International Isotopes Fluorine Products

International Isotopes Fluorine Products, Inc. (IIFP)
A Wholly Owned Subsidiary of
International Isotopes, Inc. (INIS)

Fluorine Extraction Process & Depleted Uranium De-conversion (FEP/DUP) Plant

License Application

Chapter 10
Decommissioning

Revision B
November 17, 2011

TABLE OF CONTENTS

LIST OF FIGURES 10-ii
LIST OF TABLES 10-ii
ACRONYMS and ABBREVIATIONS (Provided In License Application Chapter 1 Revision B)

10 DECOMMISSIONING 10-1

10.1 DECOMMISSIONING STRATEGY 10-1
10.1.1 IIFP Facility Description 10-1
10.1.2 Decommissioning Design Features 10-2
10.1.2.1 Overview 10-2
10.1.2.2 Radioactive Contamination Control 10-2
10.1.2.3 Worker Exposure and Waste Volume Control 10-3
10.1.2.4 Management Organization 10-4
10.1.2.5 Health and Safety 10-4
10.1.2.6 Waste Management 10-4
10.1.2.7 Security/Material Control 10-4
10.1.2.8 Recordkeeping 10-5
10.1.3 Decommissioning Process 10-5
10.1.3.1 Overview 10-5
10.1.3.2 Size Reduction and Packaging Facility Outfitting 10-7
10.1.3.3 System Preparation 10-7
10.1.3.4 Dismantling 10-7
10.1.3.5 Decontamination/Size Reduction 10-8
10.1.3.6 Salvage of Equipment and Materials 10-8
10.1.3.7 Disposal 10-8
10.1.3.8 Final Radiation Survey 10-8
10.1.3.9 Decommissioning Impact on Integrated Safety Analysis 10-9
10.1.4 Decontamination/Size Reduction Process 10-9
10.1.4.1 Overview 10-9
10.1.4.2 Methodology 10-10
10.1.4.3 Size Reduction and Packaging Facilities Description 10-10
10.1.4.4 Procedures 10-11
10.1.4.5 Results 10-11

10.2 SITE-SPECIFIC COST ESTIMATE 10-11
10.2.1 Cost Estimate Structure 10-12
10.2.2 Decommissioning Cost Estimate 10-12
10.2.2.1 Summary of Costs 10-12
10.2.2.2 Major Assumptions 10-12

10.3 FINANCIAL ASSURANCE 10-12
10.3.1 Decommissioning Funding Mechanism 10-13
10.3.2 Adjusting Decommissioning Costs and Funding 10-13
10.3.3 Recordkeeping Plans Related to Decommissioning Funding 10-14

REFERENCES 10-39

LIST OF FIGURES

Figure 10-1 Estimated Decommissioning Schedule 10-15

LIST OF TABLES

Table 10-1 DUF_4 Process and DUF_6 Autoclave Building Components 10-16

Table 10-2 Decontamination Building and Laboratory Components 10-19

Table 10-3 FEP Buildings - Components for SiF_4 Process 10-20

Table 10-4 FEP Buildings - Components for BF_3 Process 10-22

Table 10-5 EPP Facility Components 10-24

Table 10-6 Facility Components - Ventilation 10-26

Table 10-7 Planning and Preparing (Labor Hours) 10-27

Table 10-8 Facility Characterization 10-28

Table 10-9 Dismantling and Decontamination 10-29

Table 10-10 Restoration of Contaminated Areas on Facility Grounds (Labor Hours) 10-30

Table 10-11 Final Radiation Survey (Labor Hours) 10-31

Table 10-12 Site Stabilation and Long Term Surveillance (Labor Hours) 10-32

Table 10-13 Total Work Days by Labor Category (Labor Days) 10-33

Table 10-14 Worker Unit Cost Schedule 10-34

Table 10-15 Total Labor by Major Decommissioning Task 10-35

Table 10-16 Packaging, Shipping and Disposal of Radioactive Wastes 10-36

Table 10-17 Total Administrative Supplies by Major Decommissioning Task 10-37

Table 10-18 Total Decommissioning Cost 10-38

10 DECOMMISSIONING

Chapter 10 of the International Isotopes Fluorine Products, Inc. (IIFP), License Application (LA) presents the Decommissioning Funding Plan (DFP) for its initial IIFP Facility that is also referred to as the Fluorine Extraction Process and Uranium De-conversion (FEP/DUP) Plant. This Decommissioning Funding Plan has been developed following the guidance provided in NUREG-1757, U.S. Nuclear Regulatory Commission (NRC), 2006. The DFP is only for the current IIFP License Application and licensing activities. Any future facility expansions of licensing actions will require an amended or separate DFP.

IIFP, Inc. commits to decontaminate and decommission the facility at the end of its operation so that the facility and grounds can be released for unrestricted use. Prior to facility decommissioning, a Decommissioning Implementation Plan will be prepared in accordance with 10 Code of Federal Regulations (CFR) 40.42 (CFR, 2008a) and submitted to the NRC for approval.

This chapter fulfills the applicable provisions of NUREG-1757 (NRC, 2006) through the submittal of information in tabular form (Tables 10-1 through 10-18) in a format as suggested by the NUREG.

10.1 DECOMMISSIONING STRATEGY

The overall strategy for decommissioning is to decontaminate or remove all materials from the IIFP Site in order to release the facility and the site for unrestricted use. This approach avoids long-term storage and monitoring of wastes on the site. The types and volumes of wastes produced at the IIFP Facility do not warrant delays in waste removal normally associated with a deferred dismantlement option.

At the end of useful plant life, the IIFP Facility will be decommissioned such that the site and remaining facilities may be released for unrestricted use as defined in 10 CFR 20.1402 (CFR, 2008b). IIFP will use guidance provided in NUREG-1505, NUREG-1575 and NUREG-1757 in developing initial and final site survey plans sufficient to provide background and post- decontamination site condition to enable the free release of the IIFP Site.

All remaining facilities will be decontaminated where needed to acceptable levels for unrestricted use. Hazardous wastes will be treated or disposed of in licensed hazardous waste facilities. Disposal of radioactive or hazardous material will not occur at the plant site but at licensed facilities located elsewhere. Following decommissioning, the facilities and site will be available for reuse.

Financial arrangements are made to cover costs required for returning the IIFP Facility to unrestricted use. Updates on cost and funding will be provided as described below in Section 10.3.2 “Adjusting Decommissioning Costs and Funds.”

The following describes decommissioning plans and funding arrangements. This information was developed in support of the decommissioning cost estimate. Specific elements of decommissioning may change with the submittal of a Decommissioning Implementation Plan required at the time of license termination.

10.1.1 IIFP Facility Description

The IIFP Facility and Site are described in the IIFP LA, Revision B. Information relating to the following topics can be found in the referenced LA chapters listed below:

- A general description of the facility and plant processes is presented in the IIFP LA, Revision B Chapter 1 "General Information."

- A detailed description of the Plant Site and Facility and the safety aspects of the plant processes are presented in the IIFP Revision B Integrated Safety Analysis (ISA) Summary.

- A description of the specific quantities and types of licensed materials used at the facility is provided in LA, Revision B Chapter 1 Section 1.3 "Type, Quantity and Form of Licensed Material."

- A general description of how licensed materials are used at the facility is provided in LA, Revision B Chapter 1.

10.1.2 Decommissioning Design Features

The following sections describe the IIFP decommissioning design features.

10.1.2.1 Overview

Decommissioning planning begins with ensuring design features are incorporated into the plant's initial design that will simplify eventual dismantling and decontamination. The plans are implemented through proper management and health and safety programs. Decommissioning policies address radioactive waste management, radioactive contamination control, physical security and material control.

Major features incorporated into the facility design to facilitate decontamination and decommissioning are described in the following sections.

10.1.2.2 Radioactive Contamination Control

The following features primarily serve to prevent the spread of radioactive contamination during operation thereby simplifying eventual facility decommissioning. As a result, worker exposure to radiation and radioactive waste volumes is minimized as well.

- Building areas where uranium is processed and handled are separated physically from other buildings, rooms and areas where there is no need to have uranium present. These areas have separate ventilation and filtration systems to preclude the spread of contamination. Boundary control stations and hand/foot and portable monitors are used at applicable locations to verify that personnel and items exiting uranium process areas do not spread radiological materials into non-uranium areas. The Depleted Uranium Tetrafluoride ($DUF_{4)}$ Process Building, Fluorine Extraction Process (FEP) Oxide Staging Building, the plant operations Decontamination Building, DUF_4 Container Storage Building, DUF_4 Container Staging Building and the FEP Process Building are subject to these specific design features.

- All areas of the plant are sectioned into Unrestricted, Controlled and Restricted Areas as described in the LA, Revision B Chapter 1 Section 1.1.2. Restricted Areas limit access for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials. Radiation areas and potential airborne contamination areas have additional controls in place to inform workers of the potential hazard in the area and to help prevent the spread of contamination. All procedures for these areas fall under the Radiation Protection Program (RPP) and serve to minimize the spread of contamination and simplify the eventual decommissioning.

- Routine radiological surveys will be conducted throughout the operating lifetime of the facility that will minimize the likelihood that radioactive contamination goes undetected and will provide a historical record which will simplify the site characterization process. The historical Radiological Environmental Monitoring Program (REMP) will also be used to provide guidance for the final site survey. Samples will be collected to verify the historical data collected via the REMP. Additional samples will be collected if areas of contamination are found.

- The location of process equipment and systems not used in processing licensed materials is minimized in areas subject to potential contamination. This limits both the size of the Restricted Areas and the activities occurring inside these areas.

- Containment equipment with hoods that exhaust through dust collectors that are designed with high removal efficiencies are used where uranium materials are being packaged or withdrawn from process systems.

- The hazardous material processes include designs for purge and evacuation (P&E) systems and dust-collection equipment as means to provide effective clean out of residual chemicals or dust from equipment or piping prior to opening systems for maintenance. The P&E and dust collector systems use multiple collection equipment in series (defense-in-depth) to ensure removal and treatment efficiency, redundancy, effectiveness and reliability.

- Storm water runoff via the plant storm sewer system flows to a retention basin for evaporation or tree farm watering or approved discharge. It is not likely that collected storm water would exceed acceptable or regulated levels, but routine sampling for reuse or discharge is conducted for further assurance. Domestic sanitary waste water is tertiary treated to meet all discharge standards and is either evaporated or used as harvested water for the facility tree farm, . The facility is designed for no chemical process water discharges. Engineered systems are used to provide for regeneration of scrubbing solutions and recycle within the process systems.

10.1.2.3 Worker Exposure and Waste Volume Control

The following features serve primarily to minimize worker exposure to radiation and minimize radioactive waste volumes during decontamination activities. As a result, the spread of contamination is minimized as well.

- During construction, a washable coating is applied to designated floors and walls in the Restricted Areas that have higher potential to become radioactively contaminated during operation. The coating will serve to lower waste volumes during decontamination and simplify the decontamination process.

- Sealed nonporous pipe insulation is used in areas with higher potential to become contaminated. This will facilitate cleaning in the event of a spill and will reduce waste volume during decommissioning.

- Ample access is provided for efficient equipment dismantling and removal of equipment that may be contaminated. This minimizes the time of worker exposure.

- Process tanks have access for entry and decontamination. Design provisions are also made to allow complete draining of the wastes contained in the tanks.

- Process system connections provided for required operation and maintenance allow for thorough purging at plant shutdown. This will remove a significant portion of radioactive contamination prior to disassembly.

- Design drawings produced for all areas of the plant will be used to simplify the planning and implementing of decontamination procedures. This will help reduce worker exposure.

- Worker access to contaminated areas is controlled to assure that workers wear proper protective equipment and limit their time in these areas.

10.1.2.4 Management Organization

An appropriate organizational structure will be developed to support the decommissioning strategy. This organization will ensure that adequate numbers of experienced and knowledgeable personnel are available to perform the technical and administrative tasks required to decommission the facility.

IIFP intends to be the prime Decommissioning Operations Contractor (DOC) responsible for decommissioning. In this capacity, IIFP will have direct experience with the plant operations and have control and oversight over all decommissioning activities. IIFP also plans to secure contract services to supplement its capabilities, as necessary. However, for the purposes of estimating costs for the DFP, it is assumed that a third-party contractor will be used as the DOC. Management of the Decommissioning Implementation Plan will make certain that proper training and procedures are implemented to assure worker health and safety. Programs and procedures will focus heavily on minimizing waste volumes and worker exposure to hazardous and radioactive materials. Qualified contractors assisting with decommissioning will likewise be subject to facility training requirements and procedural controls.

10.1.2.5 Health and Safety

As with normal site operations, the policy during decommissioning shall be to keep individual and collective occupational radiation exposure as low as reasonably achievable (ALARA). A Health Physics Program will identify and control sources of radiation, establish worker protection requirements and direct the use of survey and monitoring instruments.

10.1.2.6 Waste Management

Radioactive and hazardous wastes produced during decommissioning will be collected, handled and disposed of in accordance with all regulations applicable to the facility at the time of decommissioning. Generally, procedures will be similar to those described for wastes produced during normal operation. These wastes will ultimately be shipped to licensed radioactive or hazardous waste disposal facilities. Non-hazardous and non-radioactive wastes will be disposed of in a manner consistent with good industrial practice and in accordance with applicable regulations.

10.1.2.7 Security/Material Control

Requirements for physical security and for Material Control and Accountability (MC&A) will be maintained as required during decommissioning in a manner similar to the programs in force during operation. The IIFP Decommissioning Implementation Plan submitted just prior to decommissioning will provide a description of any necessary revisions to these programs.

10.1.2.8 Recordkeeping

Records important for safe and effective decommissioning of the facility will be stored in the IIFP Records Management System until the IIFP Site is released for Unrestricted Use. Information maintained in these records is described below:

1. Records are maintained of spills or other unusual occurrences involving the spread of contamination and subsequent cleanup around the facility, equipment or site. These records will include any known information on identification of involved radionuclides, quantities, forms, concentrations and survey results after cleanup of any spill area.

2. Routine radiological survey records of Restricted and Unrestricted Areas will be retained indefinitely to support historical site assessment and facility characterization at the time of decommissioning.

3. As-built drawings and modifications of structures and equipment are maintained for areas where radioactive materials are used and/or stored. Required drawings will be referenced as necessary, although each relevant document will not be indexed individually. If drawings are not available, appropriate records of available information concerning these areas will be substituted.

4. The following will be contained in a single records document which will be updated every two (2) years except for areas containing only sealed sources:

    a. All areas designated and formerly designated as Restricted Areas as defined under 10 CFR 20.1003, (CFR, 2008c)

    b. All areas outside of Restricted Areas that require documentation specified in item 1 above

    c. All areas outside of Restricted Areas where current and previous licensed material wastes have been disposed as documented under 10 CFR 20.2108 (CFR, 2008d)

    d. All areas outside of Restricted Areas that contain material such that, if the license expired, the licensee would be required to either decontaminate the area to meet the criteria for decommissioning in 10 CFR 20, subpart E, (CFR, 2008e) or apply for approval for disposal under 10 CFR 20.2002, (CFR, 2008f)

5. Records will be maintained of the cost estimate performed for the Decommissioning Funding Plan or of the amount certified for decommissioning and the funding method used for assuring funds if either a funding plan or certification is used.

10.1.3 Decommissioning Process

The following section describes the IIFP decommissioning process.

10.1.3.1 Overview

Preparation for decommissioning the facility is expected to begin upon a decision to cease operations permanently. This preparation step is estimated to be completed in approximately one (1) year including NRC review and approval of the final Decommissioning Implementation Plan.

Actual decontamination and decommissioning would follow shortly upon approval of the Plan and the award of any subcontracts. The Decommissioning Implementation Plan schedule for the IIFP Facility is shown in Figure 10-1.

The IIFP Facility processes the contents of depleted uranium hexafluoride (DUF_6) cylinders routinely within a few days of when those are received, inspected and accepted. The IIFP Facility is not a long-term storage site for DUF_6 tails. However, a relatively small inventory of cylinders (an average of about 25 cylinders) may be kept during normal operations as a buffer stock for allowing flexibility in operating the facility. INIS intends to make disposition of any DUF_6 remaining on-site at the end of the useful life of its subsidiary IIFP Facility by processing all the residual inventory through the de-conversion and FEP boron trifluoride (BF_3) processes. In this manner, the DUF_6 and remaining in-process inventories of uranium feed materials (such as DUF_4) will be converted to depleted oxide for disposal at an off-site licensed low-level waste (LLW) disposal facility.

The estimated cost for final DUF_6 inventory processing and associated oxide disposal costs have been added as an update to the financial assurance decommissioning costs.

IIFP plans to be the DOC for all the shutdown, cleanout and decommissioning operations. However, for the purpose of decommissioning and financial assurance funding levels, an independent third party contractor profit and labor costs with fringes and overheads are used in the decommissioning cost estimate in the event that IIFP is unable to fulfill this role. Also, the cost estimate for processing and disposing of the residual DUF_6 (and in-process DUF_4) inventory is based on the facility operating costs plus the third party contractor costs and profit. No credit is taken in the financial assurance fund for any marketable products or assets recovered during the processing of residual materials or decommissioning.

Table 10-18 of the IIFP License Application provides the total cost for financial assurance funding including a 25% contingency. Volumes and costs for LLW disposal, including oxide from the residual DUF_6 inventory conversion, are provided in Table 10-16. The operating costs for processing of the residual DUF_6 inventory are shown as a separate line item in Table 10-18.

Prior to beginning decommissioning operations, a radiological survey of the facility will be performed and used in conjunction with a historical site assessment to identify areas where contamination may be present. The findings of the radiological survey and historical site assessment will be presented in a Decommissioning Implementation Plan to be submitted to the NRC. The Plan will be prepared in accordance with 10 CFR 40.42 (CFR, 2008a) and the applicable guidance provided in NUREG-1757.

Decommissioning activities will generally include: 1) outfitting of size reduction and packaging areas, 2) purging of process systems, 3) dismantling and removal of equipment, 4) sales of salvaged materials, 5) packaging and disposal of wastes and 6) completion of a final radiation survey. Credit is not taken for any salvage value that might be realized from the sale of potential assets during or after decommissioning.

Decommissioning, using the IIFP approach, requires residual radioactivity to be reduced below specified levels so the facilities can be released for Unrestricted Use. Current Nuclear Material Safety and Safeguards guidelines for release serve as the basis for decontamination costs estimated herein. Portions of the facility that do not exceed contamination limits may remain as-is without further decontamination measures applied. The intent of decommissioning the facility is to remove all uranium process-related equipment from the buildings such that only the building shells and site infrastructure remain. Equipment to be removed includes all piping and components from systems providing uranium hexafluoride (UF_6) or uranium tetrafluoride (UF_4) containment, uranium oxide containment, systems in direct support of uranium processing (such as refrigeration and cooling systems), radioactive and hazardous waste

handling systems, contaminated heating, ventilation and air conditioning (HVAC) filtration systems, etc. Remaining site infrastructure after decommissioning will include the steam facilities, electrical power facilities, water supply systems, sanitary water treatment systems, fire protection systems, HVAC systems, cooling water systems and communication systems.

Existing plant buildings, such as the Decontamination Building and Material Warehouse, will be outfitted to accommodate handling and packaging of components and materials for disposal. These areas will be the primary location for size reduction and packaging activities during the decommissioning process. Limited capabilities for decontamination will exist for mildly contaminated items that may be decontaminated to free release criteria in a cost effective manner.

Contaminated portions of the buildings will be decontaminated as required. Potential contamination is limited to the structures in the Restricted Areas. Good housekeeping practices during normal operation will maintain the other areas of the IIFP Site in a contamination free condition. Routine radiological contamination surveys will ensure radioactive contamination will not go undetected or be allowed to build-up to levels difficult to control.

When decontamination is complete, all areas and facilities on the Site will be surveyed to verify that further decontamination is not required. Decontamination activities will continue until the entire site is demonstrated to be suitable for Unrestricted Use.

10.1.3.2 Size Reduction and Packaging Facility Outfitting

Existing facilities can be adapted to accommodate the size reduction and packaging activities associated with decommissioning to avoid the expense of constructing other dedicated facilities to do so. The existing Decontamination Building and Material Warehouse are considered suitable for these purposes. Estimated time for equipment installation is approximately two (2) months. These newly outfitted facilities will be completed in time to support the dismantling of the equipment. These facilities are described in Section 10.1.4.3 “Size Reduction and Packaging Facilities Description.”

10.1.3.3 System Preparation

At the end of the useful life of each process line, the uranium process will be shut down and UF_6, UF_4 and uranium oxides will be removed to the extent practicable by normal process operation. This is to be followed by evacuation and purging with nitrogen and the application of a fixative where applicable. The shutdown and preparation for decommissioning activities is estimated to take approximately three (3) months.

10.1.3.4 Dismantling

Dismantling requires cutting and disconnecting all components requiring removal. Dismantling operations are labor intensive and generally require the use of protective clothing. The work process will be optimized, considering the following:

- Minimizing the spread of contamination and protective clothing requirements by application of fixative coatings
- Balancing the number of cutting and removal operations with the resultant size reduction and disposal requirements
- Optimizing the rate of dismantling with the rate of size reduction

- Providing required storage and lay down space as impacted by retrieval, security, etc.
- Balancing the cost of salvage with the cost of disposal

Details of the complex optimization process will necessarily be decided near the end of plant life, taking into account specific contamination levels, market conditions and available waste disposal sites. The DFP assumes most items that were continuously in contact with uranium hexafluoride, uranium tetrafluoride or uranium oxide will be disposed at a LLW disposal facility rather than employing rigorous techniques to attempt decontamination. Large contaminated equipment may be disassembled to separate contaminated and uncontaminated components. To avoid additional lay down space requirements and accompanying contamination issues, dismantling should proceed at a rate consistent with the downstream size reduction and packaging processes.

The time to accomplish both dismantling and size reduction during IIFP decommissioning is estimated to be approximately eighteen (18) months.

10.1.3.5 Decontamination/Size Reduction

The decontamination and size reduction process is addressed separately in detail in Section 10.1.4.

10.1.3.6 Salvage of Equipment and Materials

Items to be removed from the facilities can be categorized as potentially reusable equipment, recoverable scrap and wastes. However, based on a 40-year operating lifetime, equipment is assumed to have no reuse value. Wastes will also have no salvage value. Some amounts of uncontaminated metals such as steel, copper and Monel may be recovered and sold. However, no credit is taken for any salvage value that might be realized from the sale of potential assets during or after decommissioning.

10.1.3.7 Disposal

All wastes produced during decommissioning will be collected, handled and disposed of in a manner similar to that described for those wastes produced during normal operation. Wastes will consist of normal industrial trash, non-hazardous chemicals and fluids, small amounts of hazardous materials and radioactive wastes. The radioactive wastes will consist primarily of piping, tanks, hoppers and compactable trash generated during the dismantling process.

Radioactive wastes will ultimately be disposed in licensed low-level radioactive waste disposal facilities. Hazardous wastes will be disposed in hazardous waste disposal facilities. Non-hazardous and non-radioactive wastes will be disposed in a manner consistent with good industrial practice and in accordance with all applicable regulations. While current best estimates of the these wastes are provided in this Chapter 10, an updated estimate of the wastes and effluent to be produced during decommissioning will be provided in the Decommissioning Implementation Plan that will be submitted prior to initiating the decommissioning of the facility.

10.1.3.8 Final Radiation Survey

A final radiation survey must be performed to verify proper decontamination to allow the site to be released for Unrestricted Use. The evaluation of the final radiation survey is based in part on an initial radiation survey performed prior to initial operation. The initial survey defines the natural background radiation of the area; therefore, it provides a baseline for comparison to final survey measurements that

will be used to determine any increase in levels of radioactivity. Since only depleted uranium will be processed at the IIFP Facility, the initial and final site surveys required as part of the decommissioning process will include isotopic analysis for the U-238, U-235 and U-234 isotopes of uranium.

The final survey will systematically measure radioactivity over the entire site and will be designed to detect any unreported spills and any generalized contamination that might accumulate over the period of operation of the facility. The intensity of the survey will vary depending on the location (i.e. the buildings, their immediate areas and the remainder of the IIFP Site). Throughout the operating life of the facility, routine surveys will be conducted of licensed material areas and records will be maintained. These survey records will be used in conjunction with the REMP as part of the final survey evaluation and may reduce the amount of sampling in some areas where the survey history indicates that no contamination has occurred. The survey procedures and results will be documented in a report which will include, among other things, a map of the survey site, measurement results and the site's relationship to the surrounding area. The results will be analyzed and shown to be below allowable residual radioactivity limits; otherwise, further decontamination will be performed.

For decommissioning funding purposes, the final site survey will consist of samples being taken within the 40-acre IIFP Restricted Area as well as at other locations outside the Restricted Area but within the 640-acre site boundary. Inside the Restricted Area, samples will be taken based on a sampling grid pattern of approximately 91 m by 91 m (100 yd by 100 yd). Additional samples will be collected within an area extending ten (10) feet from process building walls on the basis of one sample per 100 ft^2 (i.e., one sample for every ten (10) feet of building perimeter). It is unlikely that the area outside the Restricted Area but within the site boundary will be contaminated. . Therefore, the grid will be expanded for this area such that samples will be taken on a grid approximately 610 m by 610 m (667 yd by 667 yd). The analysis of the samples will be provided by a third party since, at the time of performance of the final radiation survey, no analysis facilities will be available on site. A similar collection of samples will be performed for the initial site survey as part of the REMP to provide a background against which the final site survey will be compared.

10.1.3.9 Decommissioning Impact on Integrated Safety Analysis

As was described in Section 10.2.3.1 "Summary of Costs," the decommissioning of the IIFP Facility will be conducted over a period of approximately two and one-half (2- 1/2) years, consisting of one (1) year for preparation and planning and an estimated eighteen (18) months for dismantling, decontamination and disposition.

Although decommissioning steps are planned to be underway while some activities considered in the ISA Summary Revision B continue to occur in the other portions of the plant, the current ISA has not fully evaluated these decommissioning risks. An updated ISA will be performed prior to decommissioning to evaluate the risks from decommissioning operations on concurrent operations.

10.1.4 Decontamination/Size Reduction Process

The following sections address the decontamination and size reduction process.

10.1.4.1 Overview

The facilities, procedures and expected results of decontamination and size reduction are described in the paragraphs below. Reprocessed uranium will not be used as feed in any of the commercial uranium enrichment facilities that will supply DUF_6 to the IIFP Facility for depleted tails de-conversion.

Therefore, no consideration of ^{232}U, transuranic alpha-emitters and fission product residues is necessary for the decontamination/size reduction process. Only contamination from ^{238}U, ^{235}U, ^{234}U and their daughter products will be considered in the decontamination and size reduction processes. The primary contaminants will be in the form of small amounts of UF_4, uranyl fluoride (UO_2F_2), uranium oxides (UO_2 or U_3O_8).

10.1.4.2 Methodology

It is assumed that decontamination of components and equipment that have been in direct contact with uranium compounds will not achieve levels that would support free release. Therefore, decontamination efforts to a level of free release would not be feasible and would likely increase the volume of low-level radioactive waste requiring disposal. Instead, the most cost effective approach is to clean equipment and components sufficiently to be able to cut and remove them, to fix residual radioactivity in place and to size reduce by disassembly or mechanical means. The methodology to be used during IIFP Facility decommissioning will employ conventional decontamination, fixative application and size reduction techniques. The buildings and components will be characterized with respect to radioactive contamination immediately prior to the start of decommissioning. The non-contaminated components will be removed, monitored and free released for disposal off-site. Non-uranium handling components (e.g. electrical cabinets, cable runs, utility pipe work, etc.) are expected to be free of any contamination. If these items are found to be contaminated, simple decontamination techniques using mild cleaning solutions may be sufficient to remove residual radioactivity to levels that support free release. Components that are known to be contaminated will only be decontaminated to the extent necessary to prevent the spread of contamination during removal, size reduction and packaging for disposal. In many cases fixing residual radioactivity utilizing a fixative coating or expandable foam would provide adequate containment of residual radioactivity to support these activities.

- Sections of DUF_6 piping and uranium oxide vacuum transfer piping may be contained by dry cleaning to remove excess loose material and filling with an expandable foam or fixative. This piping will then be taken down, transferred to the decontamination/size reduction facility and sized and packaged for disposal.

- Some larger equipment and piping will be dismantled into sections suitable for transport to the size reduction and packaging facility where the sections will be further dismantled. The components will be subject to a disposition evaluation to determine if the item is open to the free flow of fixative or cleaning solutions and that monitoring of the component after decontamination can be performed should decontamination be attempted. Components failing the feasibility review will be consigned to sizing and packaging for shipment to a licensed disposal facility.

- Mildly contaminated items with readily accessible surfaces will be designated for decontamination. These items will be decontaminated using a mild cleaning solution.

10.1.4.3 Size Reduction and Packaging Facilities Description

Size reduction and packaging facilities will be required to accommodate decommissioning. These facilities are needed for optimal handling of equipment to be packaged for disposal. It is assumed that existing areas such as the Decontamination Building and the Material Warehouse can be outfitted to serve effectively as the size reduction and packaging facilities for decommissioning.

The decontamination facilities will have six functional areas that include: 1) a disassembly area, 2) a stock staging area, 3) a size reduction area, 4) a decontaminating and clean-up area 5) a scrap storage area for cleaned stock and 6) a packaging for disposal area. Barriers and other physical measures will be installed and administrative controls implemented, as needed, to prevent the spread of contamination.

The size reduction and packaging facilities will be equipped with the types of equipment listed below as determined in the final decommissioning plan. Examples include:

- Transport and manipulation equipment
- Dismantling tables
- Sawing machines
- Nibblers
- Degreasers
- Contamination monitors

10.1.4.4 Procedures

Formal procedures for all major decommissioning activities will be developed and approved by authorized project management personnel to minimize worker exposure and waste volumes and to assure work is carried out in a safe manner.

At the end of plant life, some of the equipment, most of the buildings and all of the outdoor areas should be acceptable for release for Unrestricted Use. If they had been accidentally contaminated during normal operations, they would have been cleaned up when the contamination was discovered. This limits the scope of necessary decontamination at the time of decommissioning.

Contaminated plant components will be processed through the size reduction packaging facilities. Potential contamination of site structures is limited to a few areas (for example; the DUF_6 to DUF_4 Autoclave Building, the DUF_4 Process Building, the processing area of the FEP Process Building, and the FEP Oxide Staging Building) and these areas will be maintained throughout plant operation by regular cleaning. Through the application of special protective coatings to surfaces that might become radioactively contaminated during operation and good housekeeping practices, final decontamination of these areas is assumed to require minimal removal of surface concrete or other structural material.

10.1.4.5 Results

Recoverable items will have been decontaminated and made suitable for reuse except for a very small amount of intractably contaminated material. The buildings and site will be decontaminated and decommissioned to a level such that they can be released for reuse.

The majority of radioactive wastes requiring disposal as the result of the IIFP Facility decommissioning will include tanks, hoppers, process piping and residual materials from the work-in-process inventory that are not recovered for reuse or sale and possible residues from the final decontamination equipment and process. Items, equipment and scrap that remain contaminated beyond free release levels will have been disposed of at approved and licensed disposal sites.

10.2 SITE-SPECIFIC COST ESTIMATE

The following sections describe the site-specific decommissioning cost estimate.

10.2.1 Cost Estimate Structure

The decommissioning cost estimate includes:

- Major assumptions for the cost estimate
- A summary of the number of major facility components volumes and type of disposal required
- The estimated costs (including labor costs, non-labor costs and contingency)

10.2.2 Decommissioning Cost Estimate

The following sections address specifics of the decommissioning cost estimate.

10.2.2.1 Summary of Costs

The decommissioning cost estimate for the IIFP Facility is approximately **$Redacted** (2009 dollars). This cost estimate and supporting information are presented in Tables 10-1 through 10-18, consistent with the applicable provisions of NUREG-1757 Volume 3 "Consolidated NMSS Decommissioning Guidance - Financial Assurance, Recordkeeping and Timeliness" (NRC, 2006).

The decommissioning project schedule is presented in Figure 10-1. Depending on market conditions related to fluorine products, condition of equipment, availability of DUF_6 de-conversion services and other uncertainties, the decommissioning strategy may need revision in the future. Whenever the strategy is revised, the DFP will be updated, including the cost estimate for decommissioning and will be resubmitted for approval.

10.2.2.2 Major Assumptions

Key assumptions underlying the decommissioning cost estimate are listed below:

- Inventories of materials and wastes at the time of decommissioning will be in amounts that are consistent with routine plant operating conditions over time.

- Costs are not included for the removal or disposal of non-radioactive structures and materials beyond that necessary to terminate the NRC license. Non-radioactive structures will be available for other industrial use following completion of decontamination and decommissioning (D&D).

- Credit is not taken 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.

- Decommissioning activities are performed in accordance with current regulatory requirements.

- The cost estimate is adjusted using the required contingency multiplier factor of 1.25.

- Decommissioning costs are presented in 2009 dollars.

10.3 FINANCIAL ASSURANCE

The following sections address the financial assurance mechanisms for decommissioning.

10.3.1 Decommissioning Funding Mechanism

IIFP presently intends to utilize a surety bond and Standby Trust Fund method to provide reasonable financial assurance that decommissioning funding will be available at the time of decommissioning the facility. At least six (6) months prior to the receipt of licensed material in quantities and form requiring decommissioning funding, IIFP will provide NRC the financial assurance instrument that IIFP intends to execute. Upon finalization of the specific funding instrument to be used and at least twenty-one (21) days prior to the commencement of operations, IIFP will supplement its application to include the signed, executed documentation. The licensee shall not obtain radioactive material until the NRC reviews and approves the executed financial assurance instrument and certification of financial assurance (See the IIFP LA, Revision B Chapter 1 Section 1.5.2 regarding request for exemption from certain provisions of 10 CFR 40.36). The surety bond will provide assurance that decommissioning costs will be paid in the unexpected event IIFP is unable to meet its decommissioning obligations at the time of decommissioning. In this case funds drawn from the surety bond will be placed directly into a standby trust fund naming the U.S. Nuclear Regulatory Commission as the beneficiary.

IIFP is committed to provide financial assurance funding for the IIFP Facility. Applying a 25% contingency factor to the decommissioning cost estimate, yields a total projected decommissioning cost for the IIFP Facility for which financial assurance would be provided, of approximately **$Redacted** million (expressed in 2009 U.S. dollars).

10.3.2 Adjusting Decommissioning Costs and Funding

In accordance with 10 CFR 40.36(d) (CFR, 2008h), IIFP will update the decommissioning cost estimate for the IIFP Facility and the associated funding levels over the life of the facility. Updates will take into account changes resulting from inflation or site-specific factors, such as changes in facility conditions or expected decommissioning procedures. IIFP will provide Decommissioning Funding Plan updates and facility decommissioning cost estimates to the NRC as specified below:

The licensee shall provide an updated DFP and updated facility decommissioning cost estimate to NRC for review at least six (6) months prior to the planned date for obtaining licensed material.

On an annual basis, starting on the anniversary date of obtaining licensed material, the licensee shall provide an updated DFP and updated facility decommissioning cost estimate to the NRC for review. With each annual update, if the cost estimate exceeds the amount of financial assurance provided, the licensee shall provide financial assurance in the amount of the updated cost estimate and an updated certification of financial assurance to NRC for review and approval.

All updates to the DFP, and cost estimate for facility decommissioning and financial assurance instruments, shall be updated to current year United States dollars and shall encompass all current cost data, taking into account changes in inflation, possession limits, licensed material, labor rates, disposal and shipping rates and site and facility factors. All updates to the DFP, and cost estimate for facility decommissioning and financial assurance instruments shall also include updated costs for the disposal of UF_6, UF_4 and uranium oxides. IIFP shall include the cost of shipping and disposal of any DUF_6 that the licensee has financial responsibility for its disposal, including DUF_6 that the licensee holds legal title. All costs shall be supported by a detailed basis, be based on the costs of a third party contractor or The U.S. Department of Energy (DOE) and shall not take credit for any salvage value that might be realized from the sale of potential assets during or after decommissioning. The total cost estimate shall include the contingency factor of at least 25 percent.

A record of the update process and results will be retained for review as discussed in Section 10.3.3, below. The NRC will be notified through the update process of any material changes to the decommissioning cost estimate and associated funding levels (e.g., significant increases in costs beyond anticipated inflation). To the extent the underlying instruments are revised to reflect changes in funding levels, the NRC will be notified as appropriate.

10.3.3 Recordkeeping Plans Related to Decommissioning Funding

In accordance with 10 CFR 40.36(f) (CFR, 2008h), IIFP will retain records until the termination of the license of information that could have a material effect on the ultimate costs of decommissioning. These records will include information regarding: 1) spills or other contamination that cause contaminants to remain following cleanup efforts, 2) as built drawings of structures and equipment and modifications thereto where radioactive contamination exists (e.g., from the use or storage of such materials), 3) original and modified cost estimates of decommissioning and 4) original and modified decommissioning funding instruments and supporting documentation.

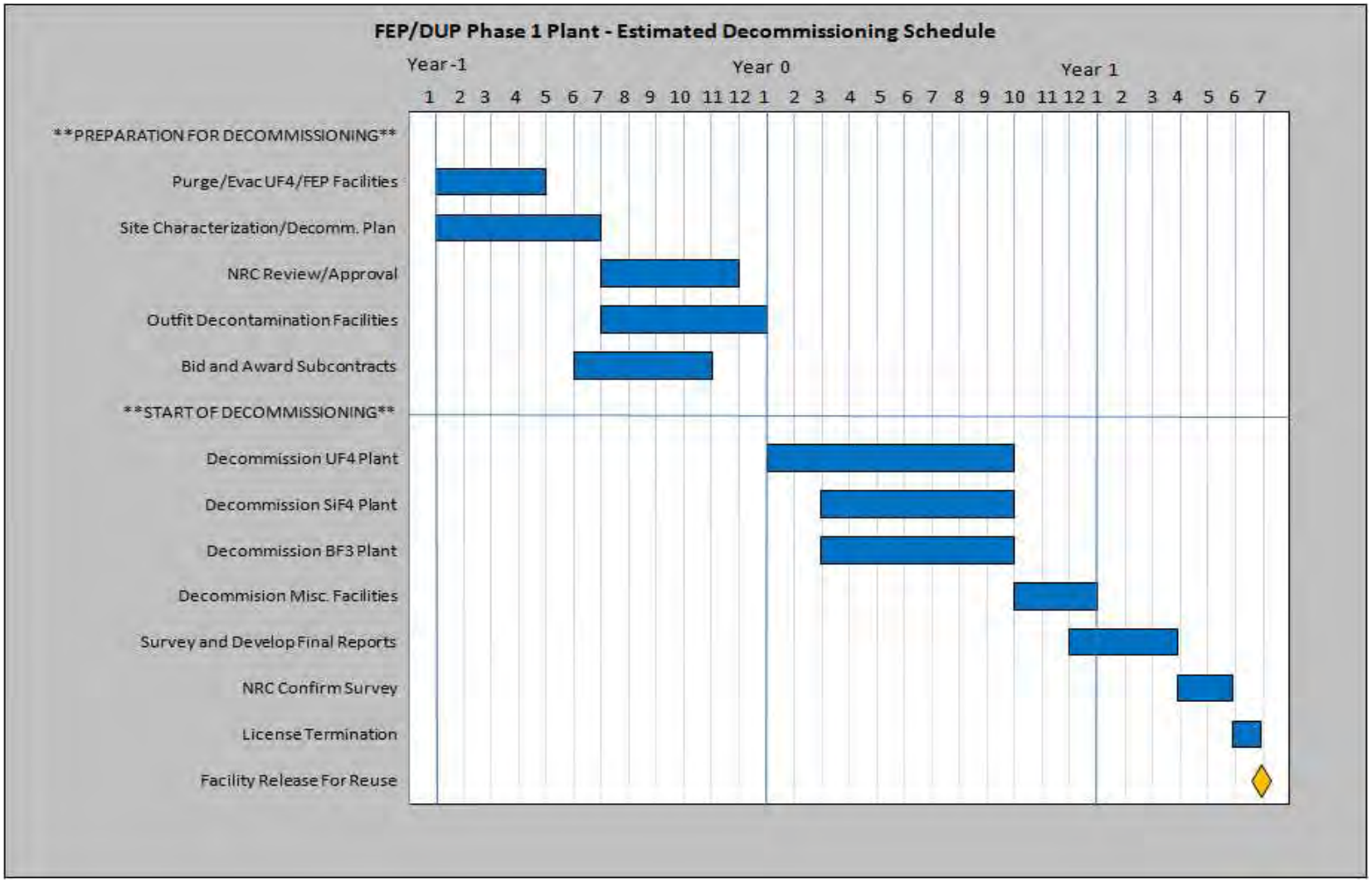

Figure 10-1 Estimated Decommissioning Schedule

Table 10-1 DUF_4 Process and DUF_6 Autoclave Building Components

Portions Redacted for Security Purposes

Component	Number of Components	Total Component Vol. (ft^3)	Total Component Vol. (ft^3) After Reduction	Vol. (ft^3) for Non-LLW Disposal	Vol. (ft^3) for LLW Disposal
EQUIPMENT/MATERIALS					
Refrigeration System for AHF Condensers	1	240	240	240	0
20 Ton Bridge Crane Hoist	1	18	18	18	0
20 Ton Bridge Crane	1	360	360	360	0
20 Ton Bridge Crane Rails	2	150	150	150	0
3 Ton Monorail	1	8	8	8	0
Cylinder Cart	2	300	300	300	0
Cylinder Scale	1	150	150	150	0
Steam Piping from Boiler to AC	2	156	156	0	156
Condensate Return Piping	2	7	7	0	7
Autoclave Relief Piping	2	75	75	0	75
Heeling Cold Traps					
P & E Cold Traps	3	85	85	0	85
P & E NaF (Sodium Fluoride Packing) Traps	3	32	32	0	32
P & E Activated Alumina Traps	3	32	32	0	32
Vacuum Pump	1	18	18	0	18
Vibrating Screen	1	67	67	0	67

Table 10-1 DUF_4 Process and DUF_6 Autoclave Building Components

Portions Redacted for Security Purposes

Component	Number of Components	Total Component Vol. (ft^3)	Total Component Vol. (ft^3) After Reduction	Vol. (ft^3) for Non-LLW Disposal	Vol. (ft^3) for LLW Disposal
Cyclone Filter Rotary Valve	2	29	29	0	29
Secondary Off Gas Filter with Sintered Filter Elements	1	46	46	0	46
Backup Filter Rotary Valve	1	14	14	0	14
Carbon-Bed Traps	6	125	125	0	125
Reaction Vessel Heaters	8	157	157	157	0
Surge Tank/Feed Piping Hot Box Electric Heaters	1	11	11	11	0
Surge Tank/Fee Hot Box	1	79	79	79	0
Primary Dust Collector	1	2280	912	0	912
Primary Dust Collector Rotary Valve	1	14	14	0	14
Secondary Dust Collector	1	588	235	0	235
Dust Collector Blower	1	216	216	0	216
Reaction Vessel Cooling Blower	1	36	36	0	36
Vacuum Cleaning Blower	1	36	36	0	36
Piping from Screw Conveyor to Dust Collectors	1	56	56	0	56
Oxide Inventory Pending Shipment After Shutdown	1	2825	2825	0	2825
Carbon & Activated Alumina Residual In Process	1	150	150	0	150
Ventilation Ducting from Table 10-6:					
DUF_6 Autoclave Room HVAC Ducting	1	432	144	0	144
DUF_4 Process Building HVAC Ducting	1	1296	432	0	432
AHF as Work-in-Process & Storage Waiting to be Shipped					Would be shipped to AHF customer. Added transportation cost to DFP.
CaF_2 as Material-in-Process & Storage Awaiting Shipment to Customer	Approximately 20,000kg				Would be shipped to AHF customer. Added transportation cost to DFP.
Regenerated KOH Solution Residual In Process	Approximately 7,000kg				Would ship to vendor or user FOB for transport cost.

Table 10-1 DUF_4 Process and DUF_6 Autoclave Building Components

Portions Redacted for Security Purposes

Component	Number of Components	Total Component Vol. (ft^3)	Total Component Vol. (ft^3) After Reduction	Vol. (ft^3) for Non-LLW Disposal	Vol. (ft^3) for LLW Disposal
Storage Tanks	Included in Equipment List				
Storage Areas	Included in Buildings				
Radiological Waste Areas	Included in Buildings				
Equipment Decontamination Areas	See Table 10-2				
TOTAL NON-LLW DISPOSAL				**5,627**	
TOTAL LLW DISPOSAL					**7,455**

Table 10-2 Decontamination Building and Laboratory Components

Component	Number of Components	Total Component Vol. (ft^3)	Total Component Vol. (ft^3) After Reduction	Vol. (ft^3) for Non-LLW Disposal	Vol. (ft^3) For LLW Disposal
EQUIPMENT/MATERIALS					
Fume Cupboards (hoods)	4	80	80	0	80
Floors (concrete/dike demolition)	1	1000	1000	0	1000
Walls And Ceilings (building demolition)	1	1000	1000	1000	0
Grit Blast Booth/Equipment	1	1998	666	0	666
Dust Collector	1	588	235	0	235
Hold Tank	2	560	187	0	187
Precipitation Tank	1	279	93	0	93
Centrifugal Pumps	4	7	7	0	7
Water Spray Submersible Pump	1	2	2	0	2
Secondary Dust Collector	1	96	38	0	38
Drum Fill Station	2	288	288	0	288
Dust Collector Blower	1	71	71	0	71
Primary Filters	2	151	151	0	151
Polishing Filters	4	170	170	0	170
Ion Exchange Columns	2	141	141	0	141
Decontamination Building Piping	1	19	19	0	19
Motors	5	9	9	0	9
Misc Conduit, Instruments, Control Panel	1	20	20	0	20
Cleaning Solution Waste	1	1875	1875	0	1875
Hazardous Waste	1	750	750	0	750
Ventilation Ducting from Table 10-6:					
Decontamination Ducting	1	78	26	0	26
Laboratory HVAC Ducting	1	78	26	0	26
TOTAL NON-LLW				**1,000**	
TOTAL LLW					**5,854**

Table 10-3 FEP Buildings - Components for SiF_4 Process
Portions Redacted for Security Purposes

Component	Number of Components	Total Component Vol. (ft^3)	Total Component Vol. (ft^3) After Reduction	Vol. (ft^3) for Non-LLW Disposal	Vol. (ft^3) for LLW Disposal
EQUIPMENT/MATERIALS					
SiO_2 Storage	1	785	0	785	0
Vacuum Secondary Filter, Pump & Discharge Silencer	1	1	1	0	1
SiO_2 Feed Hopper	1	21	21	21	0
SiO_2 Hopper Rotary Valves	1	14	14	14	0
SiO_2 Screw Conveyor	1	1	1	0	1
Ribbon Blender	1	29	29	0	29
Vibrating Screen	1	94	94	0	94
Pre Filter	1	42	42	0	42
Dust Collector & Blower	1	2280	1026	0	1026
Primary Dust Collector Rotary Valve	1	14	14	0	14
Secondary Dust Collector & Blower	1	215	86	0	86
Backup Dust Collector Rotary Valve	1	14	14	0	14
Backup Dust Collector Drum Enclosure	1	49	49	0	49

Table 10-3 FEP Buildings - Components for SiF_4 Process
Portions Redacted for Security Purposes

Component	Number of Components	Total Component Vol. (ft^3)	Total Component Vol. (ft^3) After Reduction	Vol. (ft^3) for Non-LLW Disposal	Vol. (ft^3) for LLW Disposal
Primary & Secondary Sintered Metal Filter	4	13	13	0	13
Pre-Condenser	2	1	1	1	0
Product Cold Traps	3	1	1	1	0
Chiller	1	30	30	30	0
Separator	1	33	33	33	0
Heat Exchanger	1	30	30	30	0
Vacuum Pump	1	18	18	18	0
Venturi Scrubber Downstream of DUF_4 Dust Collector Blowers	1	50	50	0	50
Venturi Scrubber Downstream of SiF_4 Dust Collector Blowers	1	50	50	0	50
Venturi Scrubber KOH Pumps for SiF_4 Dust Collector Blowers	1	50	50	0	50
Ventilation Ducting from Table 10-6: HVAC Ducting	1	1,728	576	0	576
					Package remaining inventory and ship to customer.
Storage Areas	Included in Buildings				
Radiological Waste Areas	Included in Buildings				
Equipment Decontamination Areas	See Table 10-2				
TOTAL NON-LLW				**1,575**	
TOTAL LLW					**2,432**

Table 10-4 FEP Buildings - Components for BF_3 Process
Portions Redacted for Security Purposes

Component	Number of Components	Total Component Vol. (ft^3)	Total Component Vol. (ft^3) After Reduction	Vol. (ft^3) for Non-LLW Disposal	Vol. (ft^3) for LLW Disposal
EQUIPMENT/MATERIALS					
B_2O_3 Storage	1	785	785	785	0
Oxide Hopper	1	306	102	0	102
Oxide Hopper Rotary Valves	2	29	29	0	29
Drum Filling Enclosure	2	98	98	0	98
Dust Collector Blower	1	220	220	0	220
Piping from Oxide Hopper to Dust Collector	2	56	56	0	56
Piping from Drum Fill Station	2	18	18	0	18
P & E Chem Traps	4	42	42	42	0
P & E Vacuum Pump	2	36	36	36	0
Pre-Heater Feed Screw	2	4	4	0	4
Pre-Heater	2	25	25	0	25
Rotary Calciner Feed Screw	2	4	4	0	4
Rotary Calciner	1	66	66	0	66
Cooling Screw Conveyor	1	3	3	0	3
Cooling Screw Conveyor Water Jacket	1	5	5	5	0
Vacuum Secondary Filter, Pump & Discharge Silencer	2	3	3	0	3
B_2O_3 Feed Hopper	2	42	42	42	0
B_2O_3 Hopper Rotary Valves	4	57	57	57	0
B_2O_3 Screw Conveyor	2	1	1	0	1
Ribbon Blender	2	59	59	0	59
Vibrating Screen	2	189	189	0	189
Dust Collector	1	2280	912	0	912
EQUIPMENT/MATERIALS					
Primary Dust Collector Rotary Valve	1	14	14	0	14
Backup Secondary Dust Collector	1	215	86	0	86
Backup Dust Collector Rotary Valve	1	14	14	0	14
Backup Dust Collector Drum Enclosure	1	49	49	0	49

Table 10-4 FEP Buildings - Components for BF_3 Process
Portions Redacted for Security Purposes

Component	Number of Components	Total Component Vol. (ft^3)	Total Component Vol. (ft^3) After Reduction	Vol. (ft^3) for Non-LLW Disposal	Vol. (ft^3) for LLW Disposal
Primary & Secondary Sintered Metal Filters	2	7	7	0	7
Pre-Condenser	2	1	1	1	0
Cold Traps	4	1	1	1	0
Chiller	2	60	60	60	0
Separator	2	66	66	66	0
Venturi Scrubber Downstream of DUF_4 Dust Collector Blower	1	50	50	0	50
Venturi Scrubber Downstream of BF_3 Dust Collector Blower	1	50	50	0	50
Ventilation Ducting from Table 10-6:					
HVAC Ducting	1	1728	576	0	576
					Package remaining inventory and ship to customer.
Storage Areas	Included in Building				
Radiological Waste Areas	Included in Building				
Equipment Decontamination Areas	See Table 10-2				
TOTAL NON-LLW				**4,496**	
TOTAL LLW					**2,767**

Table 10-5 EPP Facility Components

Component	Number of Components	Total Component Vol. (ft^3)	Total Component Vol. (ft^3) After Reduction	Vol. (ft^3) for Non-LLW Disposal	Vol. (ft^3) for LLW Disposal
EQUIPMENT/MATERIALS					
Venturi Scrubber	2	101	101	0	101
Venturi Scrubber Liquid/Gas Separator	2	101	101	0	101
Venturi Scrubber Water Pump	2	4	4	0	4
Packed Tower Scrubber	2	32	32	0	32
Tower Scrubber KOH Pump	2	4	4	0	4
Coke Box	2	266	266	0	266
Coke Box KOH Sump Pump	2	4	4	0	4
Coke Box Blower	2	43	43	0	43
Emergency Scrubber	1	59	59	59	0
Emergency Scrubber KOH Sump Pump	1	8	8	8	0
Emergency Scrubber KOH Pump	1	2	2	2	0
Emergency Scrubber Blower	1	21	21	21	0
KOH Makeup Tank	1	127	127	127	0
KOH Makeup Tank Pump	1	2	2	2	0
Acid Transfer Tank	1	1008	1008	1008	0
Lime Mixer Tanks and Agitators	2	71	71	71	0
Lime Mixer Tanks Pumps	2	4	4	4	0
Acid Reaction Tank and Agitators	1	996	996	996	0
Acid Reaction Tank Pumps	2	4	4	4	0
Thickener	1	168	168	168	0
Thickener Pumps	3	5	5	5	0
Emergency Acid Tank	1	7360	3680	3680	0
Lime Silo and Dust Collector	1	2276	1138	1138	0
Spent KOH Storage Tank	1	384	192	192	0
KOH Mixing Tank and Agitators	1	35	35	35	0
KOH Mixing Tank Pumps	2	4	4	4	0
KOH Reaction Vessel Pumps	2	4	4	4	0

Table 10-5 EPP Facility Components

Component	Number of Components	Total Component Vol. (ft^3)	Total Component Vol. (ft^3) After Reduction	Vol. (ft^3) for Non-LLW Disposal	Vol. (ft^3) for LLW Disposal
EQUIPMENT/MATERIALS					
Thickener and Rake	1	127	127	127	0
Rotary Vacuum Filter	1	168	168	168	0
Filtrate Liquor Tanks	2	56	56	56	0
Dryer	1	192	192	192	0
Dust Collector	1	2253	751	751	0
Clarifier and Rake	1	2202	734	734	0
Clarifier Pumps	3	5	5	5	0
Polishing Filters	2	4	4	4	0
Piping	1	156	156	156	0
KOH Regeneration Tank	1	385	385	385	0
KOH Reactor Tank	1	754	377	377	0
Lime Silo	1	4620	4620	4620	0
Ventilation Ducting from Table 10-6:					
EPP HVAC Ducting	1	279	93	0	93
Lime Storage Area Ducting	1	100	33	33	0
Equipment Decontamination Areas	See Table 10-2				
TOTAL NON-LLW				**15,136**	
TOTAL LLW					**648**

Table 10-6 Facility Components – Ventilation

Component	Number of Components	Total Component Vol. (ft^3)	Total Component Vol. (ft^3) After Reduction	Vol. (ft^3) for Non-LLW Disposal	Vol. (ft^3) for LLW Disposal
VENTILATION AND DUCTWORK					
Fume Cupboards (hoods)	4	240	80	0	80
Laboratory	1	78	26	0	26
DUF_6 Autoclave Area	1	432	144	0	144
DUF_4 Process Building	1	1296	432	0	432
Contamination Building	1	78	26	0	26
SiF_4 Building	1	1728	576	0	576
BF_3 Building	1	1728	576	0	576
EPP Building	1	279	93	0	93
Lime Storage Area	1	100	33	33	0

Note: LLW and Non-LLW disposal amounts in Table 10-6 are included in each of the building lists in Tables 10-1 through 10-5.

Table 10-7 Planning and Preparing (Labor Hours)

Decommissioning Task	Project Management	Health Physicist & Safety Officer	Engineer	Clerical
Project Plan and Schedule	320	40	160	65
Site Characterization Plan	400	150	200	94
Decommissioning Plan	1800	675	900	422
NRC Review Support	600	225	300	141
Specification for Services	400	150	200	94
Project Procedures	720	270	360	169
TOTAL HOURS	4240	1510	2120	984
HOURLY RATE	$77	$84	$79	$23
TOTAL	**$326,480**	**$126,840**	**$167,480**	**$22,632**
LABOR	**$643,432**			
ADMINISTRATIVE SUPPLIES	**$1,200**			
GRAND TOTAL	**$644,632**			

Table 10-8 Facility Characterization

Area	Project Management	Health Physicist & Safety Officer	Health Physics Technician	Clerical
DUF_6 Autoclave Room	9	9	73	11
DUF_4 Process Building	19	19	145	23
Decontamination Building	6	6	48	7
FEP Process Building	23	23	186	29
HF Day Tank and Truck Loading Building	6	6	42	6
Maintenance and Stores	3	3	25	4
EPP Building and Scrubber Systems	6	6	51	8
Lime Storage Area	1	1	7	1
Material Warehouse	5	5	42	6
Utilities Building	3	3	25	4
Main Switchgear Building	3	3	25	4
Fire Pump House	0	0	2	0
Water Treatment Building	1	1	6	1
Process Offices and Laboratories	3	3	26	4
Administration Building	5	5	38	6
Guard house	1	1	5	1
DUF_4 Storage Building	3	3	25	4
Exterior of Buildings	46	46	372	58
TOTAL HOURS	143	143	1143	177
HOURLY RATE	$77	$84	$64	$23
LABOR COST	**$11,011**	**$12,012**	**$73,152**	**$4,071**
TOTAL LABOR COST	**$100,246**			
ADMINISTRATIVE SUPPLIES	**$1,900**			
GRAND TOTAL	**$102,146**			

Table 10-9 Dismantling and Decontamination

Area	Project Management	Health Physicist & Safety Officer	Laborer	Craftsman	Supervisor	Health Physics Technician	Engineer	Clerical
DUF_6 Autoclave Room	313	626	2502	626	626	275	20	120
DUF_4 Process Building	322	646	2581	646	646	382	100	134
Decontamination Building	638	1276	5104	1276	1276	508	0	239
FEP Process Building	502	1004	4016	1004	1004	477	80	198
HF Day Tank and Truck Loading Building	11	22	87	22	22	11	20	7
EPP Building	298	595	2382	595	595	268	0	112
Lime Storage Area	45	89	357	89	89	36	0	17
DUF_4 Storage Building	5	10	40	10	10	10	0	3
TOTAL HOURS	2134	4268	17069	4268	4268	1967	220	830
HOURLY RATE	$77	$84	$26	$38	$67	$64	$79	$23
LABOR COST	**$164,318**	**$358,512**	**$443,794**	**$162,184**	**$285,956**	**$125,888**	**$17,380**	**$19,090**
TOTAL LABOR COST	**$1,577,122**							
ADMINISTRATIVE SUPPLIES	**$256,500**							
GRAND TOTAL	**$1,833,622**							

Table 10-10 Restoration of Contaminated Areas on Facility Grounds (Labor Hours)

Activity	Labor Category	Labor Category	Labor Category	Labor Category	Labor Category
Backfill and Restore Site (Note 1)					

Note 1: The facility is designed to contain and prevent contamination outside the equipment and building areas and the controlled containment areas; including measures of ALARA radiological controls that will result in a low likelihood of contaminating the facility grounds at levels that would require excavation or restoration. In the event of a small spill, the limited area affected will be cleaned, surveyed and de-contaminated, if needed, at the time as part of the required cleanup immediately following any such spill.

Table 10-11 Final Radiation Survey (Labor Hours)

Area	Project Management	Health Physicist & Safety Officer	Health Physics Technician	Clerical
DUF_6 Autoclave Room	13	13	102	16
DUF_4 Process Building	25	25	197	31
Decontamination Building	3	3	23	4
FEP Process Building	27	27	215	34
HF Day Tank and Truck Loading Building	2	2	21	3
Maintenance and Stores Building	2	2	16	2
EPP and Plant KOH Scrubbing System Buildings	1	1	8	1
Lime Storage Area	0	0	1	0
Material Warehouse Building	3	3	25	4
Utilities Building	2	2	14	2
Main Switchgear Building	2	2	14	2
Fire Pump House	0	0	1	0
Water Treatment Building	0	0	4	1
Process Offices and Laboratory Building	5	5	43	7
Administrative Building	3	3	27	4
Guard House	1	1	4	1
DUF_4 Storage Building	2	2	14	2
Building Perimeter Sampling	5	5	68	10
Grid Sampling	5	5	30	10
Date Evaluation	70	370	70	64
Close-Out Radiological Survey Report	90	280	40	51
LABOR COST	$20,097	$63,084	$59,968	$5,727
TOTAL LABOR COST	**$148,876**			
ADMINISTRATIVE SUPPLIES	**$4,680**			
SAMPLE ANALYSIS	**$32,750**			
GRAND TOTAL	**$186,306**			

Table 10-12 Site Stabilization and Long Term Surveillance (Labor Hours)

Activity	Labor Category	Labor Category	Labor Category	Labor Category	Labor Category
(Note 2)					

Note 2: The facility is designed to contain and prevent contamination outside the equipment and building areas and the controlled containment areas; including measures of radiological ALARA controls that will result in a low likelihood of contaminating the facility grounds at levels that would require excavation or restoration. In the event of a small spill, the limited area affected will be cleaned, surveyed, and decontaminated, if needed, as part of the required cleanup immediately following any such spill. Therefore, site stabilization and long-term surveillance will not be required and associated decommissioning costs are not provided.

Table 10-13 Total Work Days by Labor Category (Labor Days)

Task	Project Management	Health Physicist & Safety Officer	Laborer	Craftsman	Supervisor	Health Physics Technician	Engineer & Transport Specialist	Clerical
Planning and Preparation	530	189	0	0	0	0	265	123
Facility Characterization	18	18	0	0	0	143	0	22
Decontamination & Dismantling	267	534	2134	534	534	246	28	104
Restoration of Contaminated Areas (Note 1)								
Packaging (Note 2)	0	0	1712	0	571	571	571	0
Final Survey	33	94	0	0	0	117	0	31
Site Stabilization & Long Term Surveillance (Note 1)								
TOTAL WORK DAYS	**848**	**835**	**3,846**	**534**	**1,105**	**1,077**	**864**	**280**

Note 1: The facility is designed to contain and prevent contamination outside the equipment and building areas and the controlled containment area; including measures of ALARA radiological controls that will result in a low likelihood of contaminating the facility grounds at levels that would require excavation or restoration. In the event of a small spill, the limited area affected will be cleaned, surveyed and decontaminated, if needed, at the time as part of the required cleanup immediately following any such spill.

Note 2: The days of labor shown in this table for packaging represent 4,564 crew hours or 13,692 hours for the Laborers and 4,564 hours each for the supervisor, the HP Technician and the Transportation Specialist. These values divided by 8 hours/day equal the values shown in the table for these labor categories.

Table 10-14 Worker Unit Cost Schedule

	Project Management	Health Physicist & Safety Officer	Laborer	Craftsman	Supervisor	Health Physics Technician	Engineer & Transport Specialist	Clerical
Salary & Fringe ($/year)	$83,900	$92,243	$28,808	$41,811	$72,832	$70,000	$86,609	$25,530
Fringe at 30% Rate	$25,170	$27,673	$8,642	$12,543	$21,850	$21,000	$25,983	$7,659
Overhead at 60% Rate	$50,340	$55346	$17,285	$25,087	$43,699	$42,000	$51,965	$15,318
Total Cost per Year	$159,410	$175,262	$54,735	$79,441	$138,381	$133,000	$164,557	$48,507
Total Cost per Work Day	$613	$674	$211	$306	$532	$512	$633	$187
Hourly Rate	$77	$84	$26	$38	$67	$64	$79	$23

Note: Based on 2,080 work hours per year and 8 hours per working day.

Table 10-15 Total Labor by Major Decommissioning Task

Task	Project Management	Health Physicist & Safety Officer	Laborer	Craftsman	Supervisor	Health Physics Technician	Engineer & Transport Specialist	Clerical
Planning and Preparation	$326,480.	$126,840.	$-0-	$-0-	$-0-	$-0-	$167,480	$22,632
Facility Characterization	$11,011	$12,012	$-0-	$-0-	$-0-	$73,152	$0	$4,071
Decontamination & Dismantling	$164,318	$358,512	$443,794	$162,184	$285,956	$125,888	$17,380	$19,090
Restoration of Contaminated Areas (Note 1)								
Packaging	0	0	$355,992	0	$305,788	$292,096	$360,556	$0
Final Survey	$20,097	$63,084	$-0-	$-0-	$-0-	$59,968	$0	$5,727
Site Stabilization & Long Term Surveillance (Note 1)								
TOTAL COST	**$521,906**	**$560,448**	**$799,786**	**$162,184**	**$591,744**	**$551,104**	**$545,416**	**$51,520**

Note 1: The facility is designed to contain and prevent contamination outside the equipment and building areas and the controlled containment area; including measures of ALARA radiological controls that will result in a low likelihood of contaminating the facility grounds at levels that would require excavation or restoration. In the event of a small spill, the limited area affected will be cleaned, surveyed and decontaminated, if needed, at the time as part of the required cleanup immediately following any such spill.

Table 10-16 Packaging, Shipping and Disposal of Radioactive Wastes (See Footnote)

Areas	Volume of LLW (Cubic Feet)	Packaging Cost	LLW Disposal Cost	Transportation Cost
DUF_6 Autoclave Room/DUF_4 Process/HF Day Tank Buildings	7,455	$349,344	$Redacted	$340,133
Decontamination Building and Laboratory	5,854	$194,976	$Redacted	$241,079
FEP Building	5,199	$446,976	$Redacted	$238,475
EPP Building and Lime Storage Area	648	$137,664	$Redacted	$30,516
Totals for Facility Areas	**19,156**	**$1,128,960**	**$Redacted**	**$850,203**
Packaging Supplies		$257,689		
Transportation Supplies				$85,890
LLW Packaging Total Cost		**$1,386,649**		
LLW Disposal Total Cost			**$Redacted**	
LLW Transportation Total Cost				**$936,093**
GRAND TOTAL COST FOR LLW PACKAGING, DISPOSAL AND TRANSPORTATION	**$Redacted**			

Note: Packaging, Disposal and Transportation costs for Non-LLW wastes are not shown in this Table, but are included in Table 10-18. Also packaging costs for processing the inventory down prior to decommissioning are included in processing costs shown in Table 10-18.

Table 10-17 Total Administrative Supplies by Major Decommissioning Task

Task	Equipment Cost
Planning and Preparation	$1,200
Facility Characterization	$1,900
Decontamination and Dismantling	$256,500
Packaging	$300,000
Transportation	$100,000
Final Survey	$4,680
TOTAL	**$664,280**

Table 10-18 Total Decommissioning Cost

Task	Estimated Base Cost	Cost With 12% Profit Margin For Third Party Contractor	Total Cost With Contingency
Planning and Preparation	$644,632	$721,988	$902,485
Facility Characterization	$102,146	$114,404	$143,005
Decontamination and Dismantling	$1,833,622	$2,053,657	$2,567,071
Restoration of Contaminated Areas (Note 1)			
Sizing and Packaging	$1,614,432	$1,808,164	$2,260,205
Transportation and Disposal	$Redacted	$Redacted	$Redacted
Final Survey	$186,306	$208,663	$260,829
Site Stabilization and Long Term Surveillance (Note 2)			
Convert the Residual DUF_6 Inventory to Oxide Prior to Decommissioning	$1,102,041 (Note 4)	$1,161,480 (Note 5)	$1,451,850
TOTAL PROJECT COST	**$Redacted**	**$Redacted**	**$Redacted**

Note 1: The facility is designed to contain and prevent contamination outside the equipment and building areas and the controlled containment area; including measures of ALARA radiological controls that will result in a low likelihood of contaminating the facility grounds at levels that would require excavation or restoration. In the event of a small spill, the limited area affected will be cleaned, surveyed and decontaminated, if needed, at the time as part of the required cleanup immediately following any such spill.

Note 2: For the reasons given in Note 1, site stabilization and long-term surveillance will not be required and associated decommissioning costs are not provided.

Note 3: Transportation and Disposal Cost already includes profit which would be realized by the transport and disposal companies and not by a third party contractor. Therefore, the third party contractor margin was not applied.

Note 4: Includes Third Party Contractor labor, overheads and fringes.

Note 5: 12% profit margin applied to Third Party Contractor direct labor, overheads and fringes.

REFERENCES

CFR, 2008a Title 10, Code of Federal Regulations, Section 40.36 "Financial Assurance and Recordkeeping for Decommissioning," 2003.

CFR, 2008b Title 10, Code of Federal Regulations, Section 20.1402, "Radiological Criteria for Unrestricted Use," 2003.

CFR, 2008c Title 10, Code of Federal Regulations, Part 20.1003, "Definitions," 2003.

CFR, 2008d Code of Federal Regulations, Title 10, Part 20.2108, "Records of Waste Disposal," 2003.

CFR, 2008e Title 10, Code of Federal Regulations, Part 20, Subpart E, "Radiological Criteria for License Termination," 2003.

CFR, 2008f Title 10, Code of Federal Regulations, Part 20.2002, "Method for Obtaining Approval of Proposed Disposal Procedures," 2003.

CFR, 2008g Title 10, Code of Federal Regulations, Section 40.42, "Expiration and Termination of Licenses and Decommissioning of Sites and Separate Buildings or Outdoor Areas," 2003.

CFR, 2008h Title 10, Code of Federal Regulations, Part 40, Appendix A, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content," 2003.

CFR, 2008i Title 10, Code of Federal Regulations, Part 20.2003, "Disposal by Release into Sanitary Sewerage," 2008.

CFR, 2008j Title 10, Code of Federal Regulations, Part 20.2004, "Treatment or Disposal by Incineration," 2008.

CFR, 2008l Title 10, Code of Federal Regulations, Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," 2008.

CFR, 2008m Title 10, Code of Federal Regulations, Part 20, Subpart E—"Radiological Criteria for License Termination," 2008.

NRC, 2002 U.S. Nuclear Regulatory Commission, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," NUREG-1520, 2002.

NRC, 2002b U.S. Nuclear Regulatory Commission, "Revised Analyses of Decommissioning Reference Non-Fuel-Cycle Facilities," NUREG/CR-6477, 2002.

NRC, 2003 U.S. Nuclear Regulatory Commission, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors," Regulatory Guide 1.159, 3, 2003.

NRC, 2005 U.S. Nuclear Regulatory Commission, "Safety Evaluation Report for the National Enrichment Facility, Lea County, New Mexico," NUREG - 1827, 2005.

NRC, 2006 U.S. Nuclear Regulatory Commission, "Consolidated NMSS Decommissioning Guidance - Financial Assurance, Recordkeeping and Timeliness," NUREG-1757, Volume 3, 2006.