$0	0%
Waste Shipment		0%
Waste Packaging, Shipment and Disposal	$8,772,000	59%
Equipment/Supplies	$551,100	4%
Independent Third-Party Laboratory	$30,000	0%
Miscellaneous	$697,500	5%
Total Decommissioning Cost Estimate	$14,944,624	100%

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Fansteel Inc., Muskogee, Oklahoma
R&D Building 1st Floor

Table 1. R&D Building - General Description

NRC Materials License No. SMB-911 (§40)
Types and Quantities of Materials Authorized 1) 43,000 Kg natural uranium & 71,000 Kg natural thorium Source material possessed as tin slags, ores, process residues and oxides and 2) 4,000 Kg of U and 2,500 Kg of Th as a contaminant in soils and sediment on site.
Description of Licensed Material Use Possession, use, short term storage, and transfer of U and Th and their progenies contained in processing residues including residue processing, metal reclamation, decommissioning and site restoration.
Facility Description The R&D Building is constructed of corrugated metal and has multiple rooms containing office, laboratory, and warehouse space and was formerly used to conduct research and development.
Quantities of Licensed Materials or Waste Accumulated Before Shipping and Disposal

Table 2. R&D Building - First Floor Component Inventory

Level of Radioactive Contamination Average total alpha contamination is 33 dpm/100 cm2 with maximum of 311 dpm/100 cm2				
Level of Non-Radioactive Contamination N/A				
	Component	Number of Components	Component Dimensions ( )	Total Dimensions (ft2)
1.	Floor			5513
2.	Walls and Ceiling			18368
3.				
4.				
5.				
6.				
	Total Area			23881

Fansteel Inc., Muskogee, Oklahoma
R&D Building 1st Floor

Table 3. R&D Building - First Floor Planning and Preparation

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Corporate and Site Project Mngr	Const. Supervisor	HP Technician and Laborer	Clerical/ Production	DM & CPM Multiplier Manual Entry
Preparation of Documentation for Regulatory Agencies	15 0	1.5	1.5			2.0	1.5
Submittal of DP to NRC	10.0	1.5	3.0	5.0		2.0	
Development of Work Plans	40.0	10 0	10 0	25.0		6 0	
Procurement of Special Equipment							
Staff Training	15 0	4.0	1.5				
Radiological Characterization	1.0						
Other							
TOTAL	81.0	17.0	16 0	30.0	0.0	10.0	

Table 4. R&D Building - First Floor Component Decontamination and Dismantling

	Component	Decon Method	HP	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
1.	Floor	Wipe Down	11.0	11.0	11.0	16 5	55.1	11.0
2.	Walls and Ceiling	Wipe Down	36.7	36.7	36.7	55.1	183.7	36.7
3.								
4.								
5.								
6.	Floor (10%)	Scabble	0.0	0.0	0.0	0.0	0 0	0.0
TOTAL			47.8	47.8	47.8	71.6	238.8	47.8

Fansteel Inc., Muskogee, Oklahoma
R&D Building 1st Floor

Table 5. R&D Building - First Floor Restoration of Contaminated Areas on Facility Grounds

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. R&D Building - First Floor Final Radiation Survey

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Area Prep & Set-up (Grid, Maps, Scaffold)	31.8	21.2	21.2	31.8	106.1	21.2
Survey and Sampling Surfaces & Compnts	47.8	31.8	31.8	47.8	159.2	31.8
TOTAL	79.6	53.1	53.1	79.6	265.3	53.1

Table 7. R&D Building - First Floor Site Stabilization and Long-Term Surveillance

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0.0	0 0	0 0	0.0	0.0

Table 8. R&D Building - First Floor Labor Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Planning and Preparation	81.0	17.0	16.0	30 0	0.0	10.0
Decon/Dismantlement	47.8	47.8	47.8	71.6	238.8	47.8
Restoration of Grounds	0.0	0.0	0.0	0.0	0.0	0.0
Final Radiation Survey	79.6	53.1	53 1	79 6	265.3	53.1
Site Stabilization/Surveillance	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	208.4	117.8	116.8	181.2	504.2	110.8

Table 9. R&D Building - (First Floor) Worker Unit Cost Schedule

Labor Cost Component	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Loaded Salary ($/Hour)	$80	$70	$85	$85	$70	$20
Overhead Rate (%)						
Total Annual Cost						
Total Workday Cost (__ workdays/year)						

Fansteel Inc., Muskogee, Oklahoma
R&D Building 1st Floor

Table 10. R&D Building - (First Floor) Labor Cost Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	Technician and Laborer	Clerical/ Production	Total Cost
Planning and Preparation	$6,480	$1,190	$1,360	$2,550	$0	$200	$11,780
Decon/Dismantlement	$3,821	$3,343	$4,060	$6,090	$16,717	$955	$34,986
Restoration of Grounds	$0	$0	$0	$0	$0	$0	$0
Final Radiation Survey	$6,368	$3,715	$4,511	$6,766	$18,574	$1,061	$40,996
Site Stabilization/Surveillance	$0	$0	$0	$0	$0	$0	$0
TOTAL	$16,669	$8,248	$9,931	$15,406	$35,291	$2,217	$87,761

Table 11. R&D Building - (First Floor) Radioactive Waste Packaging Costs

Waste Type	Volume (m^3)	Number of Containers	Type of Container	Unit Cost of Container	Total Packaging Cost
DAW/PPE/Rags/Debris	4 8	1.7	B-25	$600	$1,023
					$0
					$0
					$0
					$0
TOTAL	4 8	N/A	N/A	N/A	$1,023

Table 12. R&D Building - (First Floor) Radioactive Waste Shipping Costs

Waste Type	Number of Loads	Unit Cost ($/mile/load)	Surcharges ($/mile)	Overweight Charges ($/mile)	Distance Shipped (miles)	Total Shipping Cost
DAW/PPE/Rags/Debris	0.19	$0	$1	$1	$1	$0
						$0
						$0
						$0
						$0
TOTAL	N/A	N/A	N/A	N/A	N/A	$0

Fansteel Inc., Muskogee, Oklahoma
R&D Building 1st Floor

Table 13. R&D Building - (First Floor) Radioactive Waste Shipping and Disposal Costs

Waste Type	Disposal Volume (m^3)	Unit Cost (\$/m^3)	Surcharges (\$/m^3 or \$/container)	Total Disposal Cost
DAW/PPE/Rags/Debris	4.8	100.0	$1	$478
	0.0			$0
	0.0			$0
	0.0			$0
	0.0			$0
TOTAL	N/A	N/A	N/A	$478

Table 14. R&D Building - (First Floor) Equipment/Supply Costs (excluding containers)

Equipment/Supplies	Quantity	Unit Cost	Total Cost	
Direct Alpha & Gamma NaI	1.0	$350	$350	
Removable Alpha	1.0	$350	$350	
PPE/Ras-1/Personal Pump	1.0	$350	$350	
Scabbler, HEPA Vac	0.0	$500	$0	Rent/Buy
Rolling Scaffold	1.0	$200	$200	
TOTAL	N/A	N/A	$1,250	

Table 15. R&D Building - (First Floor) Independent Third-Party Laboratory Costs

Activity	Total Cost
Sampling	
Transport of Samples	
Testing/Analyses	$500
TOTAL	$500

Table 16. R&D Building - (First Floor) Miscellaneous Costs

Cost Item	Total Cost
License Fees	$7,000
Insurance	$8,750
Taxes	$4,000
NRC Oversight	$3,500
TOTAL	$23,250

Fansteel Inc., Muskogee, Oklahoma
R&D Building 1st Floor

Table 17. R&D Building - (First Floor) Total Decommissioning Costs Rollup

Task/Component	Cost	Percentage
Planning and Preparation	$11,780	10%
Decontamination/Dismantlement	$34,986	31%
Grounds Restoration	$0	0%
Final Radiation Survey	$40,996	36%
Site Stabilization and Surveillance	$0	0%
Waste Packaging	$1,023	1%
Waste Shipment	$0	0%
Waste Shipment and Disposal	$478	0%
Equipment/Supplies	$1,250	1%
Independent Third-Party Laboratory	$500	0%
Miscellaneous	$23,250	20%
Total Decommissioning Cost Estimate	$114,262	100%

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Fansteel Inc., Muskogee, Oklahoma
R&D Building 2nd Floor

Table 1. R&D Building - General Description

NRC Materials License No SMB-911 (§40)
Types and Quantities of Materials Authorized 1) 43,000 Kg natural uranium & 71,000 Kg natural thorium Source material possessed as tin slags, ores, process residues and oxides and 2) 4,000 Kg of U and 2,500 Kg of Th as a contaminant in soils and sediment on site.
Description of Licensed Material Use Possession, use, short term storage, and transfer of U and Th and their progenies contained in processing residues including residue processing, metal reclamation, decommissioning and site restoration.
Facility Description The R&D Building is constructed of corrugated metal and has multiple rooms containing office, laboratory, and warehouse space and was formerly used to conduct research and development
Quantities of Licensed Materials or Waste Accumulated Before Shipping and Disposal

Table 2. R&D Building - Second Floor Component Inventory

Level of Radioactive Contamination Average total alpha contamination is 5 dpm/100 cm2 with maximum of 33 dpm/100 cm2.				
Level of Non-Radioactive Contamination N/A				
	Component	Number of Components	Component Dimensions ( )	Total Dimensions (ft2)
1.	Floor			1508
2.	Walls and Horizontals			5503
3.				
4.				
5.				
6				
	Total Area			7011

Fansteel Inc., Muskogee, Oklahoma
R&D Building 2nd Floor

Table 3. R&D Building - Second Floor Planning and Preparation

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Corporate and Site Project Mngr	Const. Supervisor	HP Technician and Laborer	Clerical/ Production	DM & CPM Multiplier Manual Entry
Preparation of Documentation for Regulatory Agencies	15.0	1.5	1.5			2.0	1.5
Submittal of DP to NRC	10.0	1.5	3.0	5.0		2.0	
Development of Work Plans	40.0	10.0	10 0	25.0		6 0	
Procurement of Special Equipment							
Staff Training	15.0	4 0	1.5				
Radiological Characterization	1.0						
Other							
TOTAL	81.0	17.0	16.0	30.0	0.0	10.0	

Table 4. R&D Building - Second Floor Component Decontamination and Dismantling

	Component	Decon Method	HP	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
1.	Floor	Wipe Down	3 0	3.0	3.0	4.5	15.1	3.0
2.	Walls and Horizontals	Wipe Down	11.0	11.0	11.0	16.5	55.0	11.0
3.								
4.								
5.								
6.	Floor (10%)	Scabble	0.0	0 0	0.0	0.0	0.0	0 0
TOTAL			14.0	14.0	14.0	21.0	70.1	14.0

Fansteel Inc., Muskogee, Oklahoma
R&D Building 2nd Floor

Table 5. R&D Building - Second Floor Restoration of Contaminated Areas on Facility Grounds

Activity	Health Physicist	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0.0	0.0	0.0	0 0	0.0

Table 6. R&D Building - Second Floor Final Radiation Survey

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Area Prep & Set-up (Grid, Maps, Scaffold)	9.3	6 2	6 2	9.3	31.2	6 2
Survey and Sampling Surfaces & Compnts	14.0	9.3	9.3	14.0	46.7	9 3
TOTAL	23.4	15.6	15.6	23.4	77.9	15.6

Fansteel Inc., Muskogee, Oklahoma
R&D Building 2nd Floor

Table 7. R&D Building - Second Floor Site Stabilization and Long-Term Surveillance

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0.0	0 0	0.0	0.0	0.0

Table 8. R&D Building - Second Floor Labor Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Planning and Preparation	81.0	17.0	16.0	30 0	0.0	10.0
Decon/Dismantlement	14.0	14.0	14.0	21.0	70.1	14.0
Restoration of Grounds	0.0	0.0	0.0	0.0	0 0	0.0
Final Radiation Survey	23.4	15.6	15.6	23.4	77.9	15.6
Site Stabilization/Surveillance	0 0	0.0	0 0	0.0	0.0	0.0
TOTAL	118 4	46 6	45.6	74.4	148 0	39 6

Table 9. R&D Building - (Second Floor) Worker Unit Cost Schedule

Labor Cost Component	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Loaded Salary ($/Hour)	$80	$70	$85	$85	$70	$20
Overhead Rate (%)						
Total Annual Cost						
Total Workday Cost (workdays/year)						

Fansteel Inc., Muskogee, Oklahoma
R&D Building 2nd Floor

Table 10. R&D Building - (Second Floor) Labor Cost Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/HP	Project Mngr	Const. Supervisor & QCO	Technician and Laborer	Clerical/ Production	Total Cost
Planning and Preparation	$6,480	$1,190	$1,360	$2,550	$0	$200	$11,780
Decon/Dismantlement	$1,122	$982	$1,192	$1,788	$4,908	$280	$10,271
Restoration of Grounds	$0	$0	$0	$0	$0	$0	$0
Final Radiation Survey	$1,870	$1,091	$1,324	$1,986	$5,453	$312	$12,036
Site Stabilization/Surveillance	$0	$0	$0	$0	$0	$0	$0
TOTAL	$9,471	$3,262	$3,876	$6,324	$10,361	$792	$34,087

Table 11. R&D Building - (Second Floor) Radioactive Waste Packaging Costs

Waste Type	Volume (m^3)	Number of Containers	Type of Container	Unit Cost of Container	Total Packaging Cost
DAW/PPE/Rags/Debris	1.4	0 5	B-25	$600	$300
					$0
					$0
					$0
					$0
TOTAL	1.4	N/A	N/A	N/A	$300

Table 12. R&D Building - (Second Floor) Radioactive Waste Shipping Costs

Waste Type	Number of Loads	Unit Cost ($/mile/load)	Surcharges ($/mile)	Overweight Charges ($/mile)	Distance Shipped (miles)	Total Shipping Cost
DAW/PPE/Rags/Debris	0.06	$0	$1	$1	$1	$0
						$0
						$0
						$0
						$0
TOTAL	N/A	N/A	N/A	N/A	N/A	$0

Fansteel Inc., Muskogee, Oklahoma
R&D Building 2nd Floor

Table 13. R&D Building - (Second Floor) Radioactive Waste Shipping and Disposal Costs

Waste Type	Disposal Volume (m^3)	Unit Cost ($\$/m^3$)	Surcharges ($\$/m^3$ or \$/container)	Total Disposal Cost
DAW/PPE/Rags/Debris	1.4	100.0	$1	$140
	0.0			$0
	0.0			$0
	0.0			$0
	0 0			$0
TOTAL	N/A	N/A	N/A	$140

Table 14. R&D Building - (Second Floor) Equipment/Supply Costs (excluding containers)

Equipment/Supplies	Quantity	Unit Cost	Total Cost	
Direct Alpha & Gamma NaI	1.0	$350	$350	
Removable Alpha	1.0	$350	$350	
PPE/Ras-1/Personal Pump	1.0	$350	$350	
Scabbler, HEPA Vac	0.0	$500	$0	Rent/Buy
Rolling Scaffold	1.0	$200	$200	
TOTAL	N/A	N/A	$1,250	

Table 15. R&D Building - (Second Floor) Independent Third-Party Laboratory Costs

Activity	Total Cost
Sampling	
Transport of Samples	
Testing/Analyses	$500
TOTAL	$500

Table 16. R&D Building - (Second Floor) Miscellaneous Costs

Cost Item	Total Cost
License Fees	$7,000
Insurance	$8,750
Taxes	$4,000
NRC Oversight	$3,500
TOTAL	$23,250

Fansteel Inc., Muskogee, Oklahoma
R&D Building 2nd Floor

Table 17. R&D Building - (Second Floor) Total Decommissioning Costs Rollup

Task/Component	Cost	Percentage
Planning and Preparation	$11,780	20%
Decontamination/Dismantlement	$10,271	17%
Grounds Restoration	$0	0%
Final Radiation Survey	$12,036	20%
Site Stabilization and Surveillance	$0	0%
Waste Packaging	$300	1%
Waste Shipment	$0	0%
Waste Shipment and Disposal	$140	0%
Equipment/Supplies	$1,250	2%
Independent Third-Party Laboratory	$500	1%
Miscellaneous	$23,250	39%
Total Decommissioning Cost Estimate	$59,527	100%

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Fansteel Inc., Muskogee, Oklahoma
Sodium Reduction Bldg Concrete Pad

Table 1. Sodium Reduction Bldg Concrete Pad - General Description

NRC Materials License No. SMB-911 (§40)
Types and Quantities of Materials Authorized 1) 43,000 Kg natural uranium & 71,000 Kg natural thorium Source material possessed as tin slags, ores, process residues and oxides and 2) 4,000 Kg of U and 2,500 Kg of Th as a contaminant in soils and sediment on site
Description of Licensed Material Use Possession, use, short term storage, and transfer of U and Th and their progenies contained in processing residues including residue processing, metal reclamation, decommissioning and site restoration.
Facility Description The Sodium Reduction Building was previously dismantled. Only the concrete foundation is left in tact. It was formerly used to reduce tantalum powder using metallic sodium.
Quantities of Licensed Materials or Waste Accumulated Before Shipping and Disposal

Table 2. Sodium Reduction Bldg Concrete Pad - Component Inventory

Level of Radioactive Contamination
Average total alpha contamination is 78 dpm/100 cm2 with maximum of 707 dpm/100 cm2

Level of Non-Radioactive Contamination
N/A

	Component	Number of Components	Component Dimensions ( )	Total Dimensions (ft2)
1.	Floor			5285
2.				
3.				
4.				
5.				
6.				
	Total Area			5285

Fansteel Inc., Muskogee, Oklahoma
Sodium Reduction Bldg Concrete Pad

Table 3. Sodium Reduction Bldg Concrete Pad - Planning and Preparation

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Corporate and Site Project Mngr	Const. Supervisor	HP Technician and Laborer	Clerical/ Production	DM & CPM Multiplier Manual Entry
Preparation of Documentation for Regulatory Agencies	15.0	1.5	1.5			2.0	1.5
Submittal of DP to NRC	10.0	1.5	3.0	5 0		2.0	
Development of Work Plans	40 0	10.0	10.0	25 0		6.0	
Procurement of Special Equipment							
Staff Training	15.0	4.0	1.5				
Radiological Characterization	1.0						
Other							
TOTAL	81.0	17.0	16 0	30.0	0.0	10.0	

Table 4. Sodium Reduction Bldg Concrete Pad - Component Decontamination and Dismantling

	Component	Decon Method	HP	Industrial Hygiene/ Safety/HP	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
1.	Floor	Wipe Down						
2.								
3.								
4.								
5.								
6.	Floor (10%)	Scabble	2.3	2.3	2 3	3.5	11.7	2.3
TOTAL			2.3	2.3	2.3	3.5	11.7	2.3

Fansteel Inc., Muskogee, Oklahoma
Sodium Reduction Bldg Concrete Pad

Table 5. Sodium Reduction Bldg Concrete Pad - Restoration of Contaminated Areas on Facility Grounds

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0 0	0.0	0.0	0.0	0 0

Table 6. Sodium Reduction Bldg Concrete Pad - Final Radiation Survey

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Area Prep & Set-up (Grid, Maps, Scaffold)	7.0	4.7	4.7	7.0	23.5	4.7
Survey and Sampling Surfaces & Compnts	10.6	7.0	7.0	10.6	35.2	7.0
TOTAL	17.6	11.7	11.7	17.6	58.7	11.7

Fansteel Inc., Muskogee, Oklahoma
Sodium Reduction Bldg Concrete Pad

Table 7. Sodium Reduction Bldg Concrete Pad - Site Stabilization and Long-Term Surveillance

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0.0	0.0	0 0	0.0	0.0

Table 8. Sodium Reduction Bldg Concrete Pad - Labor Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/HP	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Planning and Preparation	81.0	17.0	16 0	30.0	0.0	10.0
Decon/Dismantlement	2.3	2.3	2.3	3.5	11.7	2.3
Restoration of Grounds	0.0	0.0	0.0	0 0	0.0	0.0
Final Radiation Survey	17.6	11.7	11.7	17.6	58.7	11.7
Site Stabilization/Surveillance	0.0	0.0	0.0	0.0	0 0	0.0
TOTAL	101.0	31.1	30.1	51.1	70.5	24.1

Table 9. Sodium Reduction Bldg Concrete Pad - Worker Unit Cost Schedule

Labor Cost Component	Health Physicist	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Loaded Salary ($/Hour)	$80	$70	$85	$85	$70	$20
Overhead Rate (%)						
Total Annual Cost						
Total Workday Cost (workdays/year)						

Fansteel Inc., Muskogee, Oklahoma
Sodium Reduction Bldg Concrete Pad

Table 10. Sodium Reduction Bldg Concrete Pad - Labor Cost Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	Technician and Laborer	Clerical/ Production	Total Cost
Planning and Preparation	$6,480	$1,190	$1,360	$2,550	$0	$200	$11,780
Decon/Dismantlement	$188	$164	$200	$299	$822	$47	$1,721
Restoration of Grounds	$0	$0	$0	$0	$0	$0	$0
Final Radiation Survey	$1,409	$822	$998	$1,497	$4,111	$235	$9,073
Site Stabilization/Surveillance	$0	$0	$0	$0	$0	$0	$0
TOTAL	$8,077	$2,177	$2,558	$4,347	$4,933	$482	$22,573

Table 11. Sodium Reduction Bldg Concrete Pad - Radioactive Waste Packaging Costs

Waste Type	Volume (m^3)	Number of Containers	Type of Container	Unit Cost of Container	Total Packaging Cost
DAW/PPE/Rags/Debris	0 2	0.1	B-25	$600	$50
					$0
					$0
					$0
					$0
TOTAL	0.2	N/A	N/A	N/A	$50

Table 12. Sodium Reduction Bldg Concrete Pad - Radioactive Waste Shipping Costs

Waste Type	Number of Loads	Unit Cost ($/mile/load)	Surcharges ($/mile)	Overweight Charges ($/mile)	Distance Shipped (miles)	Total Shipping Cost
DAW/PPE/Rags/Debris	0.01	$0	$1	$1	$1	$0
						$0
						$0
						$0
						$0
TOTAL	N/A	N/A	N/A	N/A	N/A	$0

Fansteel Inc., Muskogee, Oklahoma
Sodium Reduction Bldg Concrete Pad

Table 13. Sodium Reduction Bldg Concrete Pad - Radioactive Waste Shipping and Disposal Costs

Waste Type	Disposal Volume (m^3)	Unit Cost ($/$m^3$)	Surcharges ($/$m^3$ or $/container)	Total Disposal Cost
DAW/PPE/Rags/Debris	0.2	$100	$1	$23
	0.0			$0
	0.0			$0
	0.0			$0
	0 0			$0
TOTAL	N/A	N/A	N/A	$23

Table 14. Sodium Reduction Bldg Concrete Pad - Equipment/Supply Costs (excluding containers)

Equipment/Supplies	Quantity	Unit Cost	Total Cost	
Direct Alpha & Gamma NaI	1.0	$350	$350	
Removable Alpha	1.0	$350	$350	
PPE/Ras-1/Personal Pump	1.0	$350	$350	
Scabbler, HEPA Vac	0 0	$500	$0	Rent/Buy
Rolling Scaffold	1.0	$200	$200	
TOTAL	N/A	N/A	$1,250	

Table 15. Sodium Reduction Bldg Concrete Pad - Independent Third-Party Laboratory Costs

Activity	Total Cost
Sampling	
Transport of Samples	
Testing/Analyses	$500
TOTAL	$500

Table 16. Sodium Reduction Bldg Concrete Pad - Miscellaneous Costs

Cost Item	Total Cost
License Fees	$7,000
Insurance	$8,750
Taxes	$4,000
NRC Oversight	$3,500
TOTAL	$23,250

Fansteel Inc., Muskogee, Oklahoma
Sodium Reduction Bldg Concrete Pad

Table 17. Sodium Reduction Bldg Concrete Pad - Total Decommissioning Costs Rollup

Task/Component	Cost	Percentage
Planning and Preparation	$11,780	25%
Decontamination/Dismantlement	$1,721	4%
Grounds Restoration	$0	0%
Final Radiation Survey	$9,073	19%
Site Stabilization and Surveillance	$0	0%
Waste Packaging	$50	0%
Waste Shipment	$0	0%
Waste Shipment and Disposal	$23	0%
Equipment/Supplies	$1,250	3%
Independent Third-Party Laboratory	$500	1%
Miscellaneous	$23,250	49%
Total Decommissioning Cost Estimate	$47,647	100%

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Fansteel Inc., Muskogee, Oklahoma
Thermite Building

Table 1. Thermite Building - General Description

NRC Materials License No SMB-911 (§40)
Types and Quantities of Materials Authorized 1) 43,000 Kg natural uranium & 71,000 Kg natural thorium Source material possessed as tin slags, ores, process residues and oxides and 2) 4,000 Kg of U and 2,500 Kg of Th as a contaminant in soils and sediment on site.
Description of Licensed Material Use Possession, use, short term storage, and transfer of U and Th and their progenies contained in processing residues including residue processing, metal reclamation, decommissioning and site restoration.
Facility Description The Thermite Building contains a single room that formerly housed a furnace for heating material and was also used to discharge water. It contains a tool crib and open space, a small overhead crane, two roll up doors and two man doors.
Quantities of Licensed Materials or Waste Accumulated Before Shipping and Disposal

Table 2. Thermite Building - Component Inventory

Level of Radioactive Contamination
Highest average total alpha contamination of 305 dpm/100 cm2 with maximum of 1,924 dpm/100 cm2 per room or component on the first floor.

Level of Non-Radioactive Contamination
N/A

	Component	Number of Components	Component Dimensions ( )	Total Dimensions (ft2)
1.	Floor			3176
2.	Walls and Horizontals			8658
3.				
4.				
5.				
6.				
	Total Area			11834

Fansteel Inc., Muskogee, Oklahoma
Thermite Building

Table 3. Thermite Building - Planning and Preparation

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Corporate and Site Project Mngr	Const. Supervisor	HP Technician and laborer	Clerical/ Production	DM & CPM Multiplier Manual Entry
Preparation of Documentation for Regulatory Agencies	15.0	1.5	1.5			2.0	1.5
Submittal of DP to NRC	10.0	1.5	3.0	5.0		2.0	
Development of Work Plans	40.0	10.0	10.0	25 0		6.0	
Procurement of Special Equipment							
Staff Training	15.0	4.0	1.5				
Radiological Characterization	1.0						
Other							
TOTAL	81.0	17.0	16 0	30.0	0.0	10 0	

Table 4. Thermite Building - Component Decontamination and Dismantling

	Component	Decon Method	HP	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and laborer	Clerical/ Production
1.	Floor	Wipe Down	6.4	6.4	6 4	9.5	31.8	6.4
2.	Walls and Horizontals	Wipe Down	17.3	17.3	17.3	26.0	86.6	17.3
3								
4.								
5.								
6.	Floor (10%)	Scabble	0.0	0.0	0.0	0 0	0.0	0.0
TOTAL			23.7	23.7	23.7	35.5	118.3	23.7

Fansteel Inc., Muskogee, Oklahoma
Thermite Building

Table 5. Thermite Building - Restoration of Contaminated Areas on Facility Grounds

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician and laborer	Clerical/ Production
N/A						
TOTAL	0.0	0.0	0 0	0 0	0.0	0.0

Table 6. Thermite Building - Final Radiation Survey

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and laborer	Clerical/ Production
Area Prep & Set-up (Grid, Maps, Scaffold)	15 8	10.5	10.5	15.8	52.6	10.5
Survey and Samplıng Surfaces & Compnts	23.7	15.8	15.8	23.7	78.9	15.8
TOTAL	39.4	26.3	26.3	39.4	131.5	26.3

Fansteel Inc., Muskogee, Oklahoma
Thermite Building

Table 7. Thermite Building - Site Stabilization and Long-Term Surveillance

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician and laborer	Clerical/ Production
N/A						
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0

Table 8. Thermite Building - Labor Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and laborer	Clerical/ Production
Planning and Preparation	81.0	17.0	16.0	30.0	0.0	10.0
Decon/Dismantlement	23.7	23.7	23.7	35.5	118.3	23.7
Restoration of Grounds	0.0	0 0	0.0	0.0	0.0	0.0
Final Radiation Survey	39.4	26.3	26.3	39.4	131.5	26 3
Site Stabilization/Surveillance	0.0	0 0	0.0	0.0	0.0	0.0
TOTAL	144.1	67.0	66.0	104.9	249.8	60.0

Table 9. Thermite Building - Worker Unit Cost Schedule

Labor Cost Component	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and laborer	Clerical/ Production
Loaded Salary ($/Hour)	$80	$70	$85	$85	$70	$20
Overhead Rate (%)						
Total Annual Cost						
Total Workday Cost (workdays/year)						

Fansteel Inc., Muskogee, Oklahoma
Thermite Building

Table 10. Thermite Building - Labor Cost Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and laborer	Clerical/ Production	Total Cost
Planning and Preparation	$6,480	$1,190	$1,360	$2,550	$0	$200	$11,780
Decon/Dismantlement	$1,893	$1,657	$2,012	$3,018	$8,284	$473	$17,337
Restoration of Grounds	$0	$0	$0	$0	$0	$0	$0
Final Radiation Survey	$3,156	$1,841	$2,235	$3,353	$9,204	$526	$20,315
Site Stabilization/Surveillance	$0	$0	$0	$0	$0	$0	$0
TOTAL	$11,529	$4,688	$5,607	$8,921	$17,488	$1,199	$49,432

Table 11. Thermite Building - Radioactive Waste Packaging Costs

Waste Type	Volume (m^3)	Number of Containers	Type of Container	Unit Cost of Container	Total Packaging Cost
DAW/PPE/Rags/Debris	2.4	0.8	B-25	$600	$507
					$0
					$0
					$0
					$0
TOTAL	2 4	N/A	N/A	N/A	$507

Table 12. Thermite Building - Radioactive Waste Shipping Costs

Waste Type	Number of Loads	Unit Cost ($/mile/load)	Surcharges ($/mile)	Overweight Charges ($/mile)	Distance Shipped (miles)	Total Shipping Cost
DAW/PPE/Rags/Debris	0.09	$0	$1	$1	$1	$0
						$0
						$0
						$0
						$0
TOTAL	N/A	N/A	N/A	N/A	N/A	$0

Fansteel Inc., Muskogee, Oklahoma
Thermite Building

Table 13. Thermite Building - Radioactive Waste Shipping and Disposal Costs

Waste Type	Disposal Volume (m^3)	Unit Cost (\$/m^3)	Surcharges (\$/m^3 or \$/container)	Total Disposal Cost
DAW/PPE/Rags/Debris	2.4	$100	$1	$237
	0 0			$0
	0.0			$0
	0.0			$0
	0.0			$0
TOTAL	N/A	N/A	N/A	$237

Table 14. Thermite Building - Equipment/Supply Costs (excluding containers)

Equipment/Supplies	Quantity	Unit Cost	Total Cost	
Direct Alpha & Gamma NaI	1.0	$350	$350	
Removable Alpha	1.0	$350	$350	
PPE/Ras-1/Personal Pump	1.0	$350	$350	
Scabbler, HEPA Vac	0.0	$500	$0	Rent/Buy
Rolling Scaffold	1.0	$200	$200	
TOTAL	N/A	N/A	$1,250	

Table 15. Thermite Building - Independent Third-Party Laboratory Costs

Activity	Total Cost
Sampling	
Transport of Samples	
Testing/Analyses	$500
TOTAL	$500

Table 16. Thermite Building - Miscellaneous Costs

Cost Item	Total Cost
License Fees	$7,000
Insurance	$8,750
Taxes	$4,000
NRC Oversight	$3,500
TOTAL	$23,250

Fansteel Inc., Muskogee, Oklahoma
Thermite Building

Table 17. Thermite Building - Total Decommissioning Costs Rollup

Task/Component	Cost	Percentage
Planning and Preparation	$11,780	16%
Decontamination/Dismantlement	$17,337	23%
Grounds Restoration	$0	0%
Final Radiation Survey	$20,315	27%
Site Stabilization and Surveillance	$0	0%
Waste Packaging	$507	1%
Waste Shipment	$0	0%
Waste Shipment and Disposal	$237	0%
Equipment/Supplies	$1,250	2%
Independent Third-Party Laboratory	$500	1%
Miscellaneous	$23,250	31%
Total Decommissioning Cost Estimate	$75,176	100%

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Fansteel Inc., Muskogee, Oklahoma
Weir Building

Table 1. Weir Building - General Description

NRC Materials License No. SMB-911 (§40)
Types and Quantities of Materials Authorized 1) 43,000 Kg natural uranium & 71,000 Kg natural thorium Source material possessed as tin slags, ores, process residues and oxides and 2) 4,000 Kg of U and 2,500 Kg of Th as a contaminant in soils and sediment on site.
Description of Licensed Material Use Possession, use, short term storage, and transfer of U and Th and their progenies contained in processing residues including residue processing, metal reclamation, decommissioning and site restoration.
Facility Description The WEIR Building or Outfall 001 Building has one room and was formerly utilized for wastewater discharge into the Arkansas River. It is constructed out of wood with corrugated metal and a concrete floor. There is one sliding barn door and two man-doors.
Quantities of Licensed Materials or Waste Accumulated Before Shipping and Disposal

Table 2. Weir Building - Component Inventory

Level of Radioactive Contamination Average total alpha contamination 42 dpm/100 cm2 with maximum of 67 dpm/100 cm2.
Level of Non-Radioactive Contamination N/A

	Component	Number of Components	Component Dimensions ( )	Total Dimensions (ft2)
1.	Floor			1300
2.	Walls and Horizontals			3800
3				
4.				
5.				
6.				
	Total Area			5100

Fansteel Inc., Muskogee, Oklahoma
Weir Building

Table 3. Weir Building - Planning and Preparation

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Corporate and Site Project Mngr	Const. Supervisor	HP Technician and Laborer	Clerical/ Production	DM & CPM Multiplier Manual Entry
Preparation of Documentation for Regulatory Agencies	15.0	1.5	1.5			2.0	1.5
Submittal of DP to NRC	10 0	1.5	3.0	5.0		2.0	
Development of Work Plans	40 0	10.0	10 0	25.0		6 0	
Procurement of Special Equipment							
Staff Training	15.0	4.0	1.5				
Radiological Characterization	1.0						
Other							
TOTAL	81.0	17.0	16 0	30.0	0.0	10.0	

Table 4. Weir Building - Component Decontamination and Dismantling

	Component	Decon Method	HP	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
1.	Floor	Wipe Down	3.7	3.7	3.7	5.6	18.6	3.7
2.	Walls and Horizontals	Wipe Down	10.9	10.9	10 9	16 3	54.3	10.9
3.								
4.								
5								
6	Floor (10%)	Scabble	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL			14.6	14.6	14 6	21.9	72.9	14.6

Fansteel Inc., Muskogee, Oklahoma
Weir Building

Table 5. Weir Building - Restoration of Contaminated Areas on Facility Grounds

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
N/A						
TOTAL	0.0	0 0	0 0	0.0	0.0	0 0

Table 6. Weir Building - Final Radiation Survey

Activity	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Area Prep & Set-up (Grid, Maps, Scaffold)	5 1	3.4	3.4	5.1	17.0	3.4
Survey and Sampling Surfaces & Compnts	7.7	5.1	5.1	7.7	25.5	5.1
TOTAL	12.8	8 5	8.5	12 8	42.5	8.5

Fansteel Inc., Muskogee, Oklahoma
Weir Building

Table 7. Weir Building - Site Stabilization and Long-Term Surveillance

Activity	Health Physicist	Industrial Hygiene/ Safety	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
N/A						
TOTAL	0 0	0.0	0.0	0 0	0.0	0.0

Table 8. Weir Building - Labor Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Planning and Preparation	81.0	17.0	16.0	30 0	0.0	10.0
Decon/Dismantlement	14.6	14.6	14.6	21.9	72.9	14.6
Restoration of Grounds	0 0	0.0	0.0	0.0	0.0	0.0
Final Radiation Survey	12.8	8.5	8.5	12 8	42.5	8 5
Site Stabilization/Surveillance	0 0	0 0	0.0	0.0	0.0	0.0
TOTAL	108.3	40.1	39.1	64.6	115.4	33.1

Table 9. Weir Building - Worker Unit Cost Schedule

Labor Cost Component	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	HP Technician and Laborer	Clerical/ Production
Loaded Salary ($/Hour)	$80	$70	$85	$85	$70	$20
Overhead Rate (%)						
Total Annual Cost						
Total Workday Cost (__ workdays/year)						

Fansteel Inc., Muskogee, Oklahoma
Weir Building

Table 10. Weir Building - Labor Cost Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor & QCO	Technician and Laborer	Clerical/ Production	Total Cost
Planning and Preparation	$6,480	$1,190	$1,360	$2,550	$0	$200	$11,780
Decon/Dismantlement	$1,166	$1,020	$1,239	$1,858	$5,100	$291	$10,674
Restoration of Grounds	$0	$0	$0	$0	$0	$0	$0
Final Radiation Survey	$1,020	$595	$723	$1,084	$2,975	$170	$6,566
Site Stabilization/Surveillance	$0	$0	$0	$0	$0	$0	$0
TOTAL	$8,666	$2,805	$3,321	$5,492	$8,075	$661	$29,020

Table 11. Weir Building - Radioactive Waste Packaging Costs

Waste Type	Volume (m^3)	Number of Containers	Type of Container	Unit Cost of Container	Total Packaging Cost
DAW/PPE/Rags/Debris	1.5	0.5	B-25	$600	$312
					$0
					$0
					$0
					$0
TOTAL	1.5	N/A	N/A	N/A	$312

Table 12. Weir Building - Radioactive Waste Shipping Costs

Waste Type	Number of Loads	Unit Cost ($/mile/load)	Surcharges ($/mile)	Overweight Charges ($/mile)	Distance Shipped (miles)	Total Shipping Cost
DAW/PPE/Rags/Debris	$0	$0	$1	$1	$1	$0
						$0
						$0
						$0
						$0
TOTAL	N/A	N/A	N/A	N/A	N/A	$0

Fansteel Inc., Muskogee, Oklahoma
Weir Building

Table 13. Weir Building - Radioactive Waste Shipping and Disposal Costs

Waste Type	Disposal Volume (m^3)	Unit Cost ($/$m^3$)	Surcharges ($/$m^3$ or $/container)	Total Disposal Cost
DAW/PPE/Rags/Debris	1.5	$100	$1	$146
	0.0			$0
	0.0			$0
	0.0			$0
	0.0			$0
TOTAL	N/A	N/A	N/A	$146

Table 14. Weir Building - Equipment/Supply Costs (excluding containers)

Equipment/Supplies	Quantity	Unit Cost	Total Cost	
Direct Alpha & Gamma NaI	1.0	$350	$350	
Removable Alpha	1.0	$350	$350	
PPE/Ras-1/Personal Pump	1.0	$350	$350	
Scabbler, HEPA Vac	0.0	$500	$0	Rent/Buy
Rolling Scaffold	1.0	$200	$200	
TOTAL	N/A	N/A	$1,250	

Table 15. Weir Building - Independent Third-Party Laboratory Costs

Activity	Total Cost
Sampling	
Transport of Samples	
Testing/Analyses	$500
TOTAL	$500

Table 16. Weir Building - Miscellaneous Costs

Cost Item	Total Cost
License Fees	$7,000
Insurance	$8,750
Taxes	$4,000
NRC oversight	$3,500
TOTAL	$23,250

Fansteel Inc., Muskogee, Oklahoma
Weir Building

Table 17. Weir Building - Total Decommissioning Costs Rollup

Task/Component	Cost	Percentage
Planning and Preparation	$11,780	22%
Decontamination/Dismantlement	$10,674	20%
Grounds Restoration	$0	0%
Final Radiation Survey	$6,566	12%
Site Stabilization and Surveillance	$0	0%
Waste Packaging	$312	1%
Waste Shipment	$0	0%
Waste Shipment and Disposal	$146	0%
Equipment/Supplies	$1,250	2%
Independent Third-Party Laboratory	$500	1%
Miscellaneous	$23,250	43%
Total Decommissioning Cost Estimate	$54,478	100%

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Fansteel Inc., Muskogee, Oklahoma
Impacted Site Soil

Table 1. Impacted Site Soil - General Description

NRC Materials License No. SMB-911 (§40)
Types and Quantities of Materials Authorized 1) 43,000 Kg natural uranium & 71,000 Kg natural thorium Source material possessed as tin slags, ores, process residues and oxides and 2) 4,000 Kg of U and 2,500 Kg of Th as a contaminant in soils and sediment on site.
Description of Licensed Material Use Possession, use, short term storage, and transfer of U and Th and their progenies contained in processing residues including residue processing, metal reclamation, decommissioning and site restoration.
Facility Description Impacted site soil located primarily between the Fansteel site east property line and the Chem A and Chem C Buildings including soils removed during excavation of the interceptor trench.
Quantities of Licensed Materials or Waste Accumulated Before Shipping and Disposal

Table 2. Impacted Site Soil- Component Inventory

Level of Radioactive Contamination
Surface and Subsurface soil Th-232 concentrations up to 21 pCi/g. Surface and Subsurface soil U-238 concentrations up to 59 pCi/g.

Level of Non-Radioactive Contamination

	Component	Number of Components	Component Dimensions (ft2)	Total Mass (Tons)
1.	Area 1 south of Chem C Bldg, various depths			15,855
2.	Area 2 north of Bertha Bldg, shallow deposit ~ 3 ft depth			
3.	Area 3 east of Bertha Bldg, 10 ft deep			
4.	Area 4 south of Bertha Bldg near B-51, 4 ft deep			
5.	Area 5 south of Bertha Bldg, near B-65, 20 ft deep			
6.	Super Sack Soils in storage			
	Total Site Area excluding ponds for Final Status Survey		700000	

Fansteel Inc., Muskogee, Oklahoma
Impacted Site Soil

Table 3. Impacted Site Soil - Planning and Preparation

Activity	HPS	Industrial Hygiene/ Safety/RSO	Corporate Manager and Site Project Mngr	Const. Supervisor/QCS	Technician/ Laborer/ Operator	Clerical/ Production	DM & CPM Multiplier Manual Entry
Preparation of Documentation for Regulatory Agencies	120	20	40			30	1.5
Submittal of DP to NRC	150	20	40	150		30	
Development of Work Plans	360	60	60	360		100	
Procurement of Special Equipment							
Staff Training	100	50	10				
Radiological Characterization	40	4	2				
Other							
TOTAL	770	154	152	510	0	160	

Table 4. Impacted Site Soil- Component Decontamination and Dismantling

	Component	Decon Method	HPS	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCS	HPT 3Laborer 2Operator	Clerical/ Production
1.	Impacted Site Soil	Excavation	1669	1669	1669	2503	2086	1669
2.		Hauling						
3.								
4.								
5.								
6.								
TOTAL			1669	1669	1669	2503	2086	1669

Fansteel Inc., Muskogee, Oklahoma
Impacted Site Soil

Table 5. Impacted Site Soil - Restoration of Contaminated Areas on Facility Grounds

Activity	HPS	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCS	Labor and Soil Cost	Clerical/ Production
Backfill	10	40	40	25	350	25
TOTAL	10	40	40	25	350	25

Table 6. Impacted Site Soil - Final Radiation Survey

Activity	HPS/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCS	HPT 3Laborer 2Operator	Clerical/ Production
Area Prep & Set-up (Grid, Maps)	210	140	140	210	175	140
Survey and Sampling	280	187	187	187	233	187
TOTAL	490	327	327	397	408	327

Fansteel Inc., Muskogee, Oklahoma
Impacted Site Soil

Table 7. Impacted Site Soil - Site Stabilization and Long-Term Surveillance

Activity	HP	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCS	HPT Laborer Operator	Clerical/ Production
TOTAL	0.0	0.0	0.0	0 0	0.0	0.0

Table 8. Impacted Site Soil - Labor Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCS	HPT 3Laborer 2Operator	Clerical/ Production
Planning and Preparation	770	154	152	510	0	160
Decon/Dismantlement	1,669	1,669	1,669	2,503	2,086	1,669
Restoration of Grounds	10	40	40	25	350	25
Final Radiation Survey	490	327	327	397	408	327
Site Stabilization/Surveillance	0	0	0	0	0	0
TOTAL	2,939	2,190	2,188	3,435	2,845	2,181

Table 9. Impacted Site Soil - Worker Unit Cost Schedule

Labor Cost Component	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/ QCS	HPT 3Laborer 2Operator	Clerical/ Production
Loaded Salary ($/Hour)	$80	$70	$85	$85	$240	$20
Overhead Rate (%)						
Total Annual Cost						
Total Workday Cost (workdays/year)						

Fansteel Inc., Muskogee, Oklahoma
Impacted Site Soil

Table 10. Impacted Site Soil - Labor Cost Rollup by Task

Task	HP/DM	Industrial Hygiene/ Safety/RSO	Project Mngr	Const. Supervisor/QCS	HPT 3Laborer 2Operator	Clerical/ Production	Total Cost
Planning and Preparation	$61,600	$10,780	$12,920	$43,350	$0	$3,200	$131,850
Decon/Dismantlement	$133,516	$116,826	$141,861	$212,791	$500,684	$33,379	$1,139,057
Restoration of Grounds	$800	$2,800	$3,400	$2,125	$84,000	$500	$93,625
Final Radiation Survey	$39,200	$22,867	$27,767	$33,717	$98,000	$6,533	$228,083
Site Stabilization/Surveillance	$0	$0	$0	$0	$0	$0	$0
TOTAL	$235,116	$153,273	$185,947	$291,982	$682,684	$43,612	$1,592,615

Table 11. Impacted Site Soil - Radioactive Waste Packaging Costs

Waste Type	Tons	Number of Containers (Gondolas)	Type of Container	Unit Cost of Container	Total Packaging Cost
Soil	15855	159	Rail Car	N/A	N/A
(Cost included in Table 13)					
TOTAL	15855	N/A	N/A	N/A	N/A

Table 12. Impacted Site Soil - Radioactive Waste Shipping Costs

Waste Type	Number of Loads	Unit Cost ($/mile/load)	Surcharges ($/mile)	Overweight Charges ($/mile)	Distance Shipped (miles)	Total Shipping Cost
Soil	159	N/A	N/A	N/A	N/A	N/A
(Cost included in Table 13)						
TOTAL	N/A	N/A	N/A	N/A	N/A	N/A

Fansteel Inc., Muskogee, Oklahoma
Impacted Site Soil

Table 13. Impacted Site Soil - Radioactive Waste Transport and Disposal Costs

Waste Type	Disposal (Tons)	Unit Cost ($/Ton)	Surcharges ($/m^3 or $/container)	Total Disposal Cost
Soil	15855	122.0	$1	$1,934,310
	0			$0
	0			$0
	0			$0
	0			$0
TOTAL	N/A	N/A	N/A	$1,934,310

Table 14. Impacted Site Soil - Equipment/Supply Costs (excluding containers)

Equipment/Supplies	Quantity	Unit Cost	Total Cost	
Truck, Excavator and Loader	1	$156,000	$156,000	$3000/week
Direct Alpha & Gamma NaI	2	$4,800	$9,600	
Removable Alpha	1	$3,000	$3,000	
PPE/Ras-1/Personal Pump	3	$2,000	$6,000	
Water Truck/Sprayer	1	$7,500	$7,500	
TOTAL	N/A	N/A	$182,100	

Table 15. Impacted Site Soil - Independent Third-Party Laboratory Costs

Activity	Total Cost
Sampling	
Transport of Samples	
Testing/Analyses	$10,000
TOTAL	$10,000

Table 16. Impacted Site Soil - Miscellaneous Costs

Cost Item	Total Cost
License Fees	$147,000
Insurance	$183,750
Taxes	$84,000
NRC Oversight	$73,500
TOTAL	$488,250

Fansteel Inc., Muskogee, Oklahoma
Impacted Site Soil

Table 17. Impacted Site Soil - Total Decommissioning Costs Rollup

Task/Component	Cost	Percentage
Planning and Preparation	$131,850	3%
Decontamination/Dismantlement	$1,139,057	27%
Grounds Restoration	$93,625	2%
Final Radiation Survey	$228,083	5%
Site Stabilization and Surveillance	$0	0%
Waste Packaging	$0	0%
Waste Shipment		0%
Waste Packaging, Shipment and Disposal	$1,934,310	46%
Equipment/Supplies	$182,100	4%
Independent Third-Party Laboratory	$10,000	0%
Miscellaneous	$488,250	12%
Total Decommissioning Cost Estimate	$4,207,275	100%

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