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7. Abstract

Tank 241-CX-72, was installed at the Strontium Semiworks Facility in 1955 and used as an experimental tank to study the characteristics of self-concentrating waste. Records indicate that this tank was in operation for less than one year.

In 1986, as part of the efforts to decommission the Strontium Semiworks Facility, 241-CX-72 was determined to be empty, and was filled with grout to eliminate voids in the eventual entombment of the facility. In the fall of 1988, it was determined that the tank actually contained appreciable quantities of radioactive materials including fission products and transuranic materials.

This task plan stipulates the technical and administrative strategies to be used in decommissioning tank 241-CX-72. A three phase approach to decommissioning the tank will be used: The grout will be removed; the radioactive sludge layer in the bottom will be sampled and analyzed; and the sludge layer will be retrieved. The decommissioning process is expected to require approximately 3.5 years and $4 million to complete.

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TASK PLAN FOR THE SAMPLING AND DECOMMISSIONING OF TANK 241-CX-72

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August 31, 1990

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ABBREVIATIONS

ALARA	- As Low as Reasonably Achievable
ASTM	- (formerly American Society for Testing and Materials, now ASTM)
CAA	- Cost Account Authorization
CERCLA	- Comprehensive Environmental Response, Compensation, and Liability Act
CVI	- Certified Vendor Information
DOE	- United States Department of Energy
DOT	- United States Department of Transportation
DST	- Double-shelled Tank
EA	- Environmental Assessment
EPA	- United States Environmental Protection Agency
ERD	- Environmental Restoration Division
FY	- Fiscal Year
g	- Gram
GOCO	- Government Owned Contractor Operated
HMPD	- Hanford Multipurpose Dosimeter
HRO	- Hanford Restoration Operations
HSFP	- Hanford Surplus Facilities Program
LLW	- Low-Level Waste
m^3	- Cubic Meters
mrem	- Milli-Roentgen-equivalent-man
MRP	- Management Requirements and Procedures
NDA	- Non Destructive Analysis
NDE	- Non Destructive Evaluation
OSS	- Operations Support Services
OTP	- Operational Test Procedure
PDDR	- Preliminary Decommissioning Design Report
psi	- Pounds per Square Inch
PUREX	- Plutonium and Uranium Recovery by Extraction
QA	- Quality Assurance
QAPP	- Quality Assurance Program Plan
R	- Roentgen
RCRA	- Resource Conservation and Recovery Act
RFI/CMS	- RCRA Facility Investigation/Corrective Measures Study
RI/FS	- Remedial Investigation/Feasibility Study
ROD	- Record of Decision
SST	- Single-Shelled Tank
TLD	- Thermoluminescent Dosimeter
TOC	- Total Organic Carbon
TPA	- Tri-Party Agreement
TRU	- Transuranic
TSD	- Treatment, Storage and Disposal
UST	- Underground Storage Tank
WDOE	- Washington State Department of Ecology
WHC	- Westinghouse Hanford Company

TASK PLAN FOR THE SAMPLING AND DECOMMISSIONING OF TANK 241-CX-72

1.0 INTRODUCTION

In 1986, as part of the efforts to decommission the Strontium Semiworks Facility located in the 200-E Area, tank 241-CX-72 was determined to be empty. It was then filled with grout to eliminate voids in the eventual entombment of the facility. In October of 1988, an actuator rod was discovered to have been pulled approximately 15 feet out of the tank by a piece of heavy equipment. The actuator rod was found to be contaminated and was subsequently buried as low level waste (LLW). Because the actuator rod contained appreciable levels of radioactive contamination, further analysis by nondestructive assay led to the conclusion that the tank may contain levels of transuranic (TRU) materials that could require its classification as transuranic waste.

An engineering study, completed in fiscal year (FY) 1989 concluded that the sampling and retrieval of the waste from tank 241-CX-72 could be accomplished using existing technology and methods (Griffin and Ludowise, 1989). The sampling and decommissioning of the tank would be accomplished in three phases. Initial characterization of the tank and removal of the grout layer would be accomplished during Phase 1. During Phase 2, the suspected transuranic sludge in the bottom of the tank would be sampled and analyzed and the process for retrieval of this material would be designed. During Phase 3, if confirmed as being transuranic, the sludge material would be retrieved and the tank stabilized for future closure under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or Resource Conservation and Recovery Act (RCRA) guidelines.

This task plan stipulates the technical and administrative strategies to be used in decommissioning tank 241-CX-72.

2.0 TASK OBJECTIVES

The primary objective of this task is the sampling and retrieval (if necessary) of sludge from the 241-CX-72 tank. The sludge is potentially transuranic (TRU) and possibly hazardous. Therefore, the sludge could only be left in place if it can be demonstrated that the material has sufficiently low levels of TRU materials present and that it is non-hazardous. Assuming that the sludge must be removed, the final condition of the site will be the sealed tank, emptied of its radioactive.

It is expected that the technology used to retrieve the waste from tank 241-CX-72 may be applicable to the eventual closure of other underground tanks at Hanford. The similarity of the waste contained in tank 241-CX-72 to

other storage tanks, especially the single-shell tanks (SST's) and double-shell tanks (DST's), cannot be overlooked. Detailed journals of all phases of the decommissioning task will be maintained. Upon completion of the task, all pertinent records will be compiled into a final report.

3.0 PHYSICAL DESCRIPTION

3.1 GENERAL DESCRIPTION

The 241-CX-72 tank is located in the Strontium Semiworks Facility of the 200-E Area at Hanford grid coordinates N42058, W50072.5, as shown in Figure 3-1. Tank 241-CX-72 was installed at the Strontium Semiworks Facility in 1955 and used as an experimental tank to determine characteristics of self-concentrating waste from pilot plant studies for the plutonium and uranium recovery by extraction (PUREX) processes. As shown in Figure 3-2, tank 241-CX-72 is an upright, cylindrical vessel 40 inches in diameter and 35 feet, 8 inches in length, mounted inside a caisson. Support pads, welded to the bottom of the tank, rest on the concrete pad that forms the bottom of the caisson. The 3/8 inch thick vessel walls are reinforced with five stiffener rings that extend nearly out to the caisson wall. Three rows of vertical guides connect the stiffener rings. A cylindrical electrical heater is mounted just above each stiffener ring. The top of the vessel is sealed with a plate that also extends over the caisson and seals the caisson. A 3 inch diameter dry well and 3 inch diameter vapor header are each mounted on the inner wall of the tank. Two 8 inch diameter risers and a 2 inch diameter fill pipe are each mounted near the center of the tank. One of the risers contains dip tubes that were used for liquid level and density measurements. A sparger is mounted in the bottom of the tank. A manually operated system of paddles (for "feeling" the sludge level) was mounted concentrically within the tank. These paddles were operated through a system of actuator rods that originally extended from within the vessel to above grade. Approximately 15 feet of these rods was pulled from the tank by heavy equipment sometime between 1986 and 1988. The tank was constructed of ASTM A-7-52T, carbon steel, which is similar to ASTM-A36 (reference: Drawing H-2-2563, see Appendix A). The top of tank 241-CX-72 is presently buried 13.71 feet below grade (Grade elevation = 682.96 feet above sea level, reference: Drawing H-2-2554, see Appendix A.)

The tank is set inside a caisson which is a cylinder fabricated from ½-inch carbon steel plate. The caisson is 6 feet in diameter and 35 feet, 8 inches long. The bottom of the caisson is a 12 inch thick reinforced concrete pad which is supported by reinforcing bars welded to the inside of the caisson (reference: Drawings H-2-4422 and H-2-4423, see Appendix A).

The soil surrounding the tank is consists of sand and gravel. The water table is located approximately 120 meters (390 feet) above sea level (approximately 290 feet below grade level) (DOE 1987).

Figure 3-1. Plan of 200-E Area Showing the Location of Tank 241-CX-72.

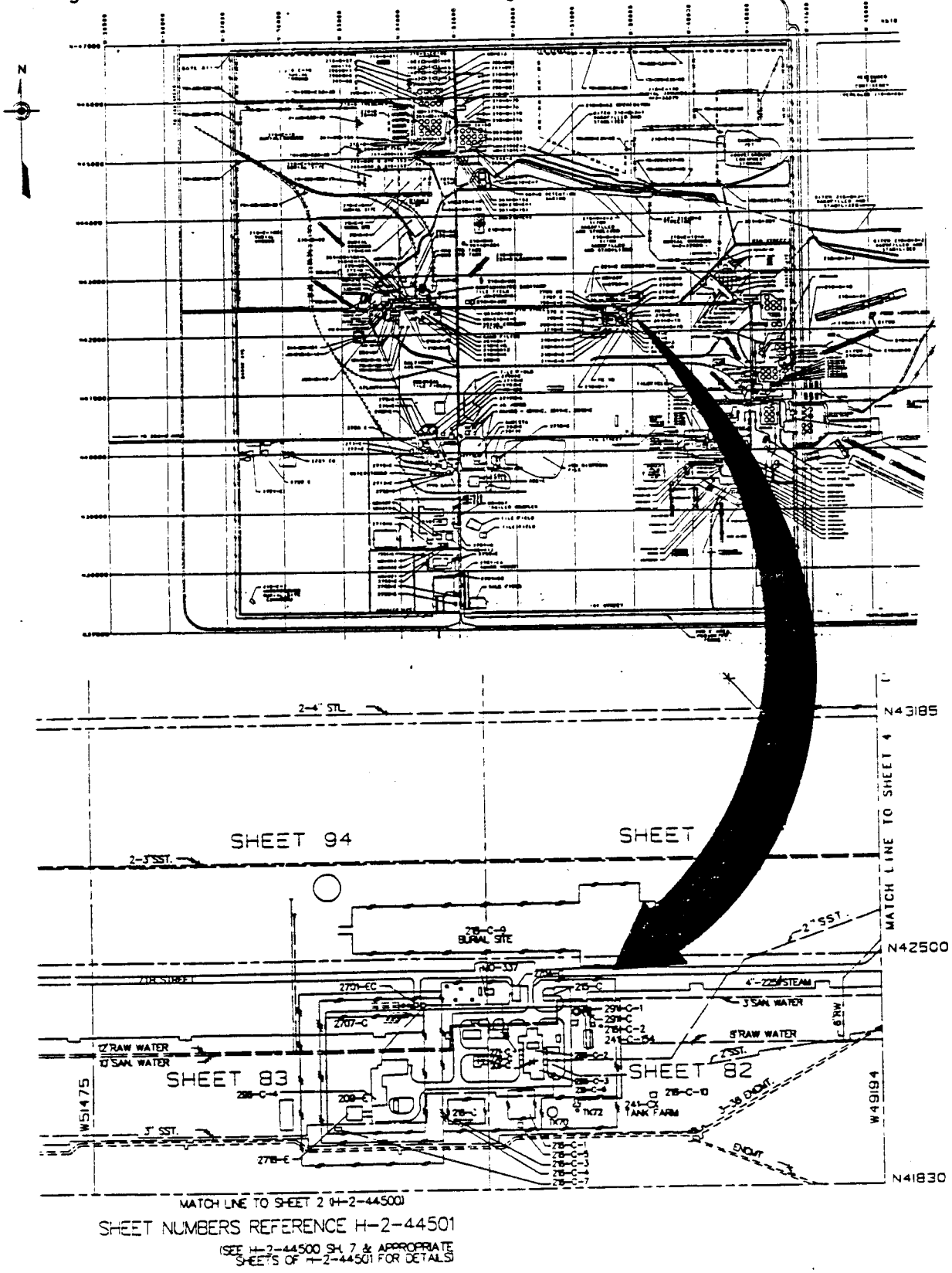
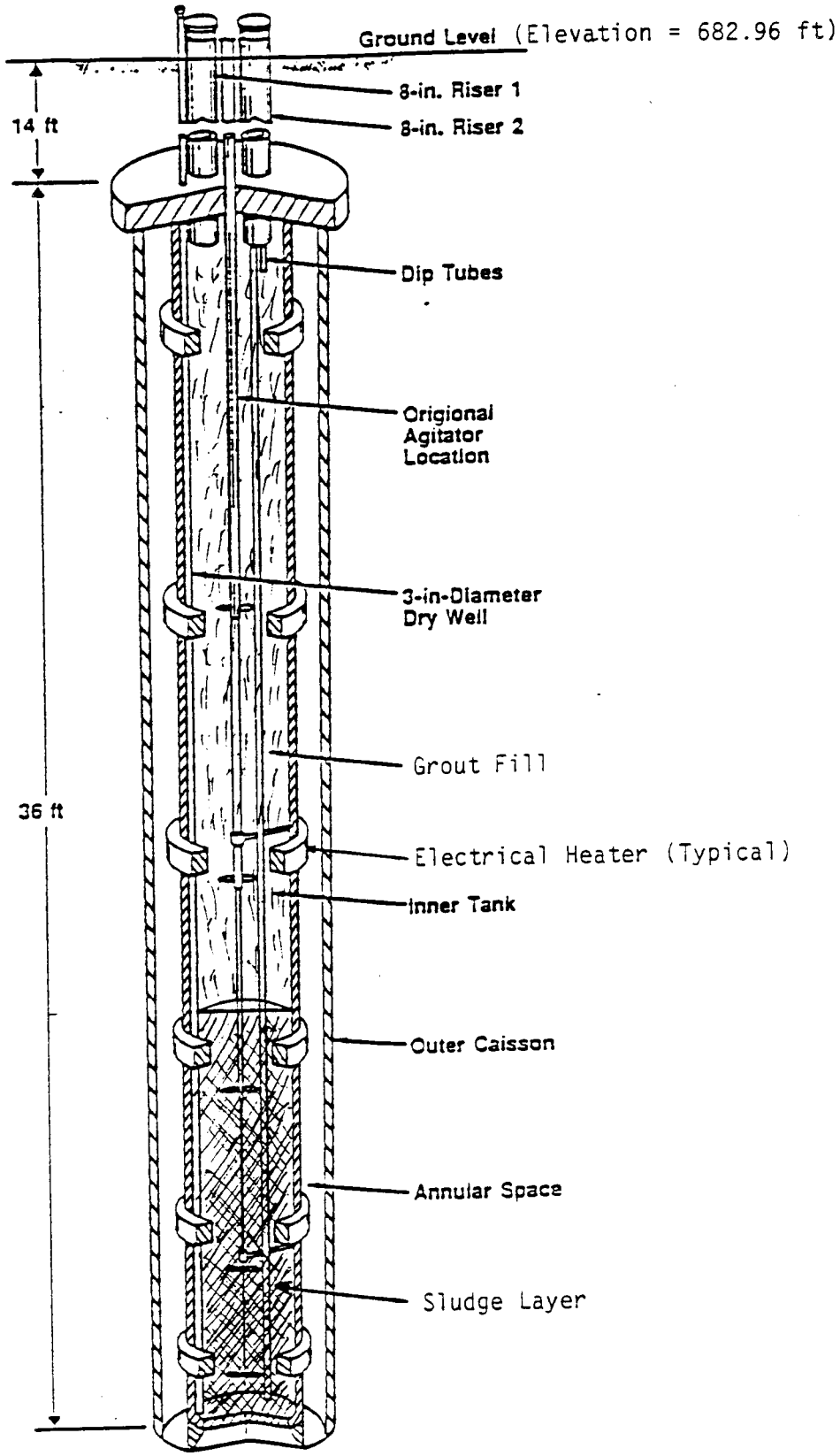


Figure 3-2. Simplified Cross Sectional View of Tank 241-CX-72.



3.2 CHARACTERIZATIONS

3.2.1 Characterization of the Tank Vessel

A structural analysis of the tank was performed to assess the feasibility of lifting the tank in its present condition. Assuming "new" conditions, calculations indicate that the lifting lug stiffeners, lifting lug welds, lifting gusset plate welds, and lid to tank weld capacity would exceed the gross load (Mackey 1989). However, the throat of the lifting lug itself would be inadequate. There is a 16 fold safety factor in the strength of the tank walls. However, hand calculations indicate that the strength of the bottom may be marginal.

3.2.2 Characterization of the Tank Contents

In the fall of 1988, neutron and gamma measurements were taken from within the 3-inch dry well (Subrahmanyam 1989) and indicated the presence of TRU isotopes in the tank. The gamma radiation rate measured inside the dry well at a location 47 feet below its top (the bottom of the tank is approximately 51 feet below the top of the dry well) is 476 R/hr, at the 38 foot level the rate is 168 R/hr, from there to grade level, the rate drops off rapidly to 0.0006 R/hr. Presently, it is believed that the sludge layer contains sufficient quantities of transuranic material such that the contents of the tank may have to be classified as TRU.

Neutron measurements taken at approximately 39 feet from the top of the dry well (12 feet from the tank bottom), indicated that mostly fast neutrons are present. Since few thermal neutrons are present, it can be inferred that no moderator, such as water, is present between the neutron source and the neutron detector.

In the spring of 1989, a gamma spectroscopic survey from within the dry well, 19 feet from the top, indicated a high cesium concentration in that area. These results indicated an approximate 40% difference between the maximum and minimum values of the only isotope identified, ^{137}Cs (Subrahmanyam 1989). Similar gamma spectra could not be obtained at deeper locations because of high activity levels. A one inch diameter, one inch long cylindrical NaI(Tl) detector with a 5/8-inch window shielded by ½ inch of lead was used for these measurements. The detector assembly was positioned inside the 3-inch dry well located at the inside periphery of the tank. The maximum reading was observed with the window directed towards the axis of the tank while the minimum reading was obtained with the window directed away from the tank axis. The observed difference in these readings is considered a positive indication of gamma activity being present inside the tank because of the fairly wide field of view (103 degrees of arc), and the fact that the lead shielding, with the window directed away from the tank attenuates the ^{137}Cs gamma peak by about 75%. It may be possible, using a detector with narrower field of view, to distinguish between ^{137}Cs being present as a coating on the walls of the tank or dry well as opposed to the

activity being present in the bulk of the grout.

A core sample of grout obtained within the top 2 feet of the 8-inch riser indicates that it is non-radioactive, and that it is of inferior structural strength. A penetrometer was used to test the compressive strength of the grout. (The penetrometer was used because no reliable compressive strength tester is available at present. Earlier experiments concluded that penetrometer readings could be converted to compressive strength values provided the material being tested has a compressive strength of less than 1200 psi.) The calculated compressive strengths at three different points on the face of grout sample were all less than 1000 psi (520, 923, and 945 psi). The grout crumbled into 3/8-inch and smaller pieces when removed from the sample tube. These results are consistent with the delivery specification for the grout (100 to 350 mesh sand with 3/8-inch aggregate, and a 3:1 sand to cement ratio, and a slump of 8 inches). Based on the specification the grout, there is no reason to suspect that it contains hazardous material.

3.2.3 Conclusions Drawn from Characterization Studies

The radiation measurements taken indicate that there are three distinct regions in the tank: The bottom 12 feet is characterized by a high neutron flux and few thermal neutrons; an intermediate layer characterized by a gradual decrease in neutron activity which is consistent with an expected decrease due to distance and shielding (i.e., the tank contains grout); and a top layer that contains little or no activity (the tank wall is relatively free of contamination).

In the absence of better information (such as a core sample) the following description of the tank contents is assumed: The bottom twelve feet of the tank contains approximately 3 m^3 of a dry solid that holds most of the TRU material [150 to 200 g of ^{239}Pu is the best estimate (Subrahmanyam 1989)]. There is a possibility that a significant fraction of neutrons is due to ^{244}Cm, which is considered non-TRU, however, there is no simple way to confirm this theory without a sample of the material. Based on the assumed similarity of these wastes to PUREX type wastes, this material is probably non-hazardous. However, there is a possibility that the tank was used to receive decontamination flush chemicals, in which case there may be significant quantities of hazardous materials present (WHC 1988d).

The intermediate layer consists of fairly uncontaminated grout with a coating of cesium on the tank walls. The upper five feet of the tank shows little or no radioactivity which would indicate that the cesium wall coating ends at this level. Based on the only grout core sample obtained to date, it is assumed that the bulk of the grout contains little or no radioactive contamination and has no structural strength.

Throughout this document, the bottom stratum containing the waste is referred to as the "sludge" layer, while the other two regions are referred to collectively as the "grout" layer. Based on radiological data obtained from inside the dry well, it would be correct to assume that the "sludge" layer in tank 241-CX-72 is a hard dry solid, not soft and moist.

4.0 MANAGEMENT APPROACH

The U.S. Department of Energy-Richland Operations Office (DOE-RL) Environmental Restoration Division oversees the Hanford Environmental Restoration Program.

The decommissioning of tank 241-CX-72 will be planned and conducted by Decommissioning and Environmental Operations of Westinghouse Hanford Company (WHC). This function has the overall responsibility to plan and conduct contractor programs for decontamination and decommissioning or beneficial reuse of surplus and excess contaminated facilities.

The Hanford Surplus Facilities Program (HSFP) has the programmatic responsibility within Environmental Restoration for the surveillance, maintenance, and decommissioning of surplus facilities at Hanford. The HSFP establishes the cost, schedule, and technical baselines for individual projects and provides the project management for completing the work. The work activities are completed by various functional organizations via a matrix management system. Performing organizations are assigned work by the Program Office using Cost Account Authorizations (CAA's) and Cost Account Plans (CAP's). Project status is reported to the Program Office using an Earned-Value System (Section 5.2). The majority of decommissioning field work and engineering at Hanford is performed by the Hanford Restoration Operations group. Subcontracted work is also managed through the HSFP. The organization structure is shown in Figure 4-1.

The Hanford Restoration Operations (HRO) group performs surveillance, maintenance, decommissioning, and environmental restoration field operations on the Hanford Site, including the engineering activities in support of these operations. The HRO also functions as landlord and plant manager for contaminated surplus facilities and inactive waste disposal sites.

Defense Waste Planning and Integration Budgeting provides a full range of business management services for the Environmental Programs Division. A detailed description of its responsibilities is in procedure A-1.4 of WHC-CM-5-5, *Operations General Administration* manual. Some of the direct support services provided to HSFP are detailed budget development and the associated monitoring, analysis, and reporting relative to cost and schedule.

The work breakdown structure for the project is shown in Table 4-1.

Figure 4-1. Block Diagram of the Decommissioning Organizational Structure.

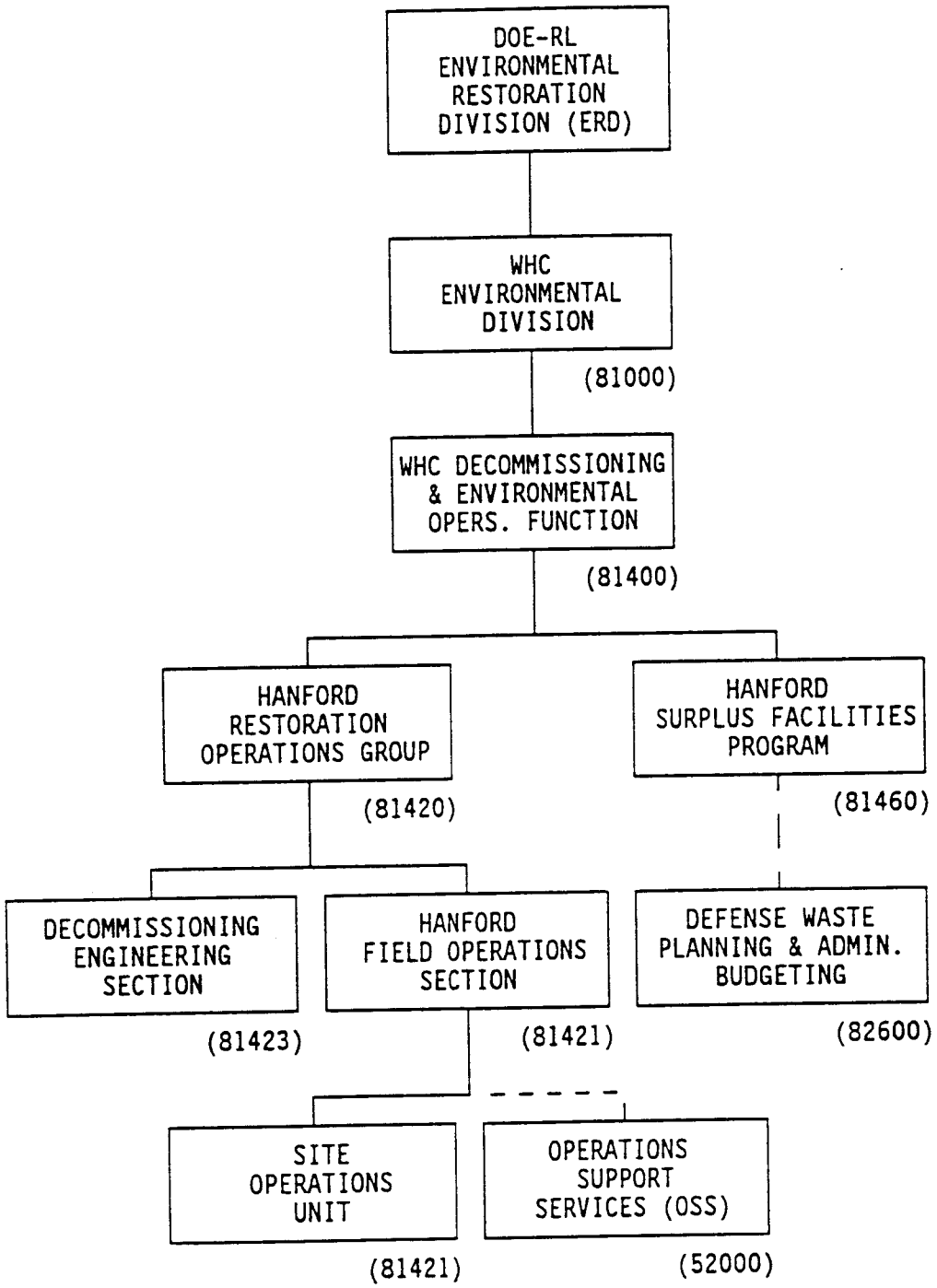


Table 4-1. Work Breakdown Structure for the Sampling and Decommissioning of Tank 241-CX-72.

WBS	Task Name
01	Characterization -
01.01	Ground Penetrating Radar
01.02	Grout Sampling -
01.02.01	Sampling & Analysis Procedures
01.02.02	Sampling
01.02.03	Sample Analysis
01.03	Sludge Sampling -
01.03.01	Sampling & Analysis Procedures
01.03.02	Sampling
01.03.03	Sample Analysis
02	Environmental Review -
02.01	Environmental Assessment
02.02	Part A Permit (If Required)
03	Engineering -
03.01	Preliminary Design
03.02	Task Plan
03.03	Grout Retrieval & Sludge Sampling
03.03.01	Definitive Design
03.03.02	Equipment Testing
03.03.03	Safety Evaluation
03.03.04	OTP, Maintenance Plan, etc.
03.03.05	Operating Procedures, Training
03.04	Task Plan Revision
03.05	Sludge Retrieval -
03.05.01	Definitive Design
03.05.02	Equipment Testing
03.05.03	Safety Evaluation
03.05.04	OTP, Maintenance Plan, etc.
03.05.05	Operating Procedures, Training
04	Decommissioning -
04.01	Grout Retrieval -
04.01.01	Site Work
04.01.02	Procure/Fabricate Equipment
04.01.02.01	Ventilation Equipment
04.01.02.02	Vacuum Equipment
04.01.02.03	Grout Retrieval Equipment
04.01.02.04	Cut Off Tool
04.01.03	Readiness Review
04.01.04	Operations
04.02	Sludge Retrieval -
04.02.01-A	A. Vacuum/Burial - Site Work
04.02.02-A	Vacuum/Burial - Equipment
04.02.04-A	Vacuum/Burial - Operations
04.02.04.01-A	Vacuum/Burial - D&D Ops.
04.02.04.02-A	Vacuum/Burial - Burial
04.02.01-B	B. Vacuum/Sluice - Site Work
04.02.02-B	Vacuum/Sluice - Equipment
04.02.04-B	Vacuum/Sluice - Operations
04.02.04.01-B	Vacuum/Sluice - D&D Ops.
04.02.04.02-B	Vacuum/Sluice - T/F Ops.
04.02.01-C	C. Sluice/Sluice - Site Work
04.02.02-C	Sluice/Sluice - Equipment
04.02.04-C	Sluice/Sluice - Operations
04.02.04.01-C	Sluice/Sluice - D&D Ops.
04.02.04.02-C	Sluice/Sluice - T/F Ops.
04.02.03	Readiness Review
05	Post Decommissioning -
05.01	Tank Surface Sampling -
05.01.01	Sampling & Analysis Procedures
05.01.02	Sampling
05.01.03	Sample Analysis
05.02	Site Stabilization/Demolition
05.03	Final Report Preparation

5.0 TECHNICAL PLAN

5.1 CHARACTERIZATION

5.1.1 Scope

A preliminary radiological characterization of the tank contents was performed and is documented elsewhere (Subrahmanyam 1989). The characterization results are summarized in Sections 3.2.2 and 3.2.3, above.

Prior to the actual retrieval process, the structural integrity of the tank will be studied to the greatest extent possible. For example, it may be feasible to ultrasonically test the dry well wall and extrapolate these results to estimate the extent of corrosion of the tank walls. Visual inspection of the tank wall, as the grout is being removed, will also be attempted.

Prior to the initiation of grout retrieval operations, samples of the grout layer will be taken by drilling through one of the 8-inch risers. These samples will be used to characterize grout removed and confirm depth of removal previously determined by the preliminary radiation survey.

As the grout is removed, its activity level will be monitored using portable equipment to verify LLW requirements. Because it is expected that the grout will be classified as LLW, it will be packaged according to requirements for LLW (Stickney, 1988). The status of the grout waste will be confirmed by laboratory analysis of samples. Grout will be removed down to a level no closer than two feet to the estimated level of the top of the sludge or to the point at which the grout samples show significant levels of TRU contamination. During the grout removal phase, an inspection of the tank interior will also be conducted.

After removal of the grout, as outlined above, samples of the sludge layer will be retrieved and analyzed for hazardous and radionuclide constituents. Tank integrity and sludge characteristic data will be evaluated in order to select the preferred sludge retrieval method.

5.1.2 Special Equipment

The only special equipment required is a sampler capable of retrieving a sample of the sludge layer. It would be desirable to use existing proven equipment for sample core drilling. However, liquid lubricant drilling coolants can not be used until a criticality analysis has established that the sludge does not contain an unacceptable amount of fissionable material.

A salt cake sampler is currently being developed specifically for the purpose of sampling salt cake in single shell tanks (Deichelbohrer 1990). Preliminary testing with simulated hard salt cake has shown that bits with hardened teeth are needed to core the cake. Bits with teeth set at a negative rake angle have been shown to bore through the salt cake without damaging the steel bottoms of waste tanks. A variety of sampler designs will be

needed to handle the anticipated forms of salt cake in SST's. Several sampler designs have been proposed and working models are currently available. However, there may be as much as another 16 months of development work for the samplers to become fully operational.

Of the various samplers that will be available, the salt cake sampler would be the most appropriate choice. The drill is being designed specifically to penetrate hard cake and will not require a liquid to remove fines. Alternatives to using the salt cake sampler are discussed in the engineering study (Griffin and Ludowise 1989).

5.1.3 Process/Techniques

Samples of grout will be taken using a 3 ½-inch auger. Containment will be assured during sampling by maintaining a negative pressure air enclosure. Drill cuttings will be sampled in 2 to 5 foot intervals. Cuttings will be analyzed to verify LLW criteria.

Samples of the sludge will be taken using the salt cake sampler (described above). Samples will analyzed for transuranic content, and hazardous materials.

5.1.4 Deliverables

All sample analyses will be reported in WHC Supporting Documents (SD). These documents will be retained as part of the records required for closeout of the task (see Section 10.0)..

5.2 ENVIRONMENTAL REVIEW

5.2.1 Purpose/Objective

The purpose of the environmental review activities is to ensure compliance with all applicable federal, state, and local government environmental regulations. Specifically, compliance with the NEPA, RCRA or CERCLA, and the Washington State Dangerous Waste Regulations is required.

Tank 241-CX-72 is part of the Operable Unit 200-SO-1 listed in the "Tri-Party Agreement" (TPA) (DOE 1989). The TPA includes 74 Operable Units divided into five priority group rankings. The first group of 20 Units have been individually ranked from one to twenty; the remaining four groups have not. The Remedial Investigation/Feasibility Studies (RI/FS) or RCRA Facility Investigation/Corrective Measures Studies (RFI/CMS) for the initial 20 Operable Units have been started and are scheduled to be completed in 1996. The start of the RCRA Facility Investigation/Corrective Measures Study (RFI/CMS) or RI/FS process for the next grouping (B), to which Operable Unit 200-SO-1 belongs, is scheduled to begin in 1992, with completion beyond 1996. At that time, remediation of the site will be performed in accordance with either RCRA or CERCLA requirements.

The lead regulatory agency has not been established and it is not possible to identify the requirements under which the final closure must be performed (RCRA or CERCLA). However, there is generally no set of criteria that defines the allowable modifications to an operable unit prior to an operable unit prior to initiation of the RI/FS or RFI/CMS. A basic element in the decision making process should be whether the decommissioning activity would disallow or impede implementation of the final remedial actions. Actions such as removal of wastes, tanks, or other structures, or removal of contaminated media such as soils, however, generally do not hinder future remedial actions and can usually be undertaken prior to the record of decision (ROD). Although removal of structures such as tanks may not preclude implementation of future remedial actions at past practice unit sites, the lead agency has the responsibility and authority to halt any improper actions. In addition, the possibility exists that tank 241-CX-72 may need to undergo closure as a treatment, storage, and disposal (TSD) unit. If this occurs, closure must be in accordance with a plan which has been approved by Washington State Department of Ecology (WDOE). Tank and contaminated media (e.g., soil) removal and disposal would not be undertaken until a determination is made regarding whether TSD closure is necessary. In the interim, soil that is removed to gain access to the contents of the tank will be screened for heavy metal, total organic carbon (TOC), and radiochemical content, and disposed of in an appropriate manner.

Although not a requirement prior to an ROD, appropriate agencies will be kept informed of actions that are being taken in order to provide a mechanism for them to respond to an action should they have any concerns. WDOE and the Environmental Protection Agency (EPA) will be notified in writing at least 30 days in advance of the removal of the contents of tank 241-CX-72.

Records will be kept on the actions to provide data for incorporation into the RFI/CMS or RI/FS at a later date. Data will include information on the characterization and decommissioning of the unit along with any information pertaining to environmental releases resulting from the unit.

Active storage and the decommissioning activities of 1986 would both act to place tank 241-CX-72 in the treatment, storage and disposal (TSD) unit category if the analysis of its contents reveals hazardous materials. While the tank may not have received the hazardous materials since November 19, 1980 (or March 12, 1982, in the case of State-only hazardous wastes) the tank management activities since that date may have removed it from the Past Practice category. Therefore, if it were determined not to be in the Past Practice Category but did contain hazardous waste or constituents, the following procedure would apply:

> Since this tank would have held hazardous waste after November 19, 1980, a Part A application will be submitted to WDOE and, as the tank is therefore considered to be a TSD unit, it will require a Closure Plan prior to commencement of final closure activities. The Part A application will allow treatment of the hazardous wastes, including neutralization and removal of the tank's contents. The removal of any such hazardous materials from the tank would, of course, need to be managed in accordance with the dangerous waste regulations of Washington State.

The above analysis is based, in part, on a precedent set by single-shell tank waste applications. The application of the TPA to decommissioning activities is less certain and the Hanford Surplus Facilities Programs may seek possible relief from the Part A application and attendant TSD designation and Closure Plan with the WDOE. Should such a relief be granted, the unit would be designated a Past Practice unit and the EPA and WDOE would jointly determine whether the unit, in conjunction with others in Operable Unit 200-SO-1, would be managed under the authority of RCRA or CERCLA and, consequently, require an RFI/CMS or similar RI/FS respectively. In any event, the removal of tank contents would still be possible provided that the activities do not preclude future corrective actions arising from the Closure, RFI/CMS, or RI/FS process.

Compliance with the National Environmental Policy Act (NEPA) will require the preparation of an Environmental Assessment (EA) for the terminal cleanout and stabilization of tanks 241-CX-70, 71, and 72. The existing NEPA documentation for decommissioning the Strontium Semiworks (DOE-RL 1985) does not cover the additional scope of work planned in the re-baselined project. While the primary concern in the new scope of work concerns the potentially high-level waste in 241-CX-72, individually documenting each tank involved could be perceived as segmenting NEPA documentation, which is not allowed under NEPA guidelines.

5.2.2 Scope

The scope of this activity is the same as that defined under characterization.

5.3 ENGINEERING

5.3.1 Scope

The engineering phase of the task will include all design, and testing of equipment and preparation of operating documentation including operating procedures, etc. Design engineering will be accomplished in several stages. A preliminary design of the system to retrieve the tank contents was prepared in the first half of FY 1990. Definitive design of the equipment for grout retrieval will begin early in the third quarter of FY 1990. During this time frame, a safety evaluation will be completed. The information from the safety evaluation will be used to complete the definitive design. Grout removal equipment will be procured, fabricated, and tested beginning in the third quarter of FY 1990. The equipment will be tested in a non-radioactive environment. Refinements to the design will be incorporated and tested so that turn-key equipment can be provided at the waste site. Also during this period, the salt-cake sampler will be tested and refined. The development of this sampler is funded as part of the single-shell tank program.

Grout retrieval is scheduled to be completed during the fourth quarter of FY 1991. At that time, the sludge layer will be sampled and analyzed. Based on the results of the sludge sample analyses, this task plan will be

revised to reflect any modifications that may be necessary to the plans for retrieval of the sludge. Also at that time, the safety evaluation will be reviewed and revised as necessary.

Definitive design of the sludge retrieval equipment will begin in the first quarter of FY 1992. Similar to the approach taken in developing the grout retrieval equipment, the sludge retrieval equipment will be tested and refined in a non-radioactive environment.

5.3.2 Design Alternatives

The preliminary design for retrieval of the contents of tank 241-CX-72 is documented elsewhere (Crawford 1990a). The following sections provide a brief summary of the alternatives being considered for grout and sludge retrieval.

5.3.2.1 Design Alternatives For Grout Retrieval. The preliminary design for grout retrieval is based on a specially designed drilling system that will simultaneously break the grout into small (less than ½-inch) pieces and vacuum transfer these pieces into a hopper. The hopper will be periodically emptied into burial containers (55-gallon drums or burial boxes). Any equipment in the tank, such as the paddles, actuator rods, or dip tubes, will either be broken up by the drill head and vacuum transferred to the hopper (preferred method), or be cut off with a tool attached to the head of the drill string, and hoisted to the surface and packaged in burial containers.

Design alternatives for the grout retrieval equipment center on the design of the drill bit. The preliminary design calls for a bit approximately 12.5 inches in diameter with cutting teeth attached to the outer diameter of the bit. Several grinding teeth will be mounted inside of the bit. Design alternatives that will be evaluated during the testing phase of the equipment design include designs that ensure that the cutting bit will not breach the carbon steel shell of the 241-CX-72 tank, and grout grinding bit arrangements for efficient size reduction of the grout.

5.3.2.2 Design Alternatives For Sludge Retrieval. Because only estimates of fissionable material in the sludge layer are currently available, the assumption was made that only techniques that do not employ a neutron moderator (such as water) could be used. The preliminary design of the sludge retrieval equipment is very similar to that for grout retrieval. The sludge would be successively broken up and vacuumed into a hopper that will be used to fill burial containers. The sludge layer is known to contain gamma emitting radionuclides (probably ^{137}Cs). Preliminary calculations would indicate that relatively small quantities of the sludge could be packaged in 55-gallon drums or waste boxes shielded with concrete (Ludowise 1990). More detailed engineering design of the packaging, including optimization of neutron and gamma shielding, would be required, in order to implement this design alternative.

It is expected that, upon analyzing samples from the sludge, the fissile material content of the sludge will be low enough so that there would be no

restrictions on the use of moderators. Anticipating this situation, designs that would allow for sluicing the sludge to a double shell tank are also being developed. One concept would use vacuum equipment to lift the sludge from the tank while a water jet is used to suspend the solids which are pumped to the tank farms as a slurry. The second method would sluice the sludge from the tank using water jets. This slurry would then be transferred to the tank farms. This activity has not yet been scheduled with tank farms.

5.3.3 Waste Management

Low level waste will be removed, packaged, and transported to the appropriate burial site in the 200 Areas. Such disposal will comply with the applicable DOE Orders and with the burial site operator regulations. Packaging and transport of the waste will be accomplished in accordance with the manual for *Packaging and Transportation of Radioactive and Hazardous Waste* (WHC 1988c). This manual provides for a degree of safety equal to that required by the Department of Transportation (DOT) for offsite shipments. Burial and TRU certification requirements are provided in the *Hanford Radioactive Solid Waste Packaging, Storage, and Disposal Requirements* manual (Stickney 1988).

5.3.4 Safety

Radiological and environmental safety will be in compliance with established controls as outlined in the *Radiation Protection* (WHC 1988g), *Operational Health Physics* (WHC 1988f), *Environmental Compliance* (WHC 1988a), and *Nuclear Criticality Safety* (WHC 1988e) manuals. Industrial and occupational safety will be assured by compliance with the *Industrial Safety Manual* (WHC 1987). Safety will be ensured primarily through the implementation of physical controls and barriers and will be supplemented through the use of specific personnel monitoring and protective measures to that will be specified in supporting work documentation (such as Radiation Work Procedures and Job Safety Analyses).

5.4 DECOMMISSIONING OPERATIONS

5.4.1 Scope

The 241-CX-72 tank will be decommissioned in three phases. Phase 1 will consist of the removal and disposal of most of the grout. Phase 2 consists of sampling and analysis of the sludge layer. Phase 3 will be the actual removal and disposal of the sludge. The proposed sequence of operations is outlined below:

Phase 1

1. Grade and level area surrounding tank.
2. Perform Ground Penetrating Radar survey of the area.
3. Pour concrete pad at grade with access hole over tank.
4. Erect vacuum system, drilling rig, containment barriers, etc.
5. Drill through riser and retrieve grout samples.

6. Analyze grout samples.
7. Excavate 10 foot diameter hole, in four foot increments: remove soil with vacuum lift, and install shoring panels.
8. Lower containment control air curtain into position on top of tank.
9. Connect containment control air curtain to ventilation equipment and begin ventilation.
10. Remove riser and cut a 38 inch diameter hole through the top plate of the tank.
11. Begin grout retrieval. Monitor grout for contamination.
12. Cease grout retrieval when mining head reaches a level (to be determined during definitive design) which will leave a two foot thick layer of grout over the top of the sludge layer or when radiation levels in the grout exceed acceptable levels.

Phase 2

1. Core drill through grout cap and obtain two full length sludge samples.
2. Analyze sludge samples for radioactive and chemical constituents.
3. Revise safety evaluation based on sample analysis.
4. Complete design and testing of sludge retrieval equipment.

Phase 3

1. Erect sludge retrieval equipment.
2. Begin sludge retrieval operations.
3. Perform verification.
4. Remove retrieval equipment, decontaminate, and dispose.
5. Weld cap on tank.
6. Decontaminate and remove surface equipment.
7. Decontaminate access pit shoring.
8. Remove greenhouse.
9. Remove concrete pad.
10. Seal access pit.

5.4.2 Special Equipment

Design criteria for the tank waste retrieval systems are documented elsewhere (Crawford 1990a; Crawford 1990b). The special equipment to be used to complete this task is described briefly in section 5.3.

5.4.3 Process/Techniques

The techniques that will be utilized to decommission the tank were chosen because of the uncertainties as to the nature of the sludge layer and the vessel. Three methods for sludge retrieval are being proposed in this plan. However, upon completion of the grout removal and sludge sampling steps, the techniques will be evaluated to select the preferred alternative and this alternative will be refined appropriately.

The sampling and decommissioning of the tank will be accomplished in three phases. Initial characterization of the tank and removal of the grout layer will be accomplished during Phase 1. During Phase 2, the suspected transuranic sludge in the bottom of the tank will be sampled and analyzed and the process for retrieval of this material will be designed. During Phase 3, if confirmed as being transuranic, the sludge material will be retrieved and the tank will be stabilized for future closure.

Because of the unknown quantity of fissionable material contained in the sludge, no moderating materials (such as water) will be added to the tank until the sludge is characterized. Also of concern is the unknown condition of the tank vessel. Until it can be determined that the vessel is structurally sound and does not leak, water will not be used (even if water could be introduced from the standpoint of nuclear safety). Characterization of the sludge cannot be accomplished until a sampler is developed. While the sampler is being developed, the grout can be removed and the integrity of the tank vessel can be evaluated.

Three methods of sludge removal have been proposed. Method A would vacuum the sludge out of the tank and package it in burial containers. This is the most costly option and would be used only if the quantity of fissionable material present in the sludge precluded the use of water. Method B would vacuum transfer the sludge to the surface, and then use water to sluice it to tank farms. This alternative would be used if it were determined that the concentration of fissionable material were low enough to permit the use of water, but that the integrity of the tank would warrant the a prohibition on the use of water. Method B could also be used on a system that has a high fissionable material content if it were designed to be geometrically favorable to prevent criticality. Option C would use water to slurry the sludge in the tank which would be lifted to the surface and pumped to the tank farms.

5.4.4 Procedures

Decommissioning of tank 241-CX-72 will be performed according to approved operating procedures and work plans. These procedures and work plans will be developed after equipment testing is completed and will provide instructions for the safe and efficient operation of equipment. Decommissioning procedures will become part of the operating document controlled manual system (WHCa; WHCb). Applicable procedures and workplans include *Operating Procedure for Packaging and Transport of Hazardous Material/Waste* (DD-026-020), and *Operating Procedure for General Equipment Dismantlement* (DD-026-022).

5.5 POST DECOMMISSIONING ACTIVITIES

5.5.1 Project Completion

After the contents of the tank have been removed, and final surveys conducted, the access hole in the tank lid will be sealed, and the caisson in the access pit will be decontaminated. The tank will be left in this

condition pending completion of the RI/FS, RFI/CMS, or approval of the Closure Plan if the tank is classified as a TSD unit. Depending on the condition of the individual pieces, equipment on the surface will be demolished or decontaminated and removed from the site. The concrete pad will be demolished and disposed of in the appropriate fashion (landfill or low level waste burial).

5.5.2 Final Surveys

After the sludge layer is core sampled, a neutron and gamma radiation profile of the sludge layer will be made using the core drilled holes as access wells for the radiation detection instruments. Upon completion of the sludge removal task, a second radiation profile of the tank will be undertaken using the same methodologies and in the same locations as performed prior to sludge retrieval. These profiles shall be integrated in one foot intervals over the length of the sludge layer and compared. The tank shall be considered to be empty when the final integrated profile is less than 0.3 percent of the initial integrated profile. [The 0.3 percent criterion is based on following the intent of regulations for the temporary closure of underground storage tanks (UST) (40 CFR 280.70). However, the measurement is radiological in nature, not volumetric.]

Once the tank is sealed, the outer surfaces of the tank, caisson, access caisson, and tank seal shall be have levels of removable contamination no greater than initial levels as measured at the beginning of the decommissioning activity.

5.5.3 Project Final Report/Data Package

The final report and data package will be assembled upon completion of the decommissioning task. This report will document the condition of the tank before and after decommissioning activities, problems encountered during decommissioning and the techniques used to resolve them, and statistics of the decommissioning activity such as volume of waste generated, condition of the tank, and total radiation exposure to personnel.

6.0 COST AND SCHEDULE

The total cost for completing all three phases is estimated to be between $4 and $8 million, depending on the complexity of the sludge retrieval process. These costs are constant value FY 1990 dollars and include functional overhead, general assessments, etc. The decommissioning project will require approximately four years to complete.

The details of the cost estimate are shown in Table 6-1. These costs are based on cost data reported in the Preliminary Decommissioning Design Report (PDDR) (Crawford 1990a). The cost estimate shown in Table 6-1 is broken down by major WBS element (Characterization, Environmental Review,

Engineering, Decommissioning Operations, and Post Decommissioning Activities), and shows the expected funding for each fiscal year through project completion.

The project schedule is shown in Figure 6-1. The project schedule is broken down to be consistent with the five major WBS elements that are listed in Table 6-1.

7.0 OCCUPATIONAL EXPOSURE ESTIMATE

Specific policies, standards, requirements, and guidelines for the control of radiation exposure, radioactive materials, and radiological work are delineated in the *Radiation Protection* manual (WHC 1988g). This manual applies to WHC facilities, employees, and non-employees who work in or visit WHC facilities.

The standards and requirements for conformance with DOE Orders and required consensus standards that pertain to preparing and maintaining radiological records is described in Section 18.0 of the *Radiation Protection* manual (WHC 1988g). The Health Physics (HP) Group of WHC has the direct responsibility for issuing and processing all record and supplemental dosimeters and for maintaining an acceptable level of quality assurance in the dosimetry program. The HP Group also has the responsibility for storing dosimetry data and to promptly report the data to line management and employees.

Basic dosimeters are issued to visitors or employees who are not classified as radiation workers and who are expected to receive less than 50 mrem/visit and less than 100 mrem annually.

Doses for radiation workers are normally measured using the Hanford Multipurpose Dosimeter (HMPD). The guidelines that are used for determining the processing frequency of dosimeters is presented in Section 5.0 of the Radiation Protection manual (WHC 1988g). Other dosimeters such as finger rings, two-chip dosimeters, wrist dosimeters, or special beta/photon thermoluminescent dosimeters (TLDs) are issued to measure doses received to a specific body area (e.g., hands, head, etc.) when such exposure would not be adequately measured by the HMPD as determined by HP.

The dosimeters described above are collectively referred to as the record dosimeters and provide the official dosimetry record for each individual. Supplemental dosimeters may be used by field personnel to provide rapid dose estimates and are always used in conjunction with record dosimeter. Supplemental dosimeter results do not become part of the official individual dosimetry record unless the record dosimeter result is lost or a special investigation determines that the supplemental result is more indicative of the true dose.

The systems used to retrieve, handle, and store wastes presently contained in tank 241-CX-72 will be designed and operated to maintain

Table 6-1. Cost Estimate for the Sampling and Decommissioning of Tank 241-CX-72.*

WBS	Task Name	Fiscal Year 1990	1991	1992	1993	1994	Total Estimated Cost
01	Characterization -						
01.01	Ground Penetrating Radar		$5,000				$5,000
01.02	Grout Sampling -						
01.02.01	Sampling & Analysis Procedures		$2,500				$2,500
01.02.02	Sampling		$7,836				$7,836
01.02.03	Sample Analysis		$34,400				$34,400
01.03	Sludge Sampling -						
01.03.01	Sampling & Analysis Procedures		$5,000				$5,000
01.03.02	Sampling		$40,512				$40,512
01.03.03	Sample Analysis			$100,000			$100,000
01	Characterization Sub-Total		$95,248	$100,000			$195,248
02	Environmental Review -						
02.01	Environmental Assessment	$49,830	$9,900				$59,730
02.02	Part A Permit (If Required)			$9,966			$9,966
02	Environmental Review Sub-Total	$49,830	$9,900	$9,966			$69,696
03	Engineering -						
03.01	Preliminary Design	$137,000					$137,000
03.02	Task Plan	$62,000					$62,000
03.03	Grout Retrieval & Sludge Sampling						
03.03.01	Definitive Design	$381,490					$381,490
03.03.02	Equipment Testing	$190,745	$190,745				$381,490
03.03.03	Safety Evaluation	$86,523					$86,523
03.03.04	OTP, Maintenance Plan, etc.		$30,000				$30,000
03.03.05	Operating Procedures, Training		$40,000				$40,000
03.04	Task Plan Revision			$19,200			$19,200
03.05	Sludge Retrieval -						
03.05.01	Definitive Design			$60,298			$60,298
03.05.02	Equipment Testing			$60,298			$60,298
03.05.03	Safety Evaluation			$29,898			$29,898
03.05.04	OTP, Maintenance Plan, etc.				$30,000		$30,000
03.05.05	Operating Procedures, Training				$40,000		$40,000
03	Engineering Sub-Total	$857,757	$260,745	$169,695	$70,000		$1,358,197
04	Decommissioning -						
04.01	Grout Retrieval -						
04.01.01	Site Work §		$611,504				$611,504
04.01.02	Procure/Fabricate Equipment						
04.01.02.01	Ventilation Equipment §	$135,816					$135,816
04.01.02.02	Vacuum Equipment §	$123,052					$123,052
04.01.02.03	Grout Retrieval Equipment	$78,699					$78,699
04.01.02.04	Cut Off Tool	$4,653					$4,653
04.01.03	Readiness Review		$54,360				$54,360
04.01.04	Operations				$17,550		

Table 6-1. Cost Estimate for the Sampling and Decommissioning of Tank 241-CX-72 (Continued).

WBS	Task Name	Fiscal Year 1990	1991	1992	1993	1994	Total Estimated Cost
04.02	Sludge Retrieval -						
04.02.01-A	A. Vacuum/Burial - Site Work						
04.02.02-A	Vacuum/Burial - Equipment			$3,227			$3,227
04.02.04-A	Vacuum/Burial - Operations						
04.02.04.01-A	Vacuum/Burial - D&D Ops.				$33,590		$33,590
04.02.04.02-A	Vacuum/Burial - Burial ¶				$3,378,200		$3,378,200
04.02.01-B	B. Vacuum/Sluice - Site Work				$68,466		$68,466
04.02.02-B	Vacuum/Sluice - Equipment			$3,227			$3,227
04.02.04-B	Vacuum/Sluice - Operations						
04.02.04.01-B	Vacuum/Sluice - D&D Ops.				$33,590		$33,590
04.02.04.02-B	Vacuum/Sluice - T/F Ops.				$29,718		$29,718
04.02.01-C	C. Sluice/Sluice - Site Work				$91,312		$91,312
04.02.02-C	Sluice/Sluice - Equipment			$104,313			$104,313
04.02.04-C	Sluice/Sluice - Operations						
04.02.04.01-C	Sluice/Sluice - D&D Ops.				$25,846		$25,846
04.02.04.02-C	Sluice/Sluice - T/F Ops.				$29,718		$29,718
04.02.03	Readiness Review				$54,000		$54,000
04-A	Decommissioning Sub-Total A	$342,220	$683,414	$3,227	$3,465,790		$4,494,651
04-B	Decommissioning Sub-Total B	$342,220	$683,414	$3,227	$185,774		$1,214,635
04-C	Decommissioning Sub-Total C	$342,220	$683,414	$104,313	$200,876		$1,330,823
05	Post Decommissioning -						
05.01	Tank Surface Sampling -						
05.01.01	Sampling & Analysis Procedures				$2,500		$2,500
05.01.02	Sampling				$36,000		$36,000
05.01.03	Sample Analysis				$11,250	$33,750	$45,000
05.02	Site Stabilization/Demolition					$110,456	$110,456
05.03	Final Report Preparation					$40,000	$40,000
05	Post Decommissioning Sub-Total				$49,750	$184,206	$233,956
	ROUNDED SUB-TOTAL A	$1,200,000	$1,000,000	$300,000	$3,600,000	$200,000	$6,300,000
	ROUNDED SUB-TOTAL B	$1,200,000	$1,000,000	$300,000	$300,000	$200,000	$3,000,000
	ROUNDED SUB-TOTAL C	$1,200,000	$1,000,000	$400,000	$300,000	$200,000	$3,100,000
	25 % CONTINGENCY:						
	ROUNDED PROJECT TOTAL A	$1,500,000	$1,300,000	$400,000	$4,500,000	$300,000	$8,000,000
	ROUNDED PROJECT TOTAL B	$1,500,000	$1,300,000	$400,000	$400,000	$300,000	$3,900,000
	ROUNDED PROJECT TOTAL C	$1,500,000	$1,300,000	$500,000	$400,000	$300,000	$4,000,000

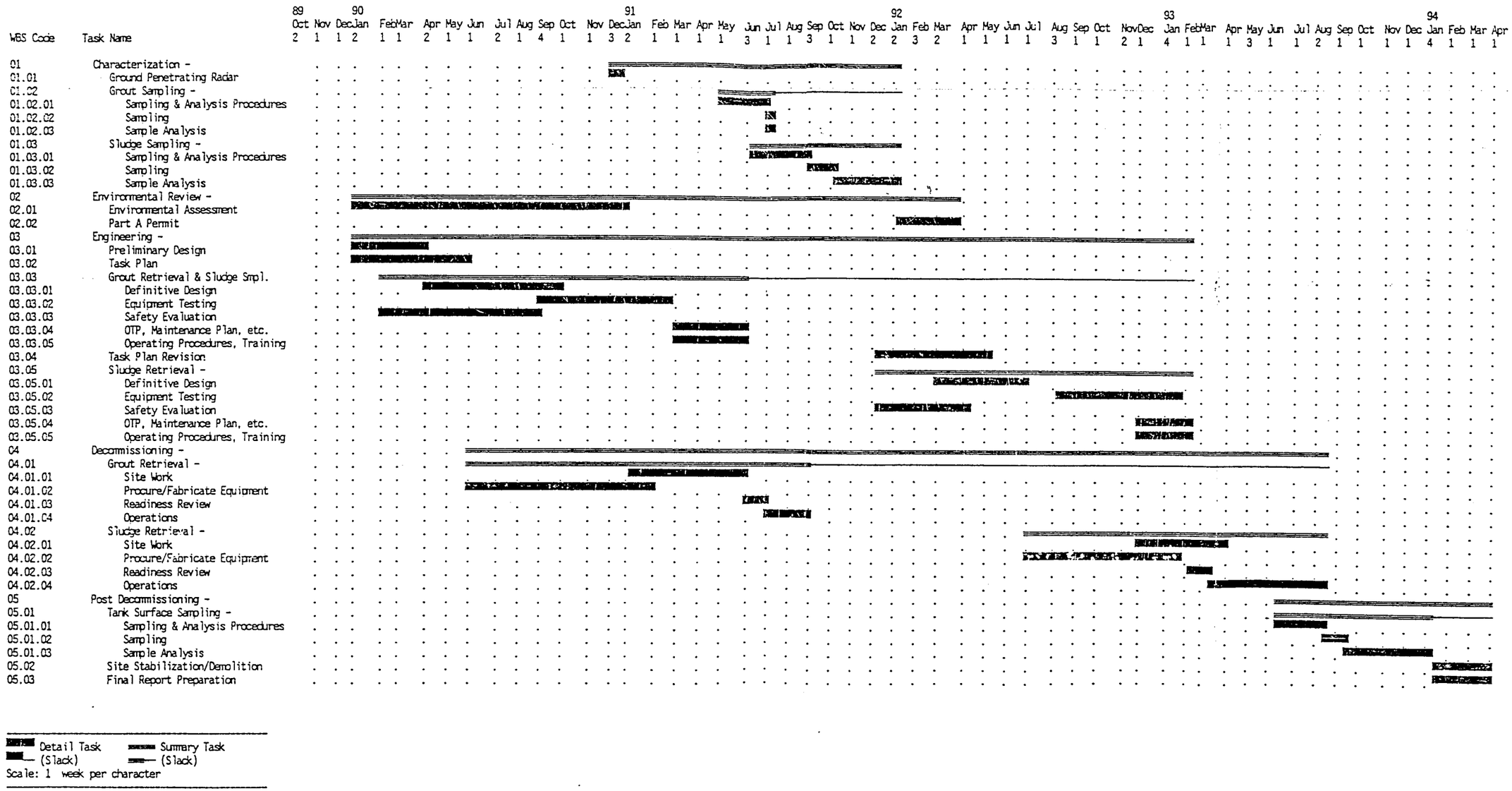
Notes:

* Costs are constant value FY 1990 dollars and include functional overhead, general assessments, etc.

§ Portions of these items may be procured under separate funding. The total cost is included here for completeness.

¶ Costs for packaging and burial of sludge are based on the use of 1300 TRUPACT-II containers (Ludowise 1990).

Figure 6-1. Schedule for the Sampling and Decommissioning of Tank 241-CX-72.



radiation exposure to be as low as reasonably achievable (ALARA) but not to exceed the shielding design criteria provided in Section 8.0 of the *Radiological Design* manual (Prevo 1988). In general, this policy prescribes a design limit of 0.2 mrem per hour and a maximum allowable exposure of 0.5 mrem per hour for continuously occupied areas. The WHC ALARA program is described in detail in the *ALARA Program* manual (WHC 1989). The total dose for all personnel for the duration of the task is estimated to be approximately 4000 mrem. This estimate is based on 10 people working full time for 12 months and receiving the maximum exposure of 0.2 mrem/hr. The dose for all personnel will be reported in the Decommissioning Final Report.

8.0 WASTE VOLUME PROJECTIONS

The decommissioning of tank 241-CX-72 is expected to result in the generation of approximately 3 m^3 of TRU waste and approximately 70 m^3 of low-level waste (LLW) which includes approximately 6 m^3 of grout, 37 m^3 of soil, 10 m^3 of miscellaneous waste, and 17 m^3 from demolition of the concrete. This waste volume estimate does not include packaging factors. If the TRU material is sluiced, approximately 30 m^3 of TRU sludge would be added to the double shell tank inventory. If the TRU material is packaged in 1300 shielded TRUPACT II Standard Waste Boxes, approximately 6000 m^3 of contact handled TRU waste would be generated. The number of TRUPACT II containers is an order of magnitude estimate. Further engineering will be required to optimize the waste packaging and shielding configuration in order to minimize the total volume and cost of waste disposal (Ludowise 1990). The actual waste volume will be reported in the Decommissioning Final Report.

9.0 QUALITY ASSURANCE PROGRAM

Quality assurance and quality control of activities will be as implemented in the Environmental Restoration Quality Assurance Program Plan (WHC 1988b).

The documentation for the task of decommissioning 241-CX-72 will be assigned Impact Level 2 as defined in MRP 5.43 of the *Management Requirements and Procedures* manual (WHC 1988d). This determination is based on the fact that documentation is "for activities with a potential release of radioactive or hazardous material to the environment in excess of permitted limits."

Quality Assurance Program requirements shall be applied to safety class items in accordance with MRP 5.2 and Table 1 of MRP 5.46 (WHC 1988d). Listings of safety items shall be included in the safety evaluation.

10.0 TASK DOCUMENT REQUIREMENTS

The quality records required to support closeout, final report preparation, and to verify performance of the decommissioning task are identified below:

1. "As-built" drawings showing the final configuration of the decommissioned 241-CX-72 tank and surrounding area.
2. Non destructive evaluation (NDE) records of the tank.
3. Radiation survey records [including non destructive analysis (NDA), and smear surveys] of the tank.
4. Data and results of laboratory characterizations of soil samples taken in the vicinity of 241-CX-72.
5. Data and results of laboratory characterizations of grout and sludge samples taken from 241-CX-72.
6. Photographs and video tapes depicting condition of the tank and surrounding area taken through the course of decommissioning.
7. Drawings and certified vendor information (CVI) of equipment used to decommission the tank.
8. Welding inspection records.
9. Records required for the packaging, shipment, and burial of radioactive materials.
10. Records required for the packaging, shipment, and disposal of hazardous materials.
11. NEPA/CERCLA/RCRA documentation.
12. Decommissioning Task Plan (this document).
13. Design documents and reviews.
14. Safety evaluations.
15. Detailed work procedures.
16. Readiness reviews.
17. Release criteria.
18. Special problems and solutions (memoranda).
19. Summaries of operating logs.

20. Incident reports.

21. Quality Assurance Documents/Third Party Inspection Reports.

22. Release restrictions.

23. Project final report.

24. Record of Completion.

25. Supporting engineering documents.

11.0 DECOMMISSIONING CRITERIA

An integrated neutron and gamma radiation profile of the tank shall be no greater than 0.3 percent of the initial integrated profile.

The accessible outer surfaces of the tank, caisson, access caisson, and tank seal shall have levels of removable contamination no greater than initial levels as measured at the beginning of the decommissioning activity.

After the concrete pad is removed and the access pit is sealed, radiation surveys above the center of the tank and within a radius of 10 feet shall not exceed background levels.

12.0 APPLICABLE REGULATIONS, STANDARDS, AND CODES

This section is a list of federal, state, DOE-RL, and WHC documents that control the planning, engineering, management, and execution of this decommissioning task.

12.1 FEDERAL REGULATIONS

Resource Conservation and Recovery Act (RCRA; Solid Waste Disposal Act), as amended, 42 U.S.C. 6901 et seq.

National Environmental Policy Act, as amended, 42 U.S.C. 4321 et seq.

General Environmental Protection Program, DOE Order 5400.1.

Hazardous and Radioactive Mixed Waste Program, DOE Order 5400.3.

National Environmental Policy Act, DOE Order 5440.1C.

Environment, Safety, and Health Program for Department of Energy Operations, DOE Order 5480.1B.

Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes, DOE Order 5480.3.

Environmental Protection, Safety, and Health Protection Standards, DOE Order 5480.4.

Safety of Nuclear Facilities, DOE Order 5480.5.

Contractor Industrial Hygiene Program, DOE Order 5480.10.

Radiation Protection for Occupational Workers, DOE Order 5480.11.

Safety Analysis and Review System, DOE Order 5481.1B.

Occupational Safety and Health Program for DOE Contractor Employees at Government-Owned Contractor-Operated Facilities, DOE Order 5483.1A.

Quality Assurance, DOE Order 5700.6B.

Radioactive Waste Management, DOE Order 5820.2A.

General Design Criteria, DOE Order 6430.1A.

12.2 STATE REGULATIONS

Dangerous Waste Regulations, Chapter 173-303 WAC.

General Health and Safety Standards (WISHA), Chapter 296-24 WAC.

12.3 DOE-RL REQUIREMENTS

Implementation of the National Environmental Policy Act at the Richland Operations Office, DOE Order RL 5440.1A.

Environment, Safety, and Health Program for Department of Energy Operations for Richland Operations, DOE Order RL 5480.1A.

Environmental Protection, Safety, and Health Protection Standards for RL, DOE Order RL 5480.4A.

Safety of Nuclear Facilities, DOE Order RL 5480.5.

Industrial Hygiene Program, DOE Order RL 5480.10A.

Requirements for Radiation Protection, DOE Order RL 5480.11A.

Safety Analysis and Review System, DOE Order RL 5481.1.

Occupational Safety and Health Program for DOE Contractor Employees at Government-Owned Contractor-Operated (GOCO) Facilities, DOE Order RL 5483.1B.

Quality Assurance, DOE Order RL 5700.1A.

12.4 WHC REQUIREMENTS

Management Requirements and Procedures, WHC-CM-1-3.

Management Control System, WHC-CM-2-5.

Cost Accounting, WHC-CM-2-10.

Hazardous Material Packaging and Shipping, WHC-CM-2-14.

Records Management, WHC-CM-3-5.

Quality Assurance, WHC-CM-4-2.

Industrial Safety, Vols. 1-3, WHC-CM-4-3.

Radiological Design, WHC-CM-4-9.

Radiation Protection, WHC-CM-4-10.

ALARA Program, WHC-CM-4-11.

Operational Health Physics Practices, WHC-CM-4-12.

Operational Health Physics Procedures, WHC-CM-4-13.

Radiation Work Requirements & Permits, WHC-CM-4-15.

Nuclear Criticality Safety, WHC-CM-4-29.

Nuclear Safety, WHC-CM-4-30.

Nonreactor Facility Safety Analysis, WHC-CM-4-46.

Hazardous Waste Management, WHC-CM-5-16.

Standard Engineering Practices, WHC-CM-6-1.

Drafting Standards, WHC-CM-6-3.

Hanford Hoisting & Rigging, WHC-CM-6-4.

Decontamination and Decommissioning Readiness Review, WHC-CM-6-6.

Environmental Restoration Quality Assurance Program Plan, WHC-CM-6-7.

Welding Procedures, WHC-CM-6-26.

Operational Environmental Monitoring, WHC-CM-7-4.

Environmental Compliance, WHC-CM-7-5.

Environmental Investigations and Site Characterization, WHC-CM-7-7.

200 Area Support Services, WHC-CM-8-2.

Operations Support Services, WHC-CM-8-7.

Job Control System, WHC-CM-8-8.

Hanford Radioactive Solid Waste Packaging, Storage, and Disposal Requirements, WHC-EP-0063.

13.0 SPECIAL TECHNICAL/DATA COLLECTION ACTIVITIES

The condition of the tank vessel and characteristics of the sludge will be evaluated and documented. This documentation will become the basis for the design of equipment used to remove the sludge layer. Tank vessel characterization will be accomplished through a combination of visual inspection and non destructive evaluation techniques. The sludge will be evaluated through radiochemical analyses.

14.0 REFERENCES

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WHC, 1988c, *Hazardous Materials Packaging and Shipping*, WA, WHC-CM-2-14, Westinghouse Hanford Company, Richland, WA.

WHC, 1988d, *Management Requirements and Procedures*, WHC-CM-1-3, Westinghouse Hanford Company, Richland, WA.

WHC, 1988e, *Nuclear Facility Safety Nuclear Criticality Safety Manual*, WHC-CM-4-29, Westinghouse Hanford Company, Richland, WA.

WHC, 1988f, *Operational Health Physics Practices Manual*, WHC-CM-4-12, Westinghouse Hanford Company, Richland, WA.

WHC, 1988g, *Radiation Protection Manual*, WHC-CM-4-10, Westinghouse Hanford Company, Richland, WA.

WHC, 1989, *ALARA Program Manual*, WHC-CM-4-11, Westinghouse Hanford Company, Richland, WA.

WHCa, *Decontamination and Decommissioning Operating Procedures*, Westinghouse Hanford Company, Richland, WA.

WHCb, *Decontamination and Decommissioning Work Plans*, Westinghouse Hanford Company, Richland, WA.

15.0 APPENDIX - DRAWINGS