

FACILITY DISPOSITION PLANNING UNDER DOE ORDER 430.1A

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ABSTRACT

This paper documents the development of recent facility dispositions at the Savannah River Site in accordance with DOE Order 430.1A "Life Cycle Asset Management". The disposition planning of two facilities, the Vendor Treatment Facility (VTF) and R-Reactor are reported in the following pages. The VTF was a subcontractor operated facility for the vitrification of mixed waste sludges that ended its contractual obligations in December 1998. R-Reactor was one of 5 isotope-producing reactors that have been shut down since 1964.

The largest environmental remediation project in the world is the cleanup of the waste left after 50 years of the U.S. production of nuclear weapons. The Department of Energy (DOE) has 15,000 facilities from nuclear reactors to laundry processes of which 7,000 are surplus and contaminated. The categorical breakdown of some types of EM-40 surplus facilities shows:

Nuclear Reactors	25
Fuel Enrichment	8
Pu and U Production	
Manufacture and Assembly	8
Laboratories	29
Support Facilities	1,000

This legacy has a price tag for EM-40 facilities of \$21 billion for decommissioning, \$13 billion for surveillance and Maintenance (S&M), and \$8 billion for nuclear stabilization. There is no estimate for facilities which are operating or not in EM.

One of the DOE Sites where cleanup is taking place is the Savannah River Site (SRS) which was established in 1950 to produce special radioactive isotopes for national security purposes. In 1989, the SRS Environmental Program (EM) was established and currently has on-going activities under 3 program areas (i.e., Nuclear Materials and Facility Stabilization; Environmental Restoration; and Waste Management). The final milestone for the Facility Stabilization Program is to deactivate all surplus facilities by 2026. A considerable amount of effort will be expended to deactivate the 5 surplus reactors, 2 surplus canyons and many surplus support facilities at SRS between now and 2015.

The SRS Facility Decommissioning Division (FDD) has developed an Administrative Manual that incorporates the requirements of this order and the technical standard DOE-STD-1120-98, "Integration of Safety and Health into Facility Disposition Activities" into procedures that govern the transition, S&M and deactivation of surplus facilities at SRS. Facilities that have gone through transition in accordance with this FDD Administrative Manual and therefore the new DOE guidelines, is the subject of this paper.

This paper documents the development of recent facility dispositions at the Savannah River Site in accordance with the DOE Order 430.1A “Life Cycle Asset Management” (Ref. 1). This new Order applies to all physical assets at Department of Energy (DOE) sites. The disposition planning of two facilities, the Vendor Treatment Facility (VTF) and R-Reactor are reported in the following pages. The VTF was a subcontractor operated facility for the vitrification of mixed waste sludges that ended its contractual obligations in December 1998. R-Reactor was one of 5 isotope producing reactors that has been shut down since 1964.

Background

The largest environmental remediation project in the world is the cleanup of the waste left after 50 years of the U.S. production of nuclear weapons material. The Department of Energy (DOE) has 15,000 facilities from nuclear reactors to laundry processes of which 7,000 are surplus and contaminated (Ref. 2). The categorical breakdown of some types of major EM-40 surplus facilities shows:

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Fuel Enrichment	8
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As the DOE complex transitions from a predominately operational or production configuration to one focused on environmental restoration and remediation, resources and guidance have evolved for disposition of retired legacy facilities. Several events related to the aging of nuclear facilities in the early 1990s prompted the DOE to initiate evaluation and prioritization planning on how to address the monumental task of safely and efficiently dispositioning these buildings, which in many cases still contained significant hazardous material. Many sites developed and implemented their own characterization and surveillance & maintenance (S&M) processes to ensure the hazards associated with these buildings were understood and isolated. In 1994, EM coordinated a complex wide evaluation of the surplus facilities and developed a prioritization process for future planning and resource allocation (Ref 3).

Most DOE Orders, Standards, and directives were written primarily for operational facilities until 1996. At that time, the development of DOE-STD-1120-98, “Integration of Environment, Safety and Health into Facility Disposition Activities” (Ref. 4) was initiated. The Standard was developed through a collaborative effort of the DOE, the Energy Facilities Contractors Group, Safety Analysis Working Group, and site contractors. This was the first DOE directive to specifically address facility safety just for these retired facilities. In conjunction with the Standard, development of a DOE Order, 430.1A, and a set of Guides, were initiated for managing the assets and project management for dispositioning these facilities. Together, the two directives provide a complete and concise roadmap for all activities and considerations that need to be included in disposition planning and implementation. Site procedures developed at the SRS are the first

documented process to incorporate and invoke the requirements and guidance provided in the DOE directives

Guidance for transitioning these surplus facilities from their present state to the final deactivated condition is provided for under the new DOE Order 430.1A, "Life Cycle Asset management". This DOE order contains a "Contractor Requirements Document" that requires the development of *"a method to ensure that prior to the completion of mission activities, ... actions are implemented to place the facility, systems and materials in stable and known conditions and to ensure hazards are identified and known pending transfer or disposition"*. In addition, *"for facilities that have already completed mission activities and are awaiting transfer or disposition, ensure that actions are taken to eliminate or mitigate hazards and provide adequate protection to workers, the public and the environment"*. These activities are required to be performed in an *"appropriately planned"* manner. The actions that are a part of this plan are:

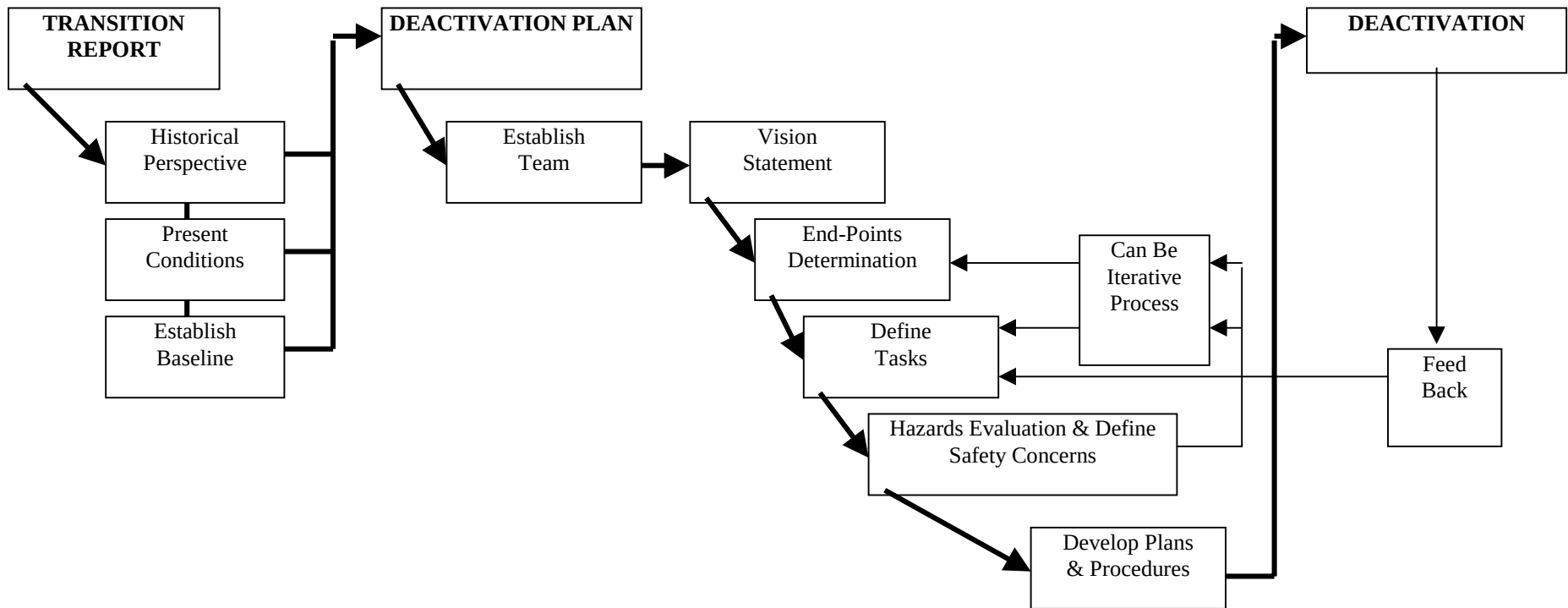
- *"Identifying and characterizing hazardous and radioactive materials and wastes remaining...."*
- *"Assessment and adjustment (if necessary) of the facility authorization basis (AB)...."*
- *"Conduct surveillance and maintenance activities...."*
- *"Identifying and allocating resources needed to maintain stable and known conditions...."*

The SRS Facility Decommissioning Division (FDD) has developed an Administrative Manual that incorporates the requirements of the order and the technical standard DOE-STD-1220-98 into procedures that govern the transition, S&M and deactivation of surplus facilities at SRS. Selected facilities that have gone through disposition planning in accordance with this FDD Administrative Manual and therefore the new DOE guidelines, are detailed below.

The process for facility dispositioning, figure 1, at SRS is to first write a Transition Report (TR). Even though this report is not required by the DOE Order, it is the basis for capturing the present conditions of an excess facility including surrounding areas that influence the dispositioning. A historical perspective is also developed for the facility that provides information about past actions/conditions that will influence the later deactivation and decommissioning work. The more facility operators and past operators that can be interviewed, the more detailed the information that can be included in the report.

Deactivation planning is the next evolutionary step from the TR. It is essential to develop the plan using input from all concerned parties (e.g., facility custodians, future custodians, facility operators, the public, etc.). A review team with representatives from all parties is an effective method to get review, direction and develop a consensus. The next step is to develop a "Vision Statement" of what the facility will look like at the end of deactivation. This is where agreement from all panel members will make the later developmental steps go smoothly. From the Vision Statement will come the End-Points that are the details of how each system, room and building will appear after deactivation is complete. Next a set of tasks can be written that will terminate at the End-Points which were approved by the panel previously. The tasks can now be evaluated for hazards to the workers, site personnel and the public. An outcome of this hazard's evaluation will be to define safety concerns that determine whether existing/approved documentation covers the task

Figure 1
FACILITY DISPOSITIONING



work or whether additional paperwork is needed. Task descriptions can also be used to determine how work activities need to be sequenced and which ones can be performed coincidentally. With the tasks defined and sequenced it can be determined what existing work procedures are applicable and which ones need to be developed. The more detailed the information in the Deactivation Plan the more efficiently the actual deactivation task work will flow. For example, documenting up to date information on services and utilities supplied to the facility will make the task for isolation an easy evolution. During the actual deactivation, there is feedback to the plan that may lead to redefinition of the planned tasks.

Facilities Dispositioning

The VTF is a subcontractor operated mixed waste vitrification facility located at the SRS. Deactivation planning has been initiated, which will leave the facility in a cold, dark and dry environment, with on-going S&M, while awaiting final disposition. The subcontractor competitively won a contract to design, build and operate a vitrification facility, figure 2, that would vitrify about 680,000 gallons of mixed waste sludge left over from the waste water treatment of nickel plating line solution. Depleted uranium (DU) slugs were plated with nickel before being used as target material for the production of isotopes in the reactors. The mixed waste sludge, from the treatment of this process waste, is an F006 listed hazardous waste because of the nickel concentrations (about 30 ppm) but also a radioactive waste because of low level radioactivity (DU). Tests showed that the VTF vitrification process would not only allow the waste glass to pass the Toxic Characteristic Leaching Procedure (TCLP) for hazardous materials but also reduce the waste volume by 75%.

An SRS facility known as the Interim Treatment and Storage Facility (IT/SF), which initially housed the waste sludge, was operationally turned over to the subcontractor as a part of the VTF. The building contains 6 - 35,000 gallon bullet tanks, with associated piping and pumps, and external to the building is another 6 tanks each with a 500,000 gallon capacity. Only 3 of the larger external tanks were used for the VTF operations. Three tanks were never used after initial construction. The IT/SF was used in conjunction with a vitrification facility that housed the melter and support systems.

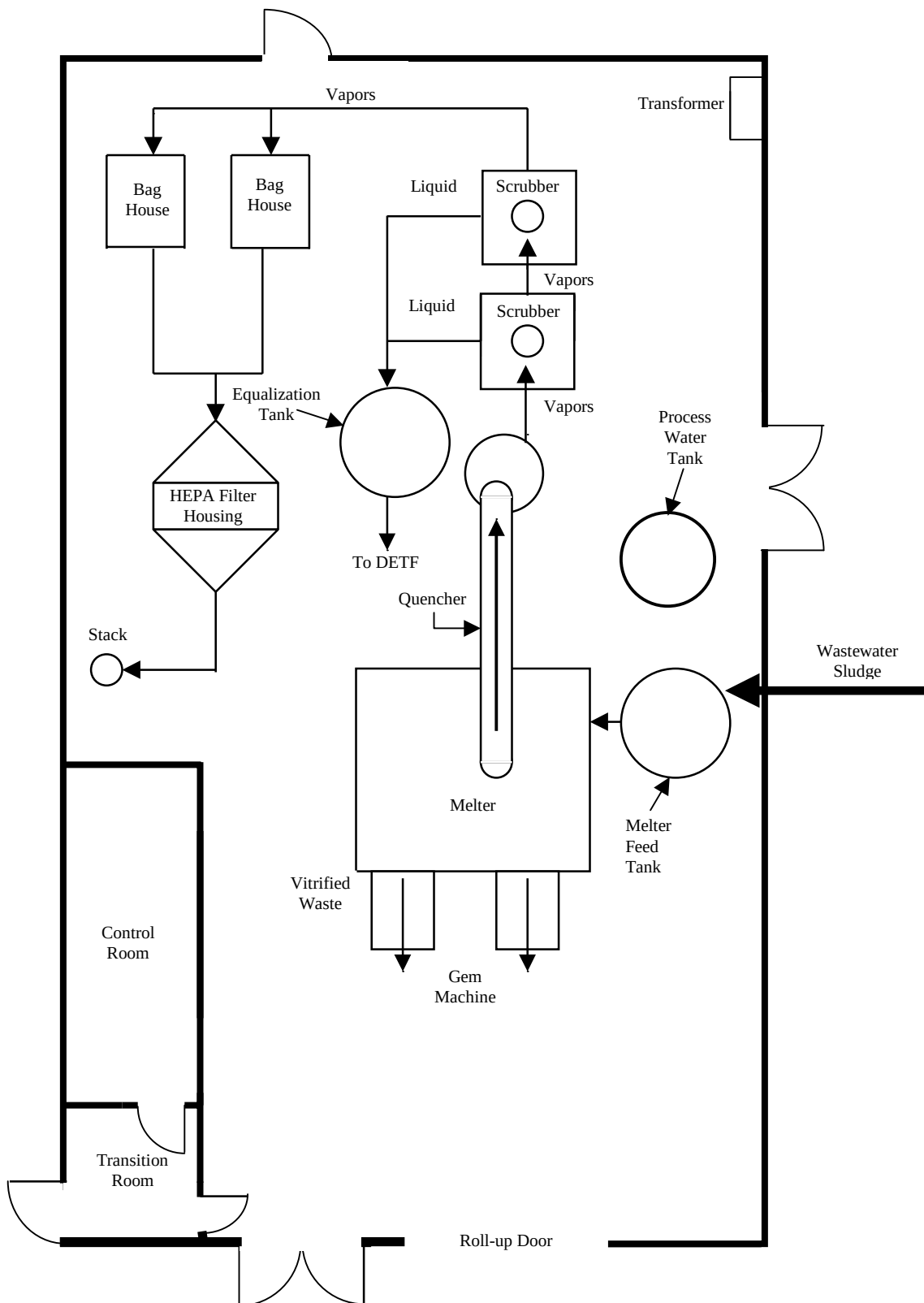
The initial phase of the VTF disposition planning was the development of a VTF Transition Report (VTF TR). Procedure 2.01 "Transition Report" of manual WSRC-C 2.1 was the basis for the development and writing of the VTF TR. This procedure was written to comply with DOE Order 430.1A and incorporate guidance from DOE-STD-1120.

The VTF Hazardous Baseline Documents (HBD) were reviewed and summarized, and it was determined that the facility classification of "Radiological Facility" could be reduced to "Other Industrial Use" categorization when all waste inventories were vitrified and placed in RCRA permitted storage. A Hazardous Assessment Document Determination (HADD) would be the vehicle for this reclassification. This effort would complete the "assessment and adjustment of the facility AB" phase.

The waste streams that were treated in the VTF have been fully identified and characterized since tests had been performed, not only to show proof of principal, but also to verify the final vitrified product would pass the Toxic Characteristic Leaching Procedure (TCLP) for listed wastes. The VTF subcontractor was required, by contract at the end of operations, to flush all systems until they were free of F006 waste. This included the IT/SF Storage Tanks and transfer system. The following photographs show the tank sludge removal activities and the clean tank surface at the end of flushing.

To meet the requirements for a "appropriate plan" to deactivate VTF, a Deactivation Plan was written in accordance with FD 3.01 "Deactivation Project Plan" also in manual WSRC-C 2.1. As an initial step in plan development, a hazard's evaluation was performed around each sequence of steps that would take the VTF from operation to long term shutdown. Attachment 1 is a copy of that sequence in chart format. The end-points determination provided the final stage in each sequence of steps at which the deactivation activities would stop. All of this planning/evaluation was captured in a summary document that became the heart of the VTF Deactivation Plan. This Deactivation Performance Table, Attachment 1, provided the deactivation task scope of work; the end points/limits of the scope; the results of the hazards evaluation for that work scope; the physical

Figure 2
Vitrification Facility



boundaries of the task; applicable procedures to be followed; and schedule and cost for the activity. The format allowed any person to easily comprehend the work scope, risk of performance and the schedule to complete.

The hazard's evaluation was also placed in a table format that allowed for easy reference on a deactivation task by task basis. Attachment 2 is an excerpt from the hazard's evaluation table from VTF deactivation. These two tables combined with drawings that highlighted areas where contamination was found as well as showing systems to be flushed, provided the basis for execution of the deactivation plan.

R-Reactor began operation in the early 1950s for production of nuclear materials and subsequently retired in 1964 due to reduced requirements for defense related products. It was defueled and all fissile components and materials were removed. The facilities, although aging, are stable, contain minimal hazards to personnel, have no regularly scheduled activities other than they are routinely entered only twice a month for observations of sump/basin levels and radiation control monitoring. The R-Reactor facility has no capability of restart and minimal landlord responsibilities. The current mission is temporary storage of bulk UO_3 in the Assembly Area. The only required operable equipment in R-Area are lighting panels, two – 40 level pumps in the 216 sumps, and two 108 Building sump pumps. All other systems have been shut down, drained, de-energized, vented, and isolated. Figure 3 is provided to show the general building layout and condition.

R-Reactor was, for all practical purposes, abandoned for many years with very minimal surveillance and maintenance. Entries into the facility were conducted usually only during a "need" to cannibalize equipment for use in the other operating reactor areas. Facility specific engineers and operators were dispersed to other areas and most have since retired or moved away. In 1993 a dedicated effort was initiated to assess the condition of the reactor facility and conduct a detailed characterization, in preparation for transition from DOE Defense Programs to Environmental Management. In preparation for disposition activities, extensive characterization of R-Area radiological, chemical, and industrial hazards was performed in 1994. Although aging and having minimal maintenance since 1964, the facility was determined to be in good structural condition with hazardous substances of concern only in limited areas such as the reactor process system and disassembly basin.

Although the actual risk for dispersible hazardous material is very low, the Facility Hazard Category, DOE-STD-1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports, was assessed to be a Category 2 Nuclear facility, due to stored drums of tritiated moderator. All tritiated moderator has been removed. In addition, prior characterization of the facility disassembly basin, all irradiated fuel and targets have been removed, had indicated Nuclear Category 3 quantities of transuranics and tritium in the water and sludge at the bottom of the basin. A more complete and defined characterization has indicated that the facility now contains less than nuclear quantities of radio-nuclides and therefore can be reclassified as a Radiological facility.

Preparation of a Transition Report, meeting the new DOE directives, was completed in 1998. This report documents the history, hazards, current condition, and issues that may impact future dispositioning. One of the legacies of dealing with surplus facilities that have been shutdown and essentially abandoned for decades is the location of documents and information required for the Transition Report that is essential for future deactivation and decommissioning planning. Location of archives, including as built drawings, hazardous material inventory data, and prior event or incident reports which could impact disposition planning was a challenge. Much of the key information in development of the report came from interviews with past operators and landlords of the facility.

The Transition Report provides the basis for deactivation planning, usually the next phase of facility disposition. The deactivation plans will be developed using the hazardous material characterization data, the structures, systems, and components, and facility condition evaluation and the drawings and photographs provided in the Transition Report. Of primary importance in preparation of this report was the detailed characterization performed in 1994. Without this information the status of the facility and hazards would have not been adequate to proceed directly into deactivation and/or decommissioning.

REFERENCES

1. Life-Cycle Asset Management. DOE Order O 430.1A, U.S. Department of Energy, Washington, DC, November 14, 1998.
2. 1996 Baseline Environmental Management Report Contents. U.S. Department of Energy, Washington, DC, 1996.
3. Accelerating Cleanup: Paths to Closure. Savannah River Operations Office, U.S. Department of Energy Savannah River, February 1998.
4. Integration of Environment, Safety, and Health into Facility Disposition Activities. DOE-STD-1120-98, Volume 1 of 2: Technical Standard, U.S. Department of Energy, Washington, DC, May 1998.



ATTACHMENT 1

DEACTIVATION PERFORMANCE TABLE

Deactivation Scope	End Point/Limits	Hazard Evaluation	Physical Boundaries	Procedure	Schedule	Cost
Building 341-1M						
Task 1 Flush Tank 10 and Transfer Lines	Clean Closure per Subcontract- <u>M-Area Sludge Stabilization And RCRA Clean Closure Service</u> , X-SPP-M-00001, Rev. 10	Evaluation 1- Hazards Mitigated per subcontractor HASP, (PI-VTF-0300) and RPP, (PI-VTF-0400)	See Drawing Sheet 1 SRM-X-I-003	RWP & WCP Process as directed in subcontractor Procedures RPP, PI-VTF-0400 & Conduct of Operations, PI-VTF-0800	Completed	Covered by Existing Subcontract
Task 2 Flush Tank 7 and Transfer Lines	Clean Closure per Subcontract- <u>M-Area Sludge Stabilization And RCRA Clean Closure Service</u> , X-SPP-M-00001, Rev. 10	Evaluation 1- Hazards Mitigated per subcontractor HASP, (PI-VTF-0300) and RPP, (PI-VTF-0400).	See Drawing Sheet 1 SRM-X-I-003 In Appendix C See highlighted layout drawing in Appendix C	RWP & WCP Process as directed in subcontractor Procedures RPP, PI-VTF-0400 & Conduct of Operations, PI-VTF-0800	Complete by 12/1/98	Covered by Existing Subcontract

Deactivation Scope	End Point/Limits	Hazard Evaluation	Physical Boundaries	Procedure	Schedule	Cost
Building 341-1M						
Task 3 Flush Tank 8 and Transfer Lines	Clean Closure per Subcontract- <u>M-Area Sludge Stabilization And RCRA Clean Closure Service</u> , X-SPP-M-00001, Rev. 10	Evaluation 1- Hazards Mitigated per subcontractor HASP, (PI-VTF-0300) and RPP, (PI-VTF-0400)	See Drawing Sheet 1 SRM-X-I-003 In Appendix C See highlighted layout drawing in Appendix C	RWP & WCP Process as directed in subcontractor Procedures RPP, PI-VTF-0400 & Conduct of Operations, PI-VTF-0800	Complete by 12/1/98	Covered by Existing Subcontract
Task 4 Flush Tank 1 and Transfer Lines Including Drummed Waste Addition System	Clean Closure per Subcontract- <u>M-Area Sludge Stabilization And RCRA Clean Closure Service</u> , X-SPP-M-00001, Rev. 10	Evaluation 2- Hazards Mitigated per subcontractor HASP, (PI-VTF-0300) and RPP, (PI-VTF-0400)	See Drawing Sheet 1 SRM-X-I-003 In Appendix C See highlighted layout drawing in Appendix C	RWP & WCP Process as directed in subcontractor Procedures RPP, PI-VTF-0400 & Conduct of Operations, PI-VTF-0800	Complete by 12/1/98	Covered by Existing subcontract

Deactivation Scope	End Point/Limits	Hazard Evaluation	Physical Boundaries	Procedure	Schedule	Cost
Building 341-1M						
Task 5 Flush Tank 2 and Transfer Lines	Clean Closure per Subcontract- <u>M-Area Sludge Stabilization And RCRA Clean Closure Service</u> , X-SPP-M-00001, Rev. 10	Evaluation 2- Hazards Mitigated per subcontractor HASP, (PI-VTF-0300) and RPP, (PI-VTF-0400)	See Drawing Sheet 1 SRM-X-I-003 In Appendix C See highlighted layout drawing in Appendix C	RWP & WCP Process as directed in subcontractor Procedures RPP, PI-VTF-0400 & Conduct of Operations, PI-VTF-0800	Complete by 12/1/98	Covered by Existing Subcontract
Task 6 Flush Tank 3 and Transfer Lines	Clean Closure per Subcontract- <u>M-Area Sludge Stabilization And RCRA Clean Closure Service</u> , X-SPP-M-00001, Rev. 10	Evaluation 2- Hazards Mitigated per subcontractor HASP, (PI-VTF-0300) and RPP, (PI-VTF-0400)	See Drawing Sheet 1 SRM-X-I-003 In Appendix C See highlighted layout drawing in Appendix C	RWP & WCP Process as directed in subcontractor Procedures RPP, PI-VTF-0400 & Conduct of Operations, PI-VTF-0800	Complete by 12/1/98	Covered by Existing Subcontract

ATTACHMENT 2 HAZARDS EVALUATION

Evaluation 1: Flush and clean Tanks 7 and 8.

Flushing and cleaning Tanks 7 and 8 is a labor-intensive process that involves manned entry into the tanks. Entry into the tanks is through a personnel entryway cut into the tanks with an acetylene torch. The tanks are cleaned by hand held pressure sprayers. The pressure sprayers are used to wash sludge off the tank walls using approximately 1500-psi water. The resultant sludge and water mixture is ultimately pumped to the melter. The final rinse water is sampled and used to flush lines. The following pertinent points should be noted:

- Labor intensive-confined space entry
- When tank reaches a certain level, entry is made
- Monitor and vent before cutting
- A 4'x 8' hole is cut in the side with an acetylene torch.
- There will be an inside platform
- Energy sources are locked out
- Worker PPE includes a full suit and supplied air
- Tank entries require use of "buddy system"
- Sides of tank pressure washed, washer will be inside tank, 1500 psi
- Ladders supplied for washing upper walls
- Air operated diaphragm pump used to vacuum waste.
- Chemical contact and inhalation hazard. Composition of sludge is: aluminum, sodium, nickel, silica, nitrate, depleted uranium. pH is 12-13. Sludge = F006 waste which is 25% solid.
- Flat bottom tank
- Lighting-open 4 hatches at top of tank or bring in portable lights.
- Final rinse water sampled and used to flush lines

Hazard Identification:

Location and Task	Hazard Energy Sources and Materials																																								
	Physiochemical												Chemically Toxic				Biological		Open Flame		Potential		Kinetic																		
	Flammable	Explosive	Corrosive	Reactive	Uncontrolled Chemical Reactions	Combustibles(Combust. Materials)	Oxygen Rich	Oxygen Deficient	Pyrophoric (Pu & U Metal)	Pyrophoric (Other)	SC ⁺ (Nitric Acid and Organics)	SC ⁻ (Other)	Other	Inhalation	Ingestion	Contact	Absorption	Carcinogen	Other	Etiologic Agents (Disease)	Wildlife (Snakes, insects, etc.)	Plants (Poison Ivy/Oak)	Other	Burns	Burners	Torches	Pilot Lights	Gas Welding	Other	Gas Bottles	Gas Receivers	Pressure Vessels	Steam Headers/Lines	Other	Fans	Pumps	Motors	Rotating Machinery	Other	Non-Facilitv Event (Other)	
Flush and clean Tanks 7 and 8.	X	X					X							X	X	X									X	X		X						X	X	X					

Location and Task	Hazard Energy Sources and Materials																																	
	Rad. Matl.				Hazardous Material								Physical								Electrical													
	Radiological Material	Fissile Material	Non-Ionizing Radiation	Other	Alkali Metals	Asphyxiants	Biological	Carcinogens	Oxidizers	Corrosives	Toxics	Other	Noise	Heat	Sever weather	Confined Space Entry	Heavy Lifting	Remote Area	Power Tool Operation	Elevated Work	Truck/Car	Heavy Equipment	Crane	Other	Electrical Equipment	Batteries	Generation Equipment	Heaters	High Voltage	Switchgear	Transformers	Underground/in-slab wiring	Wiring	Other
Flush and clean Tanks 7 and 8.	X				X	X					X		X	X	X	X		X	X					X									X	

Primary Hazards:

The primary hazards associated with this Evaluation involve entry into a confined space. Without proper ventilation in the tanks, an oxygen deficient environment may exist. Additionally, significant chemical hazards are present in the form of toxicological hazards associated with the inhalation or ingestion of chemical components found in the sludge and rinse water. Contact hazards from the sludge and rinse water present an additional hazard, though less severe than the aforementioned toxicological hazard. The uranium and other heavy elements in the sludge are chemically toxic and can result in kidney and other vital organ damage if ingested or inhaled. A pH of 12 to 13 is extremely alkaline and will cause damage to unprotected skin and tissue. The tank contents are slightly radioactive and though this hazard represents a lesser threat, radioactive precautions should still be considered when evaluating the protective equipment and monitoring requirements needed for tank entry. Other hazards that are present during parts of this Evaluation include the flammable gases and thermal hazards associated with the tank cut, ladder work in the tank (slip/fall hazard) and heat stress that may accompany work in the tank.

Potential Consequences: Public: none identified

Onsite 2: none identified

Onsite 1: (1) Fatality from oxygen deficient atmosphere in tank. (2) Serious injury is possible from direct contact, inhalation, or ingestion of tank contents. (3) External and internal contamination from unprotected contact with tank contents. (4) Sprains and strains are possible from slips or falls. (5) Heat stress.

Monitoring Required

- (1) Tank atmosphere should be checked for explosive flammable gases prior to cutting the tank wall with an acetylene torch.
- (2) Heat stress monitoring for workers in the tank.
- (3) Tank atmosphere prior to and periodically during tank entries.
- (4) Radiation monitoring of workers in contamination area (i.e., tanks)

Personnel Protective Equipment

- (1) Forced air fed plastic suits with vortex tubes or other cooling methods as appropriate.
- (2) Other radiological and chemical protective clothing and equipment as specified in RWP and WCP.

Personnel Protective Programs

The requirements of 8Q, "Worker Safety," shall be strictly followed during the performance of this evaluation. The requirements of 5Q, "Radiation Protection Manual", shall be strictly followed during the performance of this evaluation.