INFORMATION CLEARANCE FORM

S

Date Received for Clearance Process (MM/DD/YY) 02/01/06 ~~11/17/05~~ [handwritten initials]

A. Information Category

- ☐ Abstract
- ☐ Summary
- ☐ Visual Aid
- ☒ Full Paper
- ☐ Other ______
- ☐ Journal Article
- ☐ Internet
- ☐ Software
- ☐ Report

B. Document Number DOE-0315-FP Rev 0

C. Title
THE DEACTIVATION, DECONTAMINATION AND DECOMMISIONING OF THE PLUTONIUM FINISHING PLANT, A FORMER PLUTONIUM PROCESSING FACILITY AT DOE'S HANFORD SITE

D. Internet Address

E. Required Information

1. Is document potentially Classified? ◉ No ○ Yes (MANDATORY)

   (See Blk. H)
   Manager Required (Print and Sign)

   If Yes ______ ○ No ○ Yes Classified
   ADC Required (Print and Sign)

2. Export Controlled Information ◉ No ○ Yes

3. Does Information Contain the Following: (MANDATORY)
   a. New or Novel (Patentable) Subject Matter? ◉ No ○ Yes
      If "Yes", Disclosure No.: ______
   b. Information Received in Confidence, Such as Proprietary and/or Inventions?
      ◉ No ○ Yes If "Yes", Affix Appropriate Legends/Notices.
   c. Copyrights? ◉ No ○ Yes If "Yes", Attach Permission.
   d. Trademarks? ◉ No ○ Yes If "Yes", Identify in Document.

4. Is Information requiring submission to OSTI? ◉ No ○ Yes

5. Release Level? ◉ Public ○ Limited

F. Complete for a Journal Article

1. Title of Journal

G. Complete for a Presentation

1. Title for Conference or Meeting WASTE MANAGEMENT 2006 Conference Topic R1.11: Cleanup and Waste Disposal& Facilities Closure Program by Hanford's US DOE RL
2. Group Sponsoring WM SYMPOSIA, INC
3. Date of Conference 02/26-03/2/2006
4. City/State TUCSON, AZ
5. Will Information be Published in Proceedings? ○ No ◉ Yes
6. Will Material be Handed Out? ◉ No ○ Yes

H. ~~Author/~~Requestor
Elizabeth Bowers [signature]
(Print and Sign)

Responsible Manager
Albert Hawkins [signature]
(Print and Sign)

Approval by Direct Report to FH President (Speech/Articles Only) NA
(Print and Sign)

I. Reviewers

	Yes	Print	Signature	Public Y/N (If N, complete J)
General Counsel	☒	Edward Hiskes, DOE-RL	[signature]	(Y) / N
Office of External Affairs	☒	Albert Hawkins, DOE-RL	[signature]	(Y) / N
DOE-RL	☒	Albert Hawkins	[signature]	(Y) / N
Other	☒	Glenn Goldberg	[signature]	(Y) / N
Other	☒	J. D. Aardal	[signature]	(Y) / N

J. If Information Includes Sensitive Information and is not to be released to the Public indicate category below.

- ☐ Applied Technology
- ☐ Export Controlled
- ☐ UCNI
- ☐ Official Use Only
- ☐ Other (Specify) ______

Information Clearance Approval

APPROVED FOR RELEASE — OFFICIAL DOCUMENT — [initials] — Date 02/01/2006

K. If Additional Comments, Please Attach Separate Sheet

DOE-0315-FP
Revision 0

The Deactivation, Decontamination and Decommissioning of the Plutonium Finishing Plant, a Former Plutonium Processing Facility at DOE's Hanford Site

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

DOE-0315-FP
Revision 0

The Deactivation, Decontamination and Decommissioning of the Plutonium Finishing Plant, a Former Plutonium Processing Facility at DOE's Hanford Site

S. L. Charboneau
Department of Energy - Richland Operations Office

D. B. Klos
R. E. Heineman, Jr.
A. M. Hopkins
Fluor Hanford

Date Published
February 2006

To Be Presented at
Waste Management 2006

Waste Management Symposia, Inc.
Tucson, Arizona

February 26-March 2, 2006

Published in
Waste Managment 2006 Symposium Proceedings

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

**United States
Department of Energy**
**P.O. Box 550
Richland, Washington 99352**

Approved for Public Release;
Further Dissemination Unlimited

Release Approval — 02/01/2006
Date

DOE-0315-FP
Revision 0

Printed in the United States of America

WM'06 Conference, February 26-March 2, 2006, Tucson, AZ

The Deactivation, Decontamination and Decommissioning of the Plutonium Finishing Plant, a Former Plutonium Processing Facility at DOE's Hanford Site

Stacy Charboneau
U.S. Department of Energy, Richland Operations Office
825 Jadwin Avenue, Richland, WA 99352

Bruce Klos, Robert Heineman, and Andrea Hopkins
Fluor Hanford
P.O. Box 1000, Richland, WA 99352

ABSTRACT

The Plutonium Finishing Plant (PFP) was constructed as part of the Manhattan Project during World War II. The Manhattan Project was developed to usher in the use of nuclear weapons to end the war. The primary mission of the PFP was to provide plutonium used as special nuclear material (SNM) for fabrication of nuclear devices for the war effort. Subsequent to the end of World War II, the PFP's mission expanded to support the Cold War effort through plutonium production during the nuclear arms race and later the processing of fuel grade mixed plutonium-uranium oxide to support DOE's breeder reactor program.

In October 1990, at the close of the production mission for PFP, a shutdown order was prepared by the Department of Energy (DOE) in Washington DC and issued to the Richland DOE field office. Subsequent to the shutdown order, a team from the Defense Nuclear Facilities Safety Board (DNFSB) analyzed the hazards at PFP associated with the continued storage of certain forms of plutonium solutions and solids. The assessment identified many discrete actions that were required to stabilize the different plutonium forms into stable form and repackage the material in high integrity containers. These actions were technically complicated and completed as part of the PFP nuclear material stabilization project between 1996 and early 2005. The completion of the stabilization project was a necessary first step in deactivating PFP.

During stabilization, DOE entered into negotiations with the U.S. Environmental Protection Agency (EPA) and the State of Washington and established milestones for the Deactivation and Decommissioning (D&D) of the PFP.

The DOE and its contractor, Fluor Hanford (Fluor), have made great progress in deactivating, decontaminating and decommissioning the PFP at the Hanford Site as detailed in this paper.

Background information covering the PFP D&D effort includes descriptions of negotiations with the State of Washington concerning consent-order milestones, milestones completed to date, and the vision of bringing PFP to slab-on-grade. Innovative approaches in planning and regulatory strategies, as well new technologies from within the United States and from other countries and field decontamination techniques developed by workforce personnel, such as the "turkey roaster" and the "lazy Susan" are covered in detail in the paper. Critical information on issues and opportunities during the performance of the work such as concerns regarding the handling and

storage of special nuclear material, concerns regarding criticality safety and the impact of SNM de-inventory at PFP are also provided.

The continued success of the PFP D&D effort is due to the detailed, yet flexible, approach to planning that applied innovative techniques and tools, involved a team of experienced independent reviewers, and incorporated previous lessons learned at the Hanford site, Rocky Flats, and commercial nuclear D&D projects. Multi-disciplined worker involvement in the planning and the execution of the work has produced a committed workforce that has developed innovative techniques, resulting in safer and more efficient work evolutions.

INTRODUCTION

Operations at the Plutonium Finishing Plant (PFP) on the Hanford site in eastern Washington began in 1949. The PFP operations gave Hanford and the Manhattan Project the capability to make plutonium metal "buttons" for safer shipping of plutonium to weapons fabrications sites elsewhere in the United States. The plant performed a variety of complicated chemical processing steps in the purification of plutonium solutions generated in Hanford's reprocessing plants by dissolution of spent reactor fuel rods to recover plutonium. The first full-scale, remote mechanical fabrication lines at PFP were built in the 1950s. The construction of a new Plutonium Reclamation Facility (PRF) was completed in 1964 and provided the capability to recover plutonium scrap to could be recycled into PFP's final product, plutonium metal "buttons."

The PFP served for over fifty years as a cornerstone provider of plutonium feed stocks to the United States nuclear weapons defense complex. An inventory of nuclear material remains at the plant along with a variety of residue forms adhering to the inside of process equipment, piping, and process enclosures.

In 1990, the weapons production mission ended at Hanford and the new Hanford mission centered on the stabilization of the plutonium inventory, that is, materials that had not been completely processed to a stabilized end point. Some of these residuals were in liquid form which was problematic from a criticality safety perspective. By 2004, 18 metric tons of leftover plutonium material had been stabilized and packaged for shipment from the Hanford site.

PFP is now undergoing Deactivation and Decommissioning (D&D) in order to close the PFP Plant. This closure scope includes the D&D of 63 buildings located on 15 acres. Residual plutonium remained in thousands of feet of process equipment, drain lines and underground tanks, and waste sites. The PFP mission includes dispositioning the large inventory of Special Nuclear Material which was stabilized and packaged in DOE Standard 3013 containers, high integrity containers designed for up to 50 year storage. The mission also includes the stabilization and packaging of residue plutonium materials as transuranic waste. Approximately 1800 drums of transuranic waste have already been shipped to the Waste Isolation Pilot Plant in New Mexico.

The current progress for closure of PFP was made possible through several key processes: conducting negotiations with the State of Washington and the US EPA for milestones with the vision of bringing PFP to slab-on-grade, innovative approaches in D&D planning and regulatory strategies, new technologies for D&D, and new techniques developed by workforce personnel. Challenges to overcome include handling and storage of special nuclear material while conducting D&D operations, concerns regarding criticality while handling fissile materials and working around the impact of delayed SNM de-inventory at PFP.

PFP CLOSURE PLANNING - THE CASE FOR ACCELERATED CLOSURE

The scope of the PFP deactivation and decommissioning project includes cleanout and removal of all 63 above-grade structures and related infrastructure to clean, slab-on-grade throughout the 15 acre complex, and stabilizing all below-grade areas pending NEPA and CERCLA decisions on the final end state and remedial actions required across Hanford's central plateau. Significant challenges are associated with cleanup of any plutonium processing and handling facility. Decommissioning of PFP is considered particularly complex and hazardous. Key characteristics of the plant at the outset of D&D included:

- More than 200 contamination events, 2 explosions and an inadvertent criticality over 50 years of operation
- 18 metric tons of special nuclear material to be stabilized and packaged for storage or disposal
- 23,226 square meters of plutonium processing area
- 4 remote process cells and 4 major chemical storage areas
- 231 gloveboxes, hoods and conveyors
- 21 vaults and vault-type rooms
- An estimated inventory of 0.1 metric ton of plutonium remaining in the complex process systems and 0.2 metric tons in below grade waste tanks and sites
- Over 600 plutonium solution storage containers with residuals
- An estimated 60,000 cubic meters of radioactive waste and debris to be dispositioned

Prior to fiscal year 2000, the baseline plan for PFP D&D was structured in four phases: stabilization and packaging of the plutonium inventory (terminal cleanout operations in regulatory terms); facility and process cleanout and deactivation (the "transition" phase); an extended surveillance and maintenance phase awaiting shipment of the plutonium inventory to other DOE sites and PFP's position in the site cleanup funding queue; and a final decommissioning and demolition phase. The plan spanned decades, completing in 2038 at a life cycle cost of $2.6 billion.

By early fiscal year 1999, it was clear that this baseline was no longer viable. It was too costly – with provisions for years of unproductive surveillance and maintenance while awaiting D&D funding and twenty years of escalating costs. The 40 year duration of the cleanup plan was also inconsistent with DOE's then-developing accelerated cleanup objectives. Furthermore, by this time Hanford had completed several pilot projects in accelerated deactivation of major nuclear facilities, including the PUREX and B Plant reprocessing canyons and the UO3 Plant, demonstrating that decommissioning could be completed much more rapidly than originally planned, and at a cost significantly lower than previously projected. The primary benefits of accelerated decommissioning were early elimination of the safety and environmental risks associated with the facilities and the ability to reallocate hundreds of millions of dollars in so-

called "mortgage," or "min-safe" costs to other site cleanup priorities.]The lessons-learned from these early pilot projects have since been institutionalized by the now-defunct DOE National Facilities Deactivation Initiative in various DOE lessons-learned documents and DOE's decommissioning requirements and guidance documents.]Recognition of the value-added by accelerated decommissioning of high-hazard facilities resulted in increasing the funding priority for PFP and other similar D&D projects across the Hanford site.
During the spring and summer of 1999 a large team worked tirelessly to reconstruct the baseline for D&D of PFP from the bottom up. Lessons-learned from the recently completed canyon deactivation projects were applied, including:

- Detailed definition of the project's end points,
- Walkdowns and accumulation of detailed as-is facility information regarding every building and hundreds of individual work spaces,
- Application of "right to left planning," beginning with the project's end points and working backward to the as-is starting condition to assure every planned task was directly related to achieving the desired end point,
- Restructuring the project into multi-disciplined field work teams with clearly defined, long range scopes of work and end points.

Improvements in plutonium stabilization and packaging were also imported from other DOE sites, notably SRS and RFETS, and developed in several onsite process development laboratories. Plans for packaging and shipping the plutonium inventory were accelerated, including disposal of a larger portion of the inventory to WIPP as transuranic waste, and accelerated shipment of product material to SRS. Negotiations with the State of Washington and US EPA regarding the end points for the project were finalized and consent order milestones were established for execution of the new project. The results of the re-planning effort were significant. By applying the lessons-learned from prior projects, applying newly developed approaches for accelerated decommissioning, and investing more heavily in early deactivation and demolition, the scheduled completion date for the project was accelerated by 22 years, from 2038 to 2016, and the life cycle cost was reduced by 50%, from $2.6 billion to $1.3 billion.

Even as these changes were being incorporated into the Hanford Site baseline, significant progress was being made elsewhere in the DOE complex in accelerating decommissioning of high-hazard facilities, notably at Fernald and RFETS. Both DOE and the commercial nuclear decommissioning industries were deploying new technologies and new approaches for cleanout, deactivation and demolition of these facilities. Developments at RFETS, a plutonium weapons production complex, were particularly suitable for application at the PFP. Over the following two years, Fluor Hanford interfaced heavily with other DOE and commercial nuclear decommissioning projects in an effort to further optimize and streamline the PFP decommissioning plan. DOE also pressed its contractors forward to accelerate the cleanup and dismantling of the inactive Environmental Management sites, with an eye to accelerating completion of the overall EM mission from 2070 to 2035, or even 2025 where practicable.

During 2002, the PFP closure planning team, supported by key representatives from other Fluor projects, DOE-RL, industry, consultants and Battelle's Pacific Northwest National Laboratory (PNNL), again revised the PFP decommissioning plan to incorporate more recent lessons-learned and developments, resulting in another 7 year improvement in overall schedule, moving the estimated completion date from 2016 to 2009, and again reducing life cycle costs, this time by more than $300 million, bringing the total project cost from $1.3 billion to under $1 billion. Funding was accelerated to support the project, and the new baseline was put into place in December 2002. Among the breakthroughs incorporated in this phase of re-planning were:

- Additional process developments to accelerate completion of the stabilization and packaging effort by another year
- A second increase in the amount of material that could be treated, packaged and discarded to WIPP as TRU waste versus repackaging as product for shipment to SRS
- Accelerated initiation of decommissioning field work, in parallel with the last year of stabilization and packaging by focusing early work on inactive process areas and facilities
- Accelerated de-inventory shipments of the product material to another DOE site, resulting in reduced security requirements and elimination of the associated costs and impacts on decommissioning
- A streamlined environmental regulatory strategy
- Import of "best practices" in decommissioning from RFETS, Fernald, other Hanford Site decommissioning and demolition projects managed by Fluor and Bechtel Hanford, Inc, as well as applicable approaches employed in the commercial nuclear decommissioning field
- Re-sequencing of the overall work scope to focus on high hazard areas and elimination of the most urgent risks first – primarily focused on reducing the chemical and radiological source terms - providing both a rapid reduction in residual safety and environmental risk and reducing the worker hazards and the cost and productivity impacts of hazard controls on subsequent decommissioning work
- Involving the multi-disciplined field work teams directly in the work planning and the development of safe, innovative and efficient tools and work processes

To assure that the plan had not become overly aggressive, two independent reviews of the new plan were performed prior to implementation in the site baseline. The first was in essence a "peer review" conducted by nearly a dozen project managers with significant experience in decommissioning high-hazard facilities throughout the DOE complex and the commercial nuclear decommissioning industry. Recommendations and modifications proposed by that team were incorporated in the plan prior to initiation of the second, higher level review. The final review was conducted by a group of senior managers, again representing both DOE and commercial nuclear companies and contractors, to review the plan and the risks associated with it from a more strategic level. Again, the results of that review were incorporated in the final plan prior to submittal to RL and incorporation in the site baseline.

MILESTONE NEGOTIATIONS WITH REGULATORY AGENCIES

The Hanford site is subject to the Hanford Federal Facilities Compliance Act and Consent Order (HFFCCO), an order of consent signed by the DOE, the U. S. Environmental Protection Agency, (EPA) and the Washington Department of Ecology (WDOE). Under the HFFCCO, negotiations for transition milestones begin within six months after the issuance of a shutdown order. In the case of the PFP, the Nuclear Materials disposition and stabilization activities were necessary as precursor activities to the D&D "Transition" phase. This situation precipitated a crisis in the negotiations between the agencies, and formal negotiations initiated in 1997 ended in failure.

The negotiations reached impasse on several key regulatory and operational issues. The 1997 negotiation was characterized by a strongly positional style. DOE and the regulatory personnel took hard lines early in the negotiations and were unable to move to resolution of key issues after a year and a half. This resulted in unhappy stakeholders, poor publicity and work delays as well as wounded relationships between DOE and the regulatory community.

In the 2000-2001 PFP negotiations, a completely different approach was suggested by DOE personnel and subsequently initiated: Collaborative or Relational Negotiations. Within 6 months of initiation the relational negotiation style resulted in agreement between the agencies on all key issues. All parties were very pleased with the results and all parties were relieved that protracted negotiations sessions were not needed with the new style of working together collaboratively to serve each other's interests without compromising each party's needs.

Also key in the negotiations for PFP closure was the ability to scope the milestones appropriately so that they were reasonable and achievable. This was made possible because of the detailed planning that had been done for the PFP Closure Project.

To date, 10 of the 18 PFP regulatory milestones have been completed. All have been ahead of schedule. The collaborative atmosphere that was the hallmark of the PFP negotiations has continued as the work of cleaning out PFP progresses through the forum of the Project Manager Meetings which are held monthly to status milestone progress.

PFP REGULATORY STRATEGY FOR D&D

In general, the strategy at PFP is to perform most of deactivation under standard operational procedures, documented through the appropriate *National Environmental Policy Act* (NEPA) process, and complying with waste and air regulations. Additional deactivation and then dismantlement is conducted under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) and documented as a removal action through an Engineering Evaluation/Cost Analysis (EE/CA). Decommissioning includes both deactivation and dismantlement.

Because PFP was on a fast track toward closure, the regulatory scheme of compliance needed to be flexible enough to allow stabilization activities, regular operations and maintenance activities, and deactivation activities, to occur simultaneously. Consequently a regulatory strategy was developed that accommodated the non-CERCLA activities at some areas of PFP while CERCLA activities were accomplished in other areas of PFP. Basically, the strategy allowed for deactivation activities to occur under the appropriate NEPA, air and waste regulations until CERCLA EE/CAs were prepared and resulting action memoranda were put into place. Upon the issuance of an action memorandum, the deactivation activities would then be accomplished under CERCLA through the appropriate implementing documents such as the Removal Action Work Plan. This strategy ensured that work was not schedule constrained while EE/CAs were developed and Action Memoranda were signed by the appropriate agencies. The joint EPA/DOE policy on Decommissioning was key to the PFP strategy.

The PFP regulatory strategy was developed to comply with all applicable environmental laws and regulations and/or compliance agreements during PFP stabilization, deactivation, and eventual dismantlement. Significant environmental drivers for the PFP Nuclear Material Stabilization Project include the Tri-Party Agreement; the *Resource Conservation and Recovery Act of 1976* (RCRA); the *Comprehensive Environmental Response, Compensation and Liability Act of 1980* (CERCLA); the National Environmental Policy Act of 1969 (NEPA); the National Historic Preservation Act (NHPA); the Clean Air Act (CAA), and the Clean Water Act (CWA).

STABILIZATION AND REPACKAGING OF PLUTONIUM BEARING MATERIALS

Plutonium bearing material in various forms such as liquid, powder and scrap metal was located throughout the PFP. A key predecessor activity to the D&D of PFP was the stabilization and management of the plutonium bearing material. Generally speaking, materials containing greater than 30 percent plutonium were stabilized and then packaged to meet the DOE# 3013 standard for long-term storage pending eventual shipment to an offsite storage facility. Materials with less than 30 percent plutonium and less than 20% plutonium in aggregate were stabilized and packaged for disposal to the Waste Isolation Pilot Plant (WIPP) in New Mexico.

The pathway to the WIPP was intended to accommodate several groupings of specific processing residues, and all of the transuranic waste packages that result from demolition of the PFP buildings and their contents. Prior to preparing any residue wastes for disposal to the WIPP, several major activities had to be completed. As detailed a processing history as possible of the material including origin of the waste was researched and documented. A technical basis for termination of safeguards on the material was prepared and approved. These activities involved several organizations including Fluor Hanford, DOE, state representatives and other regulators such as EPA. At PFP, a process has been developed for meeting the many, varied requirements, and has been successfully used to prepare residue waste streams including Rocky Flats incinerator ash, Hanford incinerator ash, and Sand, Slag and Crucible (SS&C) material for disposal. These waste residues were packed into Pipe Overpack Containers (POC) in order to meet security requirement and then shipped to the WIPP.

INNOVATIVE TECHNOLOGIES AND PROJECT EXECUTION TECHNIQUES

Workforce personnel have developed ingenious methods to improve efficiency in glove box cleanout and waste packaging. One is called the "Lazy Susan". The Lazy Susan was developed by the 232-Z incinerator facility personnel. They recommended a turntable be used to place sealed out waste packages in order to perform dose rating and portable Nondestructive Assay (NDA). The operator performing the analyses has a platform that will allow the position of the package to be changed with minimal handling, thereby reducing dose to the fissile material handler. This approach also reduces the risk of breaching plastic layers by abrasion or puncturing from multiple lifting and movements required to obtain adequate dose rates and NDA measurements.

Another invention developed and used by plant forces is called the "keel haul tool". Also used to facilitate NDA measurements, the keel haul tool reduces contamination risks and enhances ALARA practices in the decommissioning of the PFP's open faced hoods. The keel haul tool allows the backside of the baffle plate of the process reflux hoods to be cleaned by pulling a sponge attached to cables over the baffle plate which is otherwise inaccessible.

The "turkey roaster" or rigid port bag is an innovation that proves the mother of invention is necessity. Before the rigid port bag was invented by plant forces, in order to perform glovebox cleanout, each piece of contaminated equipment within the glovebox had to be padded, wrapped, taped and then sealed out of the glovebox into a plastic seal out bag. Sometimes sharp points on the equipment breached the bag despite careful handling. The rigid port bag, which looks somewhat like a turkey roaster, was invented to enable operators to seal out as much as four times the contaminated equipment from gloveboxes per shift as had been achievable with traditional equipment. The device consists of a stainless steel can with handles on each side and a seal out bag that fits around the outer rim. It connects to the glovebox port with a large elastic band similar to a bungee cord. Glovebox cleanout is now quicker and radiation dose is lower. Additionally, plant staff has developed a new comprehensive method to track workers on daily work assignments within the highly contaminated Plutonium Reclamation Facility (PRF). A magnetic board identifies PRF status, canyon entries, cross support and attendance codes. Each worker has an assigned magnet that is placed where he/she is working in the plant. This board is updated daily to reflect current work assignments providing management an instantaneous snapshot of resource allocation and location and is invaluable for possible emergency situations that involve facility evacuations, personnel accountability, and medical emergencies.

Fig. 1. The rigid port bag being used to remove contaminated glovebox equipment.

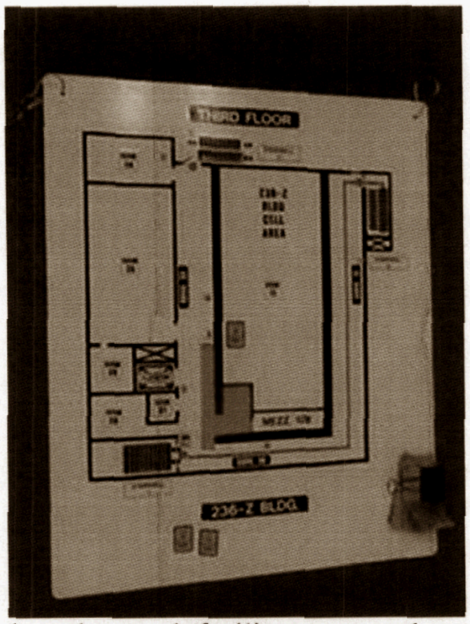

Fig. 2. Magnetic board used to track facility status and workers within the facility.

One of the issues the workers dealt with concerned cleaning out gloveboxes contaminated with transuranic waste to a clean enough state to be considered low level waste. Chemicals evaluated for decontamination of gloveboxes in PFP included cerium (IV) nitrate in a nitric acid solution, and proprietary commercial solutions that include acids and sequestering agents. Aggressive chemicals are commonly used to remove transuranic contaminants from process equipment allowing disposal of the equipment as low level waste. Fluor's decontamination procedure involves application of chemical solutions as a spray on the contaminated surfaces, followed by a wipe-down with rags. Alternatively, a process of applying oxidizing Ce IV ions contained in a gel matrix and vacuuming a dry gel material has been evaluated. These processes effectively transfer the transuranic materials to rags or a gel matrix which is then packaged as TRU waste for disposal.

Fluor investigated plutonium decontamination chemicals as a result of concerns regarding the safety of chemical procedures following a fire at Rocky Flats in 2003. The fire at Rocky Flats occurred in a glovebox that had been treated with cerium nitrate, which is one of the decontamination chemicals that Fluor Hanford had proposed to use. Although the investigation of the fire was not conclusive as to cause, the reviewers noted that rags were found in the glovebox, suggesting that the combination of rags and chemicals may have contributed to the fire. Because of this underlying uncertainty, Fluor began an investigation into the potential for fire from self heating when using the chemicals and materials, using wet disposition and dry disposition of the waste generated in the decontamination process, and the storage conditions to which the waste drum would be exposed.[1, 2] The focus of this work was to develop a disposal strategy that provides a chemically stable waste form at expected Hanford waste storage temperatures. Hanford waste storage conditions are such that heat is added to the containers from ambient conditions during storage especially during the summer months. The result of the studies, the only studies of this kind performed in the DOE complex, determined that the cerium nitrate method used with cotton rags was problematic. A proprietary gel formulation from France has been tested as well and showed promising results.[1]

D&D PROGRESS AT PFP

PFP workers have made great progress in the isolation and deactivation of contaminated equipment and the clean out and removal of chemical systems. Key accomplishments include:

- Completed Legacy Process Holdup removal and disposition on June 30, 2005, 15 months ahead of TPA Milestone. Over seventy percent of the plutonium holdup was removed and dispositioned and the security area within the plutonium processing area of the 234-5Z facility was eliminated.
- Successfully completed the first manned entry into 236-Z, the Plutonium Reclamation Facility (PRF) canyon in 14 years. There have been an additional 8 entries made to date.
- Completed RCRA closure of the LLW HA-20MB glovebox on October 28, 2004 – 17 months ahead of schedule
- Decontaminated forty-four (44) glove-boxes in 234-5Z, the primary plutonium processing facility, to low-level waste criteria, removed chemicals and equipment from twenty-two (22) hoods and gloveboxes in the Standards and Analytical Laboratories and completed decontamination of glovebox 235-B2 (Hanford's first plutonium glovebox) to low level waste criteria
- Completed demolition of ten ancillary facilities 4 ½ months ahead of schedule

In achieving these milestones, PFP accumulated two million safe-hours without a lost work day injury on two separate occasions.

Fig.3. A typical ancillary facility is undergoing demolition.

---

[1] *Safety Studies To Measure Exothermic Reactions Of Spent Plutonium Decontamination Chemicals Using Wet And Dry Decontamination Methods,* A. Hopkins, G.W. Jackson, , M. Minette J. Ewalt, T. Cooper, S. Charboneau , P. Scott, S. Jones, R. Scheele, ICEM, Scotland, September, 2005.

Significant progress has also been made in decontamination and removal of equipment and decontamination of various PFP facilities.

Progress to date includes:

- Completed isolation of 241-Z from Hanford's underground Tank Farms on December 8, 2004, 6 1/2 months ahead of the associated TPA milestone. Completed characterization work for all five of the 241-Z underground cells and initiated removal of waste and TRU tanks and piping.
- Made significant progress in cleanout and deactivation of the 232Z Incinerator facility, including removal of the large process glovebox. The facility will be the first high-hazard nuclear facility at PFP to be demolished late this summer.
- Completed initial entry into the highly contaminated 242-Z Americium extraction facility for characterization of the facility. The facility was sealed after a resin-filled column exploded, spreading contamination throughout this Americium Recovery facility. The facility was sealed following the accident in 1976 and remained sealed for 15 years. PFP workers made entries into the facility during the D&D effort and were able to enhance fire protection of the facility and provide valuable information for the planned decontamination of this highly contaminated facility.
- 13 of 63 buildings have been demolished.

Fig. 4. PFP workers readied to make entry into the 242-Z facility.

CHANGE IN PFP MISSION

Despite the tremendous progress in D&D of the PFP, work has recently been suspended on many of the facilities and others are being brought to a safe shutdown condition. The cessation of D&D work on the facility is being driven by a combination of events, including decreased funding available for site cleanup, increased funding requirements for other Hanford projects and a delay in plans to ship the product plutonium to DOE's Savannah River Site necessitating a longer term plutonium storage mission at Hanford. The PFP baseline is now being re-planned to extend completion from 2009 back to the interim 2016 target, which would support completion of the negotiated TPA milestones. The change in mission for the PFP from closure to longer term SNM storage has resulted in a series of efforts to reassess the status of the PFP facility and the safety envelope under which it operates. While PFP was engaged fully in the D&D effort with a vision toward slab-on-grade, the nuclear safety basis document, the PFP DSA, was designed for the D&D activities and was based in part on the demolition of the entire PFP complex of buildings by 2009. Since PFP will not be slab-on-grade by 2009, the nuclear safety basis for maintaining PFP must be re-evaluated for the different conditions that could reasonably be expected to exist at PFP for up to an additional 30 years.

The longer term plutonium storage mission for PFP has also increased the funding requirements to maintain the facility and its SNM inventory in a safe, secure and compliant condition. The DOE recently re-evaluated potential threats to the nation's SNM inventory, resulting in an upgrading of security requirements. The new requirements have a significant impact on the continued storage of SNM at PFP. The upgrades necessary to meet these requirements include: the retention of the PFP Protected Area, a more robust, secure storage facility, life extension/decoupling of the existing vault support facilities, the installation of more detection equipment, assessment and delay capabilities and a larger and better equipped response force.

To achieve the objectives stated, construction of new facilities and upgrades of older systems at PFP will be necessary. This of course will extend the life of the PFP Closure Project and affect the Hanford Site infrastructure in ways that are still being evaluated. Since several facilities are being prepared for an extended lay-up period prior to decommissioning, a hazards analysis is currently being conducted to evaluate the condition of old process lines with chemical and radiological hold-up, an old HVAC system and glovebox conditions. At the same time, PFP management is looking at new approaches that will minimize the life-cycle costs for the aging facility pending availability of a final disposition path for the plutonium inventory and the necessary funding to re-start D&D.

CONCLUSION

The success of the PFP D&D effort is primarily due to the detailed yet flexible approach to planning that applied innovative techniques and tools, involved a team of experienced independent reviewers, and incorporated previous lessons learned at the Hanford site, Rocky Flats, and commercial nuclear D&D projects. Dedication to the plan and the use of innovative approaches by project managers and workers in the execution of the work kept PFP D&D well ahead of schedule. Tremendous progress was made in a short time frame in the deactivation and decontamination of PFP.

Currently, the D&D activities are shutting down and will be delayed as PFP prepares for storage of SNM. Interim lay-up of the facility is currently being executed and construction activities for a new storage structure are being planned. Design of storage and support facilities is taking place at this time.

REFERENCES

1. *The Use of a Treatability Study to Investigate the Potential for Self-heating and Exothermic Reactions in Decontamination Materials at the Plutonium Finishing Plant,* J. Ewalt, A. Hopkins, C. Simiele, R. Scheele, P. Scott, D. Trent, S. Charboneau, WM 2005, Tucson, AZ, March, 2005

2. *Treatability Studies Used to Test for Exothermic Reactions of Plutonium Decontamination Chemicals,* J. Ewalt, M. Minnette, A. Hopkins, T. Cooper, P. Scott, R. Scheele, S. Jones, S. Charboneau, American Nuclear Society DD&R, 2005