

Plutonium Finishing Plant 241-Z Liquid Waste Treatment Facility Deactivation and Demolition

Submittal for 2008 Project of the Year

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

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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Richland, Washington*

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PFP Projects
Fluor Hanford, Inc.

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**Submittal for
2008 Project of the Year**

**Plutonium Finishing Plant
241-Z Liquid Waste Treatment Facility
Deactivation and Demolition**

**Submitted by:
Fluor Hanford, Inc.**

**To:
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Columbia River Basin Chapter
P.O. Box 1781
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**Prepared for the U.S. Department of Energy
Richland Operations Office
Under contract DE-AC06-96RL13200**

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INTRODUCTION

Fluor Hanford, Inc. (FH) is proud to submit the Plutonium Finishing Plant (PFP) 241-Z Liquid Waste Treatment Facility Deactivation and Demolition (D&D) Project for consideration by the Project Management Institute as Project of the Year for 2008. The decommissioning of the 241-Z Facility presented numerous challenges, many of which were unique within the Department of Energy (DOE) Complex. The majority of the project budget and schedule was allocated for cleaning out five below-grade tank vaults. These highly contaminated, confined spaces also presented significant industrial safety hazards that presented some of the most hazardous work environments on the Hanford Site.

The 241-Z D&D Project encompassed diverse tasks: cleaning out and stabilizing five below-grade tank vaults (also called cells), manually size-reducing and removing over three tons of process piping from the vaults, permanently isolating service utilities, removing a large contaminated chemical supply tank, stabilizing and removing plutonium-contaminated ventilation ducts, demolishing three structures to grade, and installing an environmental barrier on the demolition site. All of this work was performed safely, on schedule, and under budget. During the deactivation phase of the project between November 2005 and February 2007, workers entered the highly contaminated confined-space tank vaults 428 times. Each entry (or "dive") involved an average of three workers, thus equaling approximately 1,300 individual confined-space entries. Over the course of the entire deactivation and demolition period, there were no recordable injuries and only one minor reportable skin contamination.

The 241-Z D&D Project was decommissioned under the provisions of the *Hanford Federal Facility Agreement and Consent Order* (the Tri-Party Agreement or TPA), the *Resource Conservation and Recovery Act of 1976* (RCRA), and the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA). The project completed TPA Milestone M-083-032 to "Complete those activities required by the 241-Z Treatment and Storage Unit's RCRA Closure Plan" four years and seven months ahead of this legally enforceable milestone. In addition, the project completed TPA Milestone M-083-042 to "Complete transition and dismantlement of the 241-Z Waste Treatment Facility" four years and four months ahead of schedule. The project used an innovative approach in developing the project-specific RCRA closure plan to assure clear integration between the 241-Z RCRA closure activities and ongoing and future CERCLA actions at PFP. This approach provided a regulatory mechanism within the RCRA closure plan to place segments of the closure that were not practical to address at this time into future actions under CERCLA. Lessons learned from this approach can be applied to other closure projects within the DOE Complex to control scope creep and mitigate risk. A paper on this topic, entitled "*Integration of the 241-Z Building D&D Under CERCLA with RCRA Closure at the PFP*," was presented at the 2007 Waste Management Conference in Tucson, Arizona.

In addition, techniques developed by the 241-Z D&D Project to control airborne contamination, clean the interior of the waste tanks, don and doff protective equipment, size-reduce plutonium-contaminated process piping, and mitigate thermal stress for the workers can be applied to other cleanup activities.

The project-management team developed a strategy utilizing early characterization, targeted cleanup, and close coordination with PFP Criticality Engineering to significantly streamline the waste-handling costs associated with the project. The project schedule was structured to support an early transition to a criticality "incredible" status for the 241-Z Facility. The cleanup work was sequenced and coordinated with project-specific criticality analysis to allow the fissile material waste being generated to be managed in a bulk fashion, instead of individual waste packages. This approach negated the need for real-time assay of individual waste packages, greatly improving the efficiency of the cleanup operation.

The cleanup and stabilization of the 241-Z Liquid Effluent Treatment Facility reduced radiological risks to the environment and Hanford site workers. It was recognized as a success by regulatory agencies, the media, the DOE client, and stakeholders. The 241-Z D&D Project demonstrated management excellence in adapting to significant changes in project direction, fostered a safety culture that amassed impressive results on this high-hazard job, maintained excellent communications with the client and stakeholders, and developed and implemented unique cleanup techniques.

The success of the 241-Z D&D Project is an excellent example of the effective implementation of the project management principles defined in the Project Management Body of Knowledge (PMBOK).

I. GENERAL INFORMATION AND PROJECT TEAM

Fluor Hanford, Inc. (FH) is the prime contractor responsible for managing the Plutonium Finishing Plant Closure Project. This section provides information on the major members of the team that FH assembled to execute the 241-Z D&D Project.

Project Name and Location

241-Z Deactivation and Demolition Project

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Richland, WA 99352

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Project Team Members

In addition to the more than 100 Nuclear Operators, Radiological Control Technicians, Planners, Engineers, Craftsmen, Scientists, and other specialists, the leadership team included the following:

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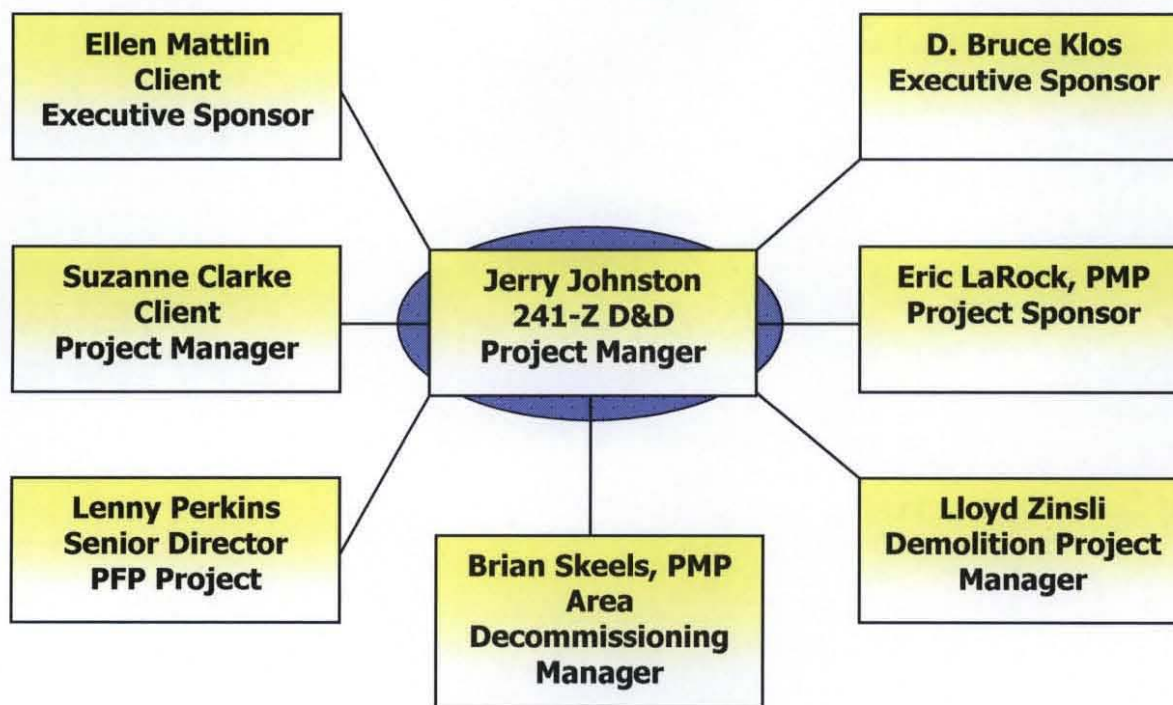


Figure 1-1: Project Management Organization Diagram

II. PROJECT PERFORMANCE

Background Before the Deactivation and Demolition Phase

The PFP complex, near the center of the 586-square-mile Hanford Site, was burdened with plutonium-bearing legacy materials, because like Hanford itself, it was the "workhorse" of the American nuclear defense arsenal. Hanford produced over 60 percent of the weapons-grade plutonium manufactured by the United States, and about 25 percent of that manufactured worldwide. Perhaps the most closely guarded area at Hanford, the PFP complex provided the final step in purifying or "finishing" plutonium before the material was ready to be fabricated into weapons components. Operational in 1949, PFP handled and finished more than 90 percent of the plutonium manufactured at Hanford. Alone, it produced more plutonium core material than any other American facility, yielding the equivalent of the output of the DOE's Rocky Flats (RFS) and Savannah River (SRS) sites combined.

The 241-Z Liquid Waste Treatment Facility operated from 1949 to 2004 to store and treat highly contaminated liquid waste from PFP operations prior to sending the waste to Hanford Tank Farms. It is estimated that 400 million liters of plutonium-contaminated liquid waste passed through the 241-Z Facility during its 55 years of operation. The 241-Z Liquid Waste Treatment Facility consisted of five, 5,000-gallon stainless steel tanks (10 foot high by 10 foot diameter); ancillary piping and equipment; and covered containment vaults. The tanks were housed individually in five ventilated below-grade reinforced concrete vaults. The tank vaults were each 17 feet square and 22 feet deep. The below-grade vaults were accessed either through a 2.5-foot square man-hatch or a 3.25-foot diameter port opening in the center cover block. An above grade, pre-engineered corrugated metal enclosure was built in 1981 to provide weather protection for the vaults, ventilation system high-efficiency particulate air filters, and other equipment. Figures 2-1 and 2-2 show the configuration of the 241-Z complex.

The 241-Z Facility's operational history included numerous process leaks and spills into the tank vault areas, resulting in extremely high levels of airborne contamination during maintenance operations in the vaults. In 1972, the center waste tank failed, spilling its contents into the vault area. At that time, the tank was permanently taken out of service. In 1989, the active process portions of the 241-Z Facility were permitted under RCRA.

In 2002, the DOE, the U.S. Environmental Protection Agency (EPA), and the Washington Department of Ecology (WDOE) established the following timetable for the transition of the 241-Z Waste Treatment Facility:

- TPA Interim Milestone M-083-030 required the DOE to "Submit to Ecology a Closure Plan for the 241-Z Liquid Waste Treatment Facility (TSD Unit)" by July 31, 2003.
- TPA Interim Milestone M-083-031 required the DOE to "Discontinue Waste Discharges from the 241-Z Tanks to Tank Farms via Existing Lines" by June 30, 2005.
- TPA Interim Milestone M-083-032 required the DOE to "Complete Closure of the 241-Z TSD Unit" by September 30, 2011.
- TPA Interim Milestone M-083-042 required the DOE to "Complete Transition and Dismantlement of the 241-Z Waste Treatment Facility" by September 30, 2011.

A Fluor Hanford PFP team was formed in March 2004 to enter and characterize each of the five 241-Z tank vaults to support detailed work planning for their deactivation and cleanup. Team members made 48 entries between June 2004 and August 2005 to obtain the necessary characterization information. During this period, vault entries were stopped for six months when characterization inspections revealed that the concrete cover blocks were structurally degraded. An engineering evaluation and a cost-benefit analysis were performed, resulting in a steel work deck being installed over all the tank vaults to support the equipment and personnel loads required to perform the pending cleanup activities.

In addition to demolishing the primary 241-Z structure, the project scope included demolishing two ancillary structures that supported 241-Z operations. The 241-ZA Sample Building contained sample gloveboxes and waste-tank monitoring equipment. The 241-ZB Caustic Load-in Station consisted of a 4,000-gallon

contaminated caustic tank and support equipment. The 241-ZG change room was a small structure that was previously removed by a different PFP D&D project.

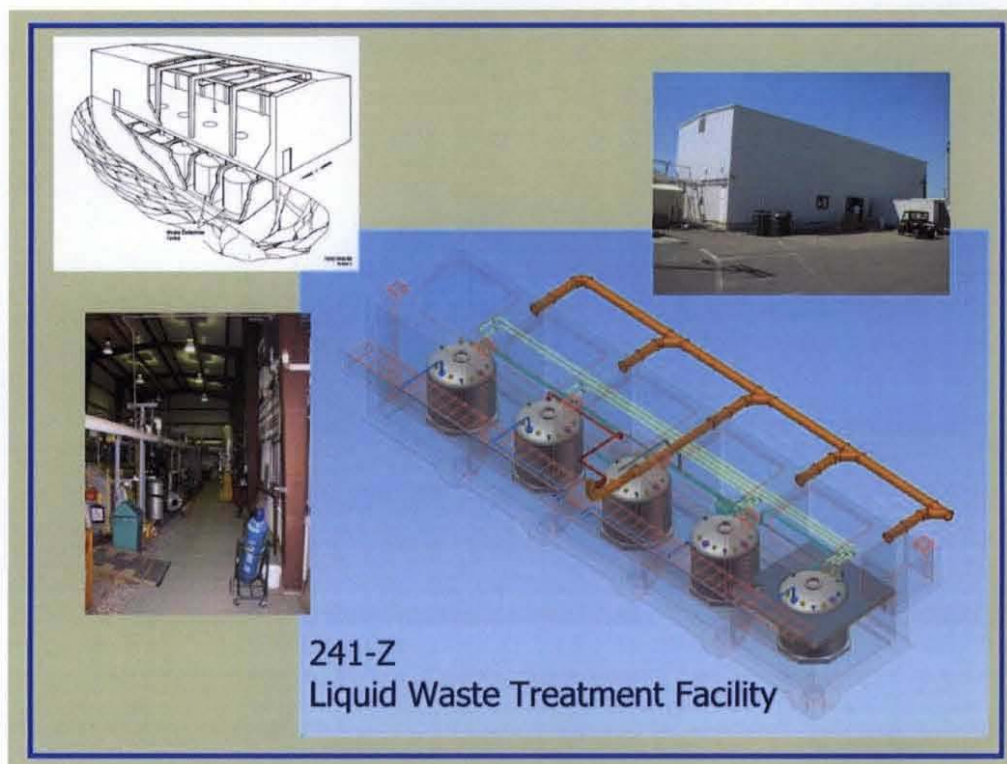


Figure 2-1. The 241-Z Facility Prior to Deactivation and Demolition.

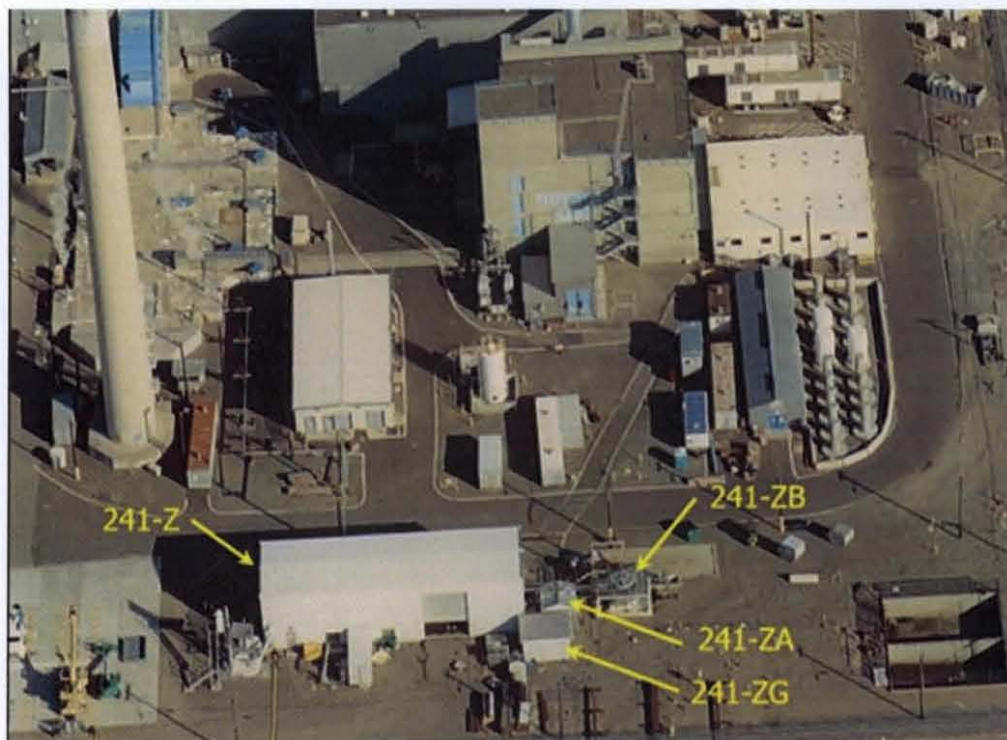


Figure 2-2. Aerial View of the 241-Z Complex, March 2005.

A. Summary of Project

The deactivation phase of the project to ready the 241-Z complex for demolition occurred in the 18-month period from October 2005 through March 2007. The three-month demolition and site stabilization phase of the project occurred from April to June 2007. The objective of the project was to complete the activities required by the 241-Z RCRA closure plan (TPA M-083-032), as well as the interim CERCLA actions to transition and dismantle the 241-Z complex (TPA M-083-042). Completing these milestones would assure that the 241-Z Facility would not pose a hazard to workers, the environment, or the public pending a future regulatory decision on the final disposition of the Hanford Central Plateau area.

The 241-Z D&D Project experienced a significant change in mission very early in the project execution. The project baseline had been developed to accomplish the regulatory objectives stated above. Five months the deactivation phase of the project began, the 241-Z below-grade vaults were tentatively identified as the preferred location for a new project to store special nuclear material at the Hanford Site. The schedule for the new storage facility was driven by national security implications that forced DOE and FH to realign the 241-Z mission in parallel with an ongoing engineering evaluation to formally confirm the use of the 241-Z location. The 241-Z Project Management team was tasked with developing a plan to complete an increased scope of work in a shorter period to prepare the site to meet a very aggressive construction schedule for a new storage facility. The revised plan required the use of three teams working around-the-clock and the shipment of the waste tanks to another facility for cleanup and size reduction. Two months into the deactivation work, DOE made a programmatic decision not to use the 241-Z site for the new interim storage project. The project mission reverted to the environmental objectives, and the 241-Z Project Management team quickly re-planned the project to more efficiently approach the D&D scope while meeting client funding constraints in fiscal years 2006 and 2007.

To deactivate the 241-Z complex, two specialized teams were established to clean out the tank vaults, and one smaller team was formed to isolate the utility systems servicing the 241-Z facilities and provide general support functions for the two vault teams. An experienced team from the FH Central Plateau (CP) D&D organization was matrixed to the 241-Z D&D Project to execute the demolition phase of the project. All the teams reported to the 241-Z Project Manager and the Area Decommissioning Manager to ensure unified project control, coordinated work planning, and a smooth transition between work scopes.

241-Z Vaults Closure (Cleanout of the Below-Grade Tank Vaults)

The vaults closure phase of the project dealt with cleaning and stabilizing four of the five below-grade tank vaults. This scope included the four vaults that were included in the RCRA permit. The tank in the center vault that had failed and been taken out of service excluded the center vault from the subsequent permitting of the 241-Z TSD unit.

The activities required by the 241-Z RCRA closure plan were performed with the objective to "clean close" the 241-Z TSD unit. In addition, the cleanup actions were intended not only to meet the interim CERCLA objectives to eliminate hazards to the environment, workers, and public, but also to eliminate long-term surveillance and maintenance costs pending a future regulatory decision on final disposition of the site. In general, these objectives translated to the following actions in each of the four tank vaults:

- Isolate steam and electrical utilities to the respective tank vault.
- Construct a large (~20-foot x 20-foot) plastic containment tent over the tank vault and configure support equipment such as filtered tent ventilation, breathing air bottles and hoses, air-sampling equipment, spot coolers, hoisting equipment, and temporary electrical power.
- Apply an aerosol fog to the tank vault to initially fix contamination.
- Perform initial hazard inspections of the vault to verify anticipated conditions.
- Install temporary lighting, power, and remote video.
- Utilize hand-held sprayers to apply contamination control fixatives: this is a recurring activity that is performed on almost every vault entry.

- Size-reduce, package, and load out legacy debris and waste on the work grating level (maintenance grating around the top of the tank located 12 feet below the entry level and nine feet above the concrete vault floor).
- Connect a 20-inch flexible duct to the primary exhaust duct for the vault to provide a large capacity portable directed air source to minimize airborne contamination during aggressive cutting and cleaning operations.
- Size-reduce and remove process piping and tubing (e.g., piping that either contained plutonium-bearing solutions or posed a hazard in the conduct of other cleanout work). Each vault had approximately 1,350 pounds of process piping that had to be cut in two-foot lengths, padded and bagged, hoisted from the vault, and loaded into 55-gallon waste drums.
- Access the vault floor level to size-reduce and remove legacy waste and debris, clean out a low-point sump, clean the vault floor, and remove process equipment and piping.
- Assure all exterior penetrations from the vault to the environment are sealed.
- Utilize a plasma arc torch to cut a 2.5-foot x 5-foot opening in the side of the stainless steel tank wall to allow access to manually clean the tank interior.
- Perform RCRA sampling of process piping, floor and wall surfaces as dictated by the closure plan.
- Perform RCRA video inspections of the tank, sump, floor, and walls for compliance to the closure plan.
- Utilize Non-Destructive Assay (NDA) to provide accountability for nuclear material removed from the vault area. NDA was performed prior to activities beginning and at the conclusion of cleanout activities.
- Load out all D&D equipment to prepare for painting and apply a permanent fixative (specialized paint) to all accessible vault surfaces.
- Perform a final video inspection and radiological survey to verify compliance with CERCLA end point objectives.
- Re-install the vault cover, demobilize support equipment and remove the containment tent.

All entries into the underground vaults were handled as high-risk, confined-space entries and required supplied breathing air and multiple layers of protective equipment. Each confined entry was approved by PFP's Industrial Hygiene and Radiological Control Operations specialists. PFP Surveillance Stationary Operating Engineers ensured proper ventilation alignment to maximize the capture velocity at the 39-inch opening during vault entries. Industrial Hygienists monitored the vault atmosphere for oxygen levels, hazardous fumes, and heat and cold stress. Radiological Control Technicians monitored the vault atmosphere for airborne radioactivity and controlled entry into, and out of, the vault to minimize the spread of contamination from the vault entrants.

Those entering the vaults were required to work in multiple layers of protective clothing and wear respiratory protection that included supplied breathing air. Each entrant was assisted by a qualified co-worker who helped each entrant don the appropriate equipment and assured that the entrant was dressed properly. This measure ensured worker safety in entering a hazardous atmosphere. Each entrant's personal protective equipment was checked a second time before he/she entered the confined-space area. Personnel working in the vaults continually monitored each other's protective clothing to assure there was no exposure to the hazardous atmosphere. Radio communications between the entrants and outside support personnel was continuous and video was used to observe physical conditions in the vault during work activities. The number of workers in the vault varied from a minimum of two to a maximum of six, depending on the work scope. The work in the vaults was physically demanding with the "stay-times" limited to two hours or less per entry. Personnel were rotated out after each entry to regain physical stamina. Job rotation provided an additional layer of worker protection.

In addition to the personnel in the vault, 10 to 16 workers (dependent on work scope) were on the operating deck to provide support. Support personnel monitored the entrants' physical work and helped them in exiting the vault. Support personnel were specially trained to remove entrants' protective clothing to prevent the spread of contamination from the vault atmosphere. Support included emergency personnel on full-time stand-by basis at the site to provide first-aid and rescue during specific high-hazard work evolutions.

Extensive pre-job briefings, entry preparations, and post-job reviews usually limited the number of vault entries to one per shift. Post-job reviews assisted workers and management in making decisions on work scope and improving safety and hazard assessments. The amount of resources required per entry placed a high premium on every entry, especially in view of the short work window available. A good deal of management focus was placed on assuring that every entry was planned to maximize worker safety and cleanup results. The project-management team paid very close attention to anticipating potential problems that could affect the team's ability to enter a cell or disrupt the execution of the planned work scope.

The time and cost required to mobilize for work in the vaults made it imperative that when the cleanup work in each vault was complete, there would be no cause to return. The Project Management Team maintained constant communications with DOE-RL and the lead regulatory agency to assure that they were satisfied with the results of vault cleanup. In addition, a contracting strategy was implemented to hire an independent professional engineer to certify the 241-Z RCRA closure very early in the process to allow a vault-by-vault review of the results. The restricted access to the confined-space vault areas required that extensive photographs and video be taken to document and present cleanup progress to the engineers, client, and regulators.

Space constraints and ventilation restrictions on the number of vaults open at one time in the 241-Z building required that the two crews cleaning the vaults work on separate shifts. The crews were assigned responsibility for separate vaults to build ownership and minimize the need for turnover communication between shifts. Much of the work was unique, and there was an extensive learning curve. The efficiency of the crews showed marked improvement as the work progressed. Refer to Table 2-1 for a tabular listing. It should be noted that the last vault had more scope than any of the previous because it contained extra process piping and because work-grating repairs were needed in the vault. The grating repairs alone resulted in 12 additional entries.

Vault #	Start Date	End Date	Total Dives	Process Pipe Removed (lbs.)
D8	2-Nov-05	15-Jun-06	122	1,180
D5	20-Dec-05	21-Jun-06	101	920
D7	6-Jul-06	26-Oct-06	85	1,620
D4	12-Jul-06	25-Sep-06	60	1,200
D6	13-Nov-06	11-Feb-07	60	1,750
TOTAL			428	6,670

Table 2-1. Listing of 241-Z Vaults Entries to Perform Cleanout Operations

Utility Isolation Phase 1

Phase 1 of the 241-Z utility isolations included permanently deactivating selected systems that were not needed to support ongoing D&D activities in the vaults. These systems included instrument air, process air, cathodic protection, and the criticality monitoring system. In addition, all process drains to the 241-Z Facility had to be isolated at their source in various PFP process buildings. The Project Manager worked with PFP Engineering early in the project to develop a configuration management plan to assure that all PFP drawings and procedures affected by the 241-Z D&D Project were identified. The configuration plan also timed deleting or revising these documents in coordination with the major elements of the project schedule.

241-Z Vault Transition

This phase of the work dealt with the cleanup of the final tank vault. This non-RCRA vault had the same CERCLA interim cleanup objectives as the previously cleaned vaults. In addition, prior characterization entries had determined that the work grating around the top of the waste tank had been structurally degraded due to chemical attack from the failed waste tank. As a result, 20 percent of the vault entries had to be dedicated to reinforcing this grating before cleanup work could be completed.

Although the baseline plan called for the two crews to work the final tank vault, the 241-Z Project Management team implemented a plan using only one slightly larger crew. This approach maintained schedule objectives by routinely performing multiple vault entries in one shift, decreased cost and allowed resources to be allocated to other D&D work at PFP.

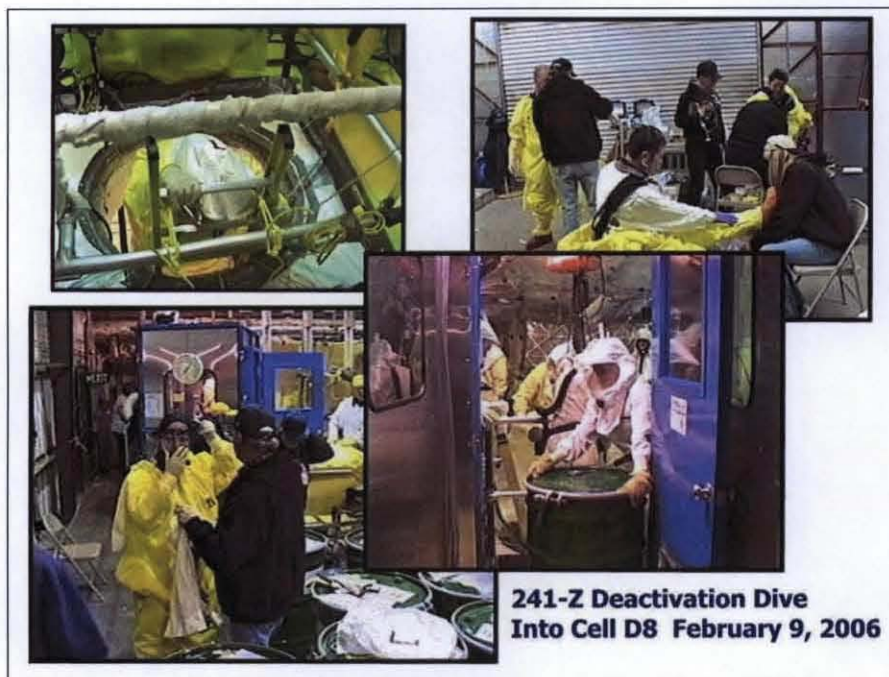


Figure 2-3. Typical Support Activities During a 241-Z Vault Entry.

241-Z Utility Isolation Phase 2

This phase of the project permanently isolated those remaining services to the 241-Z Facility that had to remain active until cleanup work was completed in the last vault. These services included electrical power, steam, the exhaust stack monitoring system, communications, sanitary water, and building ventilation.

In addition, this phase of the work included the following activities to prepare the 241-Z complex for the demolition phase of the project:

- Access, characterize, and drain as necessary abandoned buried chemical lines that were capped at the floor level of the 241-Z building.
- Access, characterize, and drain as necessary abandoned process lines that were capped in the retention basin for the 241-ZB caustic tank.
- Characterize, stabilize, and configure the 4,000-gallon 241-ZB caustic tank for shipment to Hanford's Environmental Remediation Disposal Facility (ERDF).
- Remove all regulated materials that did not meet the ERDF waste profile from the 241-Z, 241-ZA, and 241-ZB facilities.
- Cap and air-gap all electrical conduit and piping systems at slab level.
- Air-gap and stabilize the interior of the above-grade exhaust ventilation duct, filter housings, and stack.
- Perform radiological surveys of the above-grade structures to assure conditions support an open-air demolition activity.

PFP workers completed deactivation and ready-for-demolition work scope for the 241-Z complex on March 29, 2007.

Building Dismantlement and Site Stabilization

The final phase of the 241-Z D&D Project removed the 241-Z, 241-ZA, and 241-ZB above-grade structures, installed an environmental barrier over the tank vaults and the remaining building slabs, and configured the 241-Z complex site to meet regulatory end point criteria.

The deactivation phase of the project configured the 241-Z complex to be ready for an open-air mechanized demolition. The FH PFP project-management team coordinated with the FH Central Plateau D&D Project (D&DP) organization to use experienced D&D workers and managers for the demolition phase of the project. The D&DP team was matrixed to the 241-Z project-management team, which had overall project-management responsibility. A memorandum of understanding was prepared to clearly define the roles and responsibilities between the 241-Z D&D Project and the D&DP organization.

The D&DP workers began mobilization in March 2007 in parallel with the final deactivation activities. A PFP management review was performed to assure that the project was ready to proceed with the demolition phase. The review assured that all design media, facility procedures, work plans, hazard evaluations, and worker training were in place to support the safe execution of this work scope. In coordination with PFP Operations, a demolition zone was established and posted around the work site, and a description of the upcoming schedule was communicated to the entire PFP staff. Stringent security restrictions for the PFP yard area required a project-specific security plan to assure that the planned work activities were coordinated with security operations.

The above-grade 241-Z structures had been maintained as radiological buffer areas. With a few exceptions, the relatively radiologically clean condition of the 241-Z structures supported an open-air demolition approach. The exceptions included the contaminated 241-ZB caustic tank and a portion of the 241-Z exhaust duct and filter housings. The radiological contamination levels on the interior of these components were too high to support transport to Hanford's Environmental Remediation Disposal Facility (ERDF) in the standard waste containers called "roll-off boxes." In addition, size reducing these items in place would risk spreading contamination to adjacent areas, increasing the cost of demolishing these areas. The project team developed a plan to configure the exhaust system components and hoist them into large, specialized containers for shipment to, and grout filling at, ERDF. The 241-ZB tank was also configured to function as its own container for shipment to ERDF for grout filling and disposal. The project's demolition schedule was adjusted to perform limited demolition of the steel superstructure around the 241-ZB tank and the 241-Z wall structure to allow crane access to hoist these items for shipment to ERDF.

For efficiency, the Project Manager approved a design for the environmental barrier installed on the remaining slab that incorporated the steel work deck placed over the tank vaults during characterization. The steel deck also protected the tank vault cover blocks during the demolition of the 241-Z structure.

A key planning consideration for the demolition task concerned the very limited work space around the 241-Z complex. The primary piece of equipment chosen to perform the demolition was a 100-ton, tracked excavator with a shear end effector. The Project Manager and his team had to plan very carefully to place the demolition equipment and the roll-off boxes, due to the closeness of adjacent facilities, security fences, and restrictions on the proximity of the equipment to the below-grade walls of the vaults. The general sequence of demolition was first to remove the smaller structures around the main 241-Z building, and then strip the sheet metal skin from the walls of the 241-Z building, next partially cut the vertical supports at the base, and then use the excavator to pull down the steel structure in a controlled manner. This approach allowed the structure to be size-reduced at ground level and then be loaded into roll-off boxes.

Demolition began on April 19, 2007, the site was stabilized by June 04, 2007, and compliance with the end-point criteria was documented on June 08, 2007. During that period, the buildings were demolished, the debris size-reduced, and the waste loaded into 24 ERDF roll-off boxes. The remaining slabs were prepared, and a 90-mil layer of polyurea was installed with a gravel overlay to function as an environmental barrier.

Throughout demolition, the project team relied on a nearby weather station and windsocks to continually monitor weather conditions to ensure contamination control. The maximum wind speed allowed during demolition and waste load out was 12 miles per hour. Radiological conditions were monitored by four fixed-head air samplers. Radiological Control Technicians constantly surveyed equipment, tools, debris, and the general work area during all demolition activities to assure that radiological conditions were as planned. The demolition debris was loaded using a front-end loader into 30-cubic-yard roll-off containers staged in the contamination area. The entire building was designated as low-level waste (LLW) and disposed in Hanford's ERDF.

B. Special Management Methods

The project team faced a huge challenge in planning the transition of the 241-Z complex. The project was not a typical construction or hazardous waste remediation project; it required extensive physical and administrative controls to ensure the health and safety of the workforce and public from some of the most toxic and dangerous substances on earth. In addition to the complexity of the field operations, the project required risk-mitigation actions for the technical changes and approaches, and careful management of the human resources and organizational structure to meet the schedule and budget constraints. To successfully execute the project, the 241-Z D&D project management team used numerous special management methods:

- **Unique Technical Solutions**

The 241-Z Facility deactivation required 428 manned entries into one of the most hazardous environments in the DOE Complex. Airborne contamination levels in the tank vaults were a million times higher than uncontrolled entry would have allowed. Using an integrated team of engineers, experienced nuclear operators, nuclear engineers, industrial hygiene experts, health physics technicians and experts from the respective bargaining-unit crafts, the Project Manager and his team were able to develop engineering and physical protections that allowed safe entries into the tank vaults.

- **Bargaining-Unit Management**

The interface with bargaining-unit labor with respect to jurisdictional issues has historically been difficult for project managers at Hanford, and could have led to industrial relations difficulties within the 241-Z D&D Project and other FH operations, to the detriment of the 241-Z Project and the client. In numerous cases, the unique activities associated with the deactivation work did not have established jurisdictional precedents. The 241-Z Project Management team took extra measures to provide early communication about the work scope to the bargaining unit representatives and FH Industrial Relations, and obtained their feedback to assure that job assignments would minimize disruption from jurisdictional disputes. The project team demonstrated strong interpersonal skills in managing the risk associated with human/industrial relations factors without causing labor problems or work stoppages in the remaining portions of the plant.

- **Emerging Scope**

The inability to fully characterize highly contaminated/inaccessible vaults will always lead to surprises during D&D. Furthermore, anytime a "first-of-a-kind" effort is initiated, scope forecasts miss portions of the work and accurate cost and schedule baselines are difficult to develop. The project team developed risk management plans for potential scope changes and response plans to unexpected facility conditions. These plans allowed the project to complete emerging work quickly and safely. A change in the client's end state objectives for the 241-Z Facility drove a significant change early in the project evolution. The project team demonstrated the effective use of Project Management tools and techniques by quickly adjusting to these significant changes, preparing and implementing appropriate baseline change documentation in a timely fashion, and maintaining stringent cost and schedule objectives.

- **Regulatory Strategy**

By design, the 241-Z RCRA Closure Plan was developed with a great deal of flexibility regarding the methods used to demonstrate closure and the interface with the ongoing CERCLA action at PFP. The

plan provided three acceptable methods to support closure including component removal, visual inspection for clean debris surface, and sampling. Sampling radiological materials for RCRA constituents can be expensive, and waiting for results can adversely impact the schedule. The Project manager and PFP Environmental Compliance Officer minimized sampling costs for the 241-Z D&D Project by selecting conservatively representative sample points throughout large portions of the system, and by using alternate closure methods where appropriate. The closure plan was also designed to be flexible. It allowed for partial closure of portions of the 241-Z TSD (e.g. soil beneath the tank vaults) during the immediate project, and then completion of the remaining work during the future final remediation performed under CERCLA. This was a significant element in the contingency planning for the project and was accomplished via early involvement and buy-in of the Regulator and DOE. Due to the outstanding effort of the field crews, the preferred outcome, RCRA clean closure was achieved.

Team Building

Establishing dedicated deactivation teams was a key step in successfully meeting the milestones and commitments of the contractor. The project-management team met with the crew members to make sure they understood the project goals and worked with them to develop the steps and processes to complete the work safely and efficiently. The Project manager ensured that ample time was provided in the schedule for the teams to train and practice emergency response actions, so that they could feel confident in executing this high-hazard work. It was everyone's job to finish the project safely and on time.

C. Owner's Satisfaction

Letters of support and commendation for the 241-Z D&D Project have been submitted by both the client (DOE-RL) and the lead regulator for the CERCLA action (WDOE). These letters (in Attachment C) confirm that the project met or exceeded the client's expectations and worked with all parties with professionalism and commitment.

D. Summary of Accomplishments

The 241-Z D&D Project completed the deactivation and demolition of the highly hazardous and radiologically contaminated 241-Z complex ahead of all regulatory milestones, as shown in Table 2-2. The team also completed this high-hazard work with an extraordinary record of safety and contamination control.

Table 2-2. Performance Against Milestones

Milestone	FH Performance Milestone Due	TPA Milestone Due	Actual Finish Date	Positive Schedule Variance	
				FH Milestone	TPA
Submit Operator & PE Certification of 241-Z RCRA Closure	March 30, 2007	September 30, 2011	February 22, 2007	1 Month Early	4 Years & 7 Months Early
Transition the 241-Z Facility to Demolition Ready	June 30, 2007	N/A	March 30, 2007	3 Months Early	N/A
Transition 241-Z Facility to Slab-on-Grade	September 30, 2007	September 30, 2011	June 8, 2007	4 Months Early	4 Years & 4 Months Early

III. PROJECT INTEGRATION MANAGEMENT

Project Plan Development and Execution

DOE-RL wanted to ensure that the 241-Z D&D Project met the Tri-Party Agreement completion dates while it complied with all applicable regulatory requirements. A Documented Safety Analysis (DSA) that covered the full life cycle of PFP closure activities was finished and approved in 2003 (HNF-15500) and a coordinated PFP Closure Project Execution Plan (PEP) was revised in August 2004 (D&D-21452) to support D&D efforts throughout the PFP complex. A 241-Z project-specific closure plan (DOE/RL-96-82, Rev 1) was issued to detail the actions needed to close this RCRA TSD unit. The 241-Z deactivation was detailed in Removal Action Work Plan (RAWP) for the PFP above grade structures while the 241-Z demolition was addressed in a separate RAWP for PFP ancillary facilities.

Integration Change Control

The project-management team worked very closely with DOE-RL and met with stakeholders monthly to ensure that D&D progress was communicated, issues identified, and appropriate and required work and funding authorizations were obtained. The team made sure that information flow was current and that changes required to maintain momentum were resolved immediately.

The deactivation phase of the project started on July 18, 2005. Almost immediately, project leaders held an orientation meeting with workers to kick off a focused, two-month training period for approximately 80 bargaining-unit personnel. These workers were organized into three new crews to clean up the tank vaults on an accelerated three-shift schedule to meet the emergent construction schedule for the new storage facility using the 241-Z below grade vaults. The programmatic direction changed in November 2006, while the deactivation crews were still performing initial training entries. The 241-Z D&D Project's objectives reverted to the original regulatory goals (i.e. RCRA closure and CERCLA interim stabilization), and the team quickly re-planned the project and submitted a baseline change request (BCR) to more efficiently complete the new objectives. The project performance baseline was formally adjusted on February 21, 2006.

During the D&D phase of the project the staff submitted two BCRs. One resulted from the client-directed mission change discussed above, and the other was needed to obtain client recognition of a schedule impact from an externally driven work force restructuring action. The first BCR was incorporated into the project's baseline, while the second adjusted a performance incentive but not the baseline schedule.

IV. PROJECT SCOPE MANAGEMENT

Initiation

The work scope detail for the 241-Z D&D Project can be found in the project history section (Section IIA).

Progress on the work scope was monitored daily against baseline, while progress on the project control target and the work scope was reported weekly. Cost performance was collected every two weeks and was formally reported monthly.

The Work Breakdown Structure (WBS) followed the above work scope with the addition of the project support account.

WBS	4	Project Hanford Management Contract
WBS	4.01.	Project Hanford Cleanup Work
WBS	4.01.02.	200 Area Cleanup Work
WBS	4.01.02.02.	Plutonium Finishing Plant (PFP) Cleanup

WBS	4.01.02.02.05.	Disposition PFP
WBS	4.01.02.02.05.29	Transition 241-Z
WBS	4.01.02.02.05.29.01	241-Z Preparations for Modifications for Construction
WBS	4.01.02.02.05.29.02	241-Z Vault Closure
WBS	4.01.02.02.05.29.03	241-Z Utility Isolation Phase 1
WBS	4.01.02.02.05.29.04	241-Z Project Management
WBS	4.01.02.02.05.29.05	241-Z Vault Transition
WBS	4.01.02.02.05.29.06	241-Z Utility Isolation Phase 2
WBS	4.01.02.02.05.29.07	241-Z Building Dismantlement and Site Stabilization

The ".01" WBS element was used to capture sunk costs associated with the initial client direction (which was changed four months into execution and formally changed via a BCR described in Section III).

Scope Planning, Definition, and Verification

The 22 criteria used to determine project completion were established in the 241-Z Facility End Point Completion document (HNF-30038) and in the Removal Action Work Plan document for the PFP Above-Grade Ancillary Facility Demolition (DOE/RL-2005-15).

Project scope, cost and schedule were defined by preparing baseline documents consistent with contractual requirements between FH and DOE. The baseline planning documents prepared by FH defining the scope, cost, and schedule for this project are briefly summarized by year in Table 4-1.

Table 4-1. Baseline Planning Documents

Year	Primary	Secondary	Other	Supplements
FY 2005	Final Reporting Baseline in HANDI (1) and HSTD (2)	Formal BOE (3), MAESTRO (4)	N/A	N/A
FY 2006	Final Reporting Baseline in HANDI and HSTD	Formal BOE, COBRA (5), P3 Primavera (6)	The baseline was reviewed as part of the External Independent Review and validated by the Office of Engineering and Construction Management (DOE-HQ)	Recommended for Validation BCR RL11-2006-001 to transition scope from ready for turnover to construction to RCRA closure and CERCLA end points.

- (1) HANDI – Hanford Data Integrator
- (2) HSTD – Hanford Site Technical Database
- (3) BOE – Basis of Estimate
- (4) MAESTRO cost estimating software used by Fluor
- (5) COBRA is a cost and budget software provided by Welcom Applications, WST Corporation
- (6) P3 scheduling software by Primavera® Systems Inc.

The baseline documents defining scope, cost, and schedule for the 241-Z D&D Project were very comprehensive. They included a formal life-cycle, resource-loaded schedule; numerous cost exhibits detailing life-cycle cost by fiscal year; a detailed WBS with dictionary; and formal narrative descriptions with defined statements of work, deliverables, and milestones as documented in the Hanford Site Technical Database (HSTD). In addition, a detailed BOE, using an activity-based cost estimating approach, was generated, along with working reference materials.

Although the 241-Z D&D Project was well into execution, it was chosen for special, detailed examination as a WBS element in the June 2006 External Independent Review (EIR) of PFP conducted by DOE's Office of Engineering and Construction Management. The review validated the PFP Closure Project near-term (FY06 - 08) baseline consistent with DOE O 413.3A, *Program and Project Management for the Acquisition of Capital*

Assets. In fact, the review team specifically commented that the 241-Z D&D estimate was "very well defined and the documentation is clear and consistent," and that "the Review Team has a high confidence level in the schedule baseline." In addition, in March 2007, the 241-Z D&D Project successfully passed a DOE Headquarters review of the project's compliance with earned value management system guidelines in ANSI/EIA-748-A.

Prior to the startup of new work processes, the 241-Z D&D Project conducted activity-based management reviews (ABMRs) to ensure the readiness of the teams to complete work in a safe and effective manner. These ABMRs provided a rigorous review of the planned scope, and provided detailed verification to demonstrate to PFP senior management that the scope planning, preparatory activities, team-work documents were comprehensive and complete, and the operating facility was ready to initiate effective and safe execution.

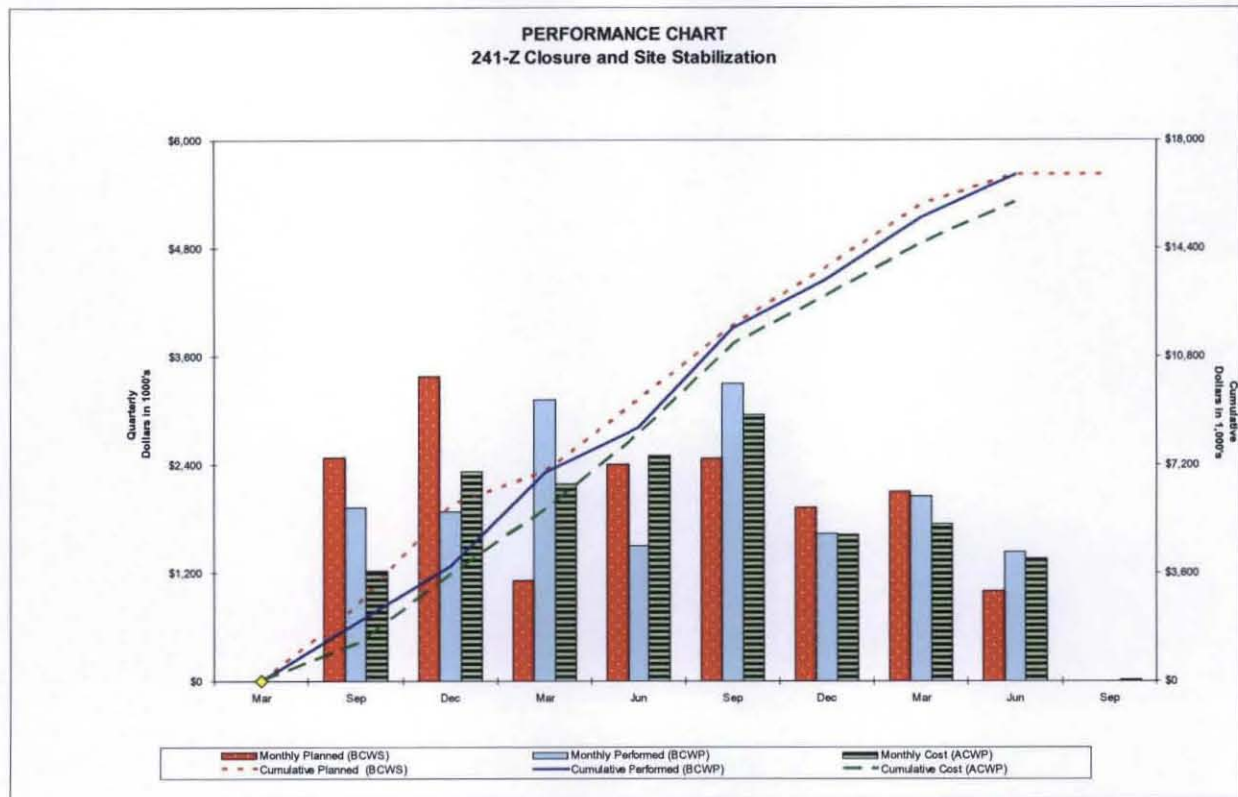
Scope Change Control/Challenges

The project manager and his team implemented scope change control at several levels, consistent with all Hanford Site DOE projects. All scope changes, whether driven by the client, changing strategies, or emerging risks, were reviewed and approved by the Project Manager, and are recorded in the baseline documentation referenced in Table 4-1.

The 241-Z project management team did an outstanding job of scope definition, verification, and control. These accomplishments in scope management were largely responsible for the superb overall performance of the project.

V. PROJECT TIME/SCHEDULE MANAGEMENT

Although the remaining 241-Z TPA Milestones were not due until 2011, completing this project in FY 2007 was extremely beneficial to the overall D&D schedule for the PFP Complex because it limits the number of parallel activities that will have to be performed in a critical period in the future. Continuity on the 241-Z D&D Project was also important to DOE-RL and FH to take advantage of the personnel experience and momentum gained from the recently completed characterization work. Refer to Attachment B for a project schedule with baseline and actual dates. The schedule performance curve is shown in Figure 5-1.



	FY05			FY06			FY07			Totals
	Mar	Sep	Dec	Mar	Jun	Sep	Dec	Mar	Jun	Sep
Monthly Planned (BCWS)	\$0	\$2,476	\$3,373	\$1,114	\$2,397	\$2,466	\$1,925	\$2,103	\$996	\$0
Monthly Performed (BCWP)	\$0	\$1,930	\$1,876	\$3,119	\$1,466	\$3,304	\$1,636	\$2,054	\$1,434	\$0
Monthly Cost (ACWP)	\$0	\$1,223	\$2,318	\$2,191	\$2,492	\$2,951	\$1,628	\$1,741	\$1,360	\$20
Cumulative Planned (BCWS)	\$0	\$2,476	\$5,849	\$6,963	\$9,359	\$11,825	\$13,750	\$15,853	\$16,849	\$16,849
Cumulative Performed (BCWP)	\$0	\$1,930	\$3,807	\$6,926	\$8,421	\$11,725	\$13,361	\$15,415	\$16,849	\$16,849
Cumulative Cost (ACWP)	\$0	\$1,223	\$3,541	\$5,732	\$8,224	\$11,175	\$12,803	\$14,544	\$15,904	\$15,924
Schedule Variance (BCWP-BCWS)	\$0	(\$546)	(\$2,042)	(\$37)	(\$938)	(\$100)	(\$389)	(\$439)	(\$0)	(\$0)
Cost Variance (BCWP-ACWP)	\$0	\$707	\$266	\$1,194	\$197	\$550	\$558	\$871	\$945	\$925

(Dollars in \$000's)

Figure 5-1. Cost & Schedule Performance Curve

Key project dates are summarized as follows:

Table 5-1. Key Project Dates

	Original Baseline Schedule Date	Actual Date
Start Date (WBS 4.01.02.02.05.29)	July 18, 2005	July 18, 2005
Submit Operator and PE Certification for 241-Z RCRA Closure to RL	December 29, 2006	December 8, 2006
Complete Cleanup of Five 241-Z Tank Vaults	February 16, 2007	February 15, 2007
Complete 241-Z Utility Isolations (Ready for Demolition)	February 26, 2007	March 30, 2007
Complete 241-Z Demolition and Site Stabilization (Project Complete)	June 04, 2007	June 08, 2007

Baseline schedules covered current year work scope and were maintained at a summary task level. The baseline included the activities and resources (labor hours) required to complete the prior year's work scope. In order to avoid double counting, project managers tracked offsetting activities and negative budget. This approach accurately reflected the remaining scope and labor resources required, while it maintained the original schedule and budget. The baseline schedule was monitored every two weeks.

The working level schedule for the project showed tasks on a day-by-day basis. The Project Manager and his team reviewed the working level schedule every day and reviewed the project status against the working level

schedule weekly. The project team defined activities in both the baseline and the working level schedule on a collaborative basis. Engineering and field work planners planned every task in detail with direct input from the nuclear operators and crafts.

The project team was challenged to meet the aggressive schedule set by the client and the regulators. The team decided to sequence the major deactivation work activities strategically, using two teams working concurrently to complete vaults cleanout while a smaller third team completed in parallel as many of the utility isolation activities as possible. Using the third team significantly reduced the time needed to ready the facility for demolition after the cleanup work in the vaults was completed. The demolition team was brought on board early to complete its training, work planning, and mobilization so it could start immediately after deactivation was completed.

Schedule Development

Once the resource-loaded WBS was completed and the scheduling strategies were delineated, the Project Manager and his team converted this data into the 241-Z D&D Project baseline schedule and cost estimate.

Schedule Control

Formal change-control for the 241-Z D&D project was established in accordance with FH procedures and DOE requirements. Control was maintained at three levels, internally within PFP as a cost center, externally within Fluor Hanford as a cost center, and externally with DOE-RL. PFP used a Change Control Board to approve changes to the project schedule independently, using this flexibility to realize performance efficiencies where possible. When external events added constraints or new requirements to the project, PFP and project personnel continually analyzed the impact to the project and took appropriate actions.

The ability to maintain schedule for the vaults cleanout phase of the project depended on adhering to the schedule for frequency of vault entries and scope completion on each entry. Numerous obstacles could impact a team's ability to make a vault entry ranging from building ventilation issues to problems with a single piece of respiratory equipment. In the vaults, another subset of potential problems ranging from thermal stress upon the worker to the inability to maintain airborne contamination levels below an established control point could impact the duration or efficiency of an entry. The success of the project depended upon the ability of the teams to maintain the scheduled pace. The Project Manager established performance metrics that monitored vault entry frequency and scope completion, and shared them with FH senior management and DOE-RL on a weekly basis to provide real time visibility on schedule performance. These tools complemented the monthly baseline performance reviews. Considering the size, uncertainties, and complexity of the scope of work, the project team did an extraordinary job in planning for schedule risk and identifying opportunities to streamline the schedule by fast-tracking or eliminating activities from the schedule. The team controlled the schedule by solving technical, administrative, and/or safety issues that had potential to impact the project schedule. The Project Manager and his team maintained control of the schedule and the associated risks in several ways:

- Holding brainstorming sessions with the work supervisors and crews to improve the vaults cleanup process and implement lessons learned.
- Inputting improvements to field work execution to the working level schedules on a continuing basis. By inputting and refining real-time data, the team improved schedule performance by eliminating the risks associated with poor assumptions early in each task and work planning package.
- Using mock-ups where there was a real value to performance improvement or worker safety. For example, a mock up on the use of a plasma arc torch to cut an access opening in side the 241-Z waste tanks proved invaluable in supporting five safe iterations of this high hazard activity.
- Managing personnel resources effectively to avoid impacts from worker absences. One missing person could idle a 25-person vault cleanup crew, so it was essential to manage scheduled absences and assure adequate resources were available to fill in unexpected absences. A small standing day shift crew was established to supply both logistical and fill-in support to the two large crews performing critical path vaults cleanup work and to perform non-critical path utility isolation work. This approach

proved to be very effective in providing a queue of personnel to support critical path vault work, while also performing beneficial "look ahead" entry planning and non-critical path work scope.

VI. PROJECT COST/RESOURCE MANAGEMENT

The budget at completion (BAC) for the 241-Z D&D Project was \$16,849,000. The actual cost totaled \$15,924,000, yielding a \$925,000 (5.5 percent) positive cost variance. Refer to Figure 5-1 for a time phased cost and schedule performance curve. The cost savings from the forecast primarily resulted from the performance efficiencies gained during the execution of the vaults cleanup work.

Resource Planning/Cost Estimating

Resource planning and cost estimating for the 241-Z D&D Project were generated from the output of the development of the BOE for the larger PFP Closure Project, in which the 241-Z effort was a major subproject. Cost estimates for each task were provided in a template form, as taken from the BOE, and rolled into cost accounts managed by WBS and individual work-package categorizations.

Cost Control/Challenges

The PFP Project Controls organization, along with the 241-Z D&D project team, held detailed monthly budget reviews to evaluate earned value performance, analyze variance trends, and implement changes required to maintain compliance with WBS and work package budgets. The Project Manager was responsible for all decisions in scope, schedule, and expenditures.

The Project Controls personnel matrixed to the 241-Z D&D Project managed the project changes, and played an important role in keeping the Project Manager and his team cognizant of the budget constraints on a real-time basis. Thus, schedules and resources could be balanced to maintain good cost and schedule performance for the 241-Z D&D Project.

VII. PROJECT QUALITY MANAGEMENT

Quality Planning

The 241-Z D&D Project Manager and his team were responsible to ensure that Quality Assurance (QA) requirements were factored into their work activities, understood by personnel, continually assessed, and fully implemented in accordance with 10 CFR 830, Sub-part A and the quality requirements of the RAWP. The Project Manager obtained the support of the FH Quality Assurance (QA) group to determine that execution of this project would be adequately addressed by the existing PFP Quality Assurance Project Plan (QAPP).

Quality Assurance

Qualified QA professionals were matrixed to the 241-Z D&D project team. These persons participated in design reviews encompassing the technical, functional, operational, construction, regulatory, quality, and safety aspects of the project. They performed audits, assessments, and surveillances during the project. Thus, the Project Manager made sure that potential conditions adverse to quality were identified early in the process and actions were taken to preclude issues during the implementation phases.

Quality Control

Quality control (QC) requirements were included in project procurement and work documents. Qualified QC and Acceptance Inspectors performed in-process and final inspections of work throughout the project, to ensure compliance with the design or end point criteria.

VIII. PROJECT HUMAN RESOURCE MANAGEMENT

Organizational Planning/Staff Acquisition

The 241-Z D&D Project was a labor-intensive job that required a large number of bargaining unit personnel. The security restrictions and training requirements associated with working at PFP imposed significant obstacles to fielding the large crews required for the deactivation phase of the project. In addition, hiring bargaining unit personnel required close coordination with ongoing work at PFP and other Hanford Projects to avoid impacts to these activities. The demolition phase of the project also required close coordination with the FH Central Plateau D&D organization to assure their D&D workers and supervisors were available when needed to support the 241-Z D&D Project schedule.

A core team of exempt staff was temporarily assigned to the 241-Z Project Manager from existing PFP support organizations. The 241-Z D&D Project also had the ability to pull additional resources from a wide range of functional groups on an as-needed basis. For example, engineering, planning, maintenance crafts, and operations personnel were matrixed directly to work on teams in infrastructure organizations, such as fire systems maintenance and electrical teams, to maximize their effectiveness in deactivating the facility. This proved to be a cost-efficient approach by supplying the project a pool of resources to quickly respond to fluctuations in exempt staffing needs.

The 241-Z D&D Project Manager, Area Decommissioning Manager, and PFP Projects Director spent considerable effort planning and coordinating the staffing of this project. The success of this planning is evidenced by the project's ability to meet schedule objectives while quickly responding to significant programmatic changes in mission.

Team Development

Because PFP is a nuclear facility, with significant quantities of plutonium and other nuclear materials, it is subject to very strict security and safety controls to eliminate the possibility of theft while minimizing the likelihood and of public and environmental exposure to radioactive substances. As stated previously, the operational constraints imposed on projects at the Hanford Site from the Code of Federal Regulations, DOE Orders, and other state and local regulations, required extensive planning and execution to ensure worker safety and proper training. In the 241-Z D&D Project, project team development was a real challenge due to the number of people involved, the mixture of craft types, and the unique nature of the work. The Project Management team recognized the critical importance of team building, and performed the following activities to foster team development:

- **Craft Involvement in Routine Work Planning** Worker involvement in work planning for the 241-Z D&D Project was implemented constantly using PFP's Integrated Safety Management System (ISMS). For each work package, craft and exempt workers reviewed a comprehensive hazard checklist, brainstormed and work together to identify safety risks and issues to ensure the safe and productive execution of the work. Sub-teams assumed specific responsibility for completing clean out tasks, typically along craft jurisdictional activities, such as process pipe removal, size reduction and waste packaging/handling. These teams planned each entry required to complete the tasks, including contingency or tasks of opportunity. These sub-teams took ownership of the work and completed it safely and within given schedules.

ISMS involvement supports the goals contained within the Voluntary Protection Program (VPP), sponsored emphatically by DOE-RL. Teamwork on these issues led to the PFP complex becoming the first high-hazard nuclear facility in the nation to be awarded Star Status under the national VPP program. This prestigious award was based not only on safety statistics but also on extensive reviews and interviews with workers, emphasizing teamwork between workers and management. The award goes only to facilities meeting the highest standards of the program.

- **Participation in Zero-Accident Council (ZAC)** On a monthly basis, craft and management personnel participated in the PFP's Zero Accident Council. This regular meeting provided a forum for representatives of all labor categories to address worker safety concerns and other safety issues at PFP, with action items recorded, tracked, and closed as agreed by the council.
- **Interface with Contractors and Outside Resources** The 241-Z D&D Project brought in an FH team from outside the PFP plant to perform the demolition work. The project team expended considerable effort coordinating and communicating within and between the groups to ensure a smooth, safe and efficient transition.

Training was an extremely important aspect of team development for 241-Z D&D Project employees, due to the many stringent regulatory requirements and the need for safe and compliant performance. All 241-Z D&D Project personnel were provided general training on the hazards inherent in plutonium and nuclear facility work at Hanford. In addition, depending on job assignment, some personnel performing more complex nuclear operations assignments spent hundreds of hours on training, required reading, qualification, and preparation for oral examinations.

Several types of training were provided to the 241-Z D&D team including the following:

- Fluor corporate project management classes for selected personnel.
- Extensive training on the equipment, radiation worker safety, safe handling of nuclear materials, and operational safety for operations personnel.
- A 241-Z D&D project-specific training certification for Nuclear Chemical Operators. This provided a standardized training module for these key bargaining unit personnel in addition to a monetary incentive to obtain this certification.
- Specialized 241-Z project-specific training developed by the work team for donning and doffing protective clothing when working in the highly contaminated tank vaults.
- Training in specific crafts, selected major equipment, hazardous energy control, and work control for maintenance personnel.
- Training on emergency response procedures, and participation in numerous drills simulating actual emergencies, for emergency response personnel.
- Discipline-specific training as well as training in FH engineering procedures, material procurement, configuration management, nuclear safety and others for engineering personnel.

The Project Management team also used recognition activities to reward outstanding accomplishments by the project team as a whole, by subprojects and work groups within the project, and by individual contributors. Here are some examples:

- A catered lunch for achieving one million safe work hours without a lost time injury at PFP.
- Awards of commemorative coins, custom jackets and other items recognizing achieving project goals, especially safety goals
- Numerous pizza feeds or other events in recognition of work group accomplishments.
- Merit increase awards and grade promotions for top performers

IX. PROJECT COMMUNICATIONS MANAGEMENT

Communications Planning/Information Distribution

The 241-Z management team understood the importance of open, two-way communications with stakeholders, including regulators, DOE, the media, the public, and the workers. All of these groups were concerned that the project be performed safely and timely, in a technically competent manner. The ultimate goal of all concerned was to reduce hazards to the public, workers, and the environment.

To accomplish these goals, the Project Management Team established the following lines of communication:

- **Stakeholders and Regulators**

Primary regulatory agencies included the U.S. WDOE, EPA, and the Washington Department of Health (WDOH). Primary stakeholders included the members and constituencies of the Hanford Advisory Board (HAB). DOE, conducted primary communications with regulators and stakeholders, with the FH Project Manager and his team providing support. DOE and regulatory agencies communicated via quarterly Tri-Party Agreement status meetings and monthly Project Manager Meetings. To meet TPA requirements, key actions associated with the 241-Z D&D Project were released for public comment and review. The DOE communicated with stakeholders through the meetings of the HAB (whole and in committees), with the FH Project Manager and his team providing support when requested.

- **Media and the Public**

The 241-Z D&D Project maintained visibility with the media and the general public through a series of interviews, media tours, and articles about progress, a few of which are included in Attachment D. Project leaders worked with Fluor Hanford's Communications department to coordinate tours and media releases in an attempt to make the 241-Z work as visible as Hanford Site security guidelines would allow.

- **Employee Communications**

The 241-Z D&D project-management team continued a strong PFP tradition of keeping the work force informed and involved. Every major phase of the 241-Z project began with the 241-Z project manager making a presentation to the entire team regarding the scope, unique hazards, lessons learned, safety expectations, and performance objectives for the project. The importance of active worker involvement and ownership of the project safety and performance objectives was heavily stressed by the management team. Through the PFP Z-ZAC (Z Plant is a colloquial name for PFP), workers had constant, regular opportunities to express any safety concerns and suggestions about project work. PFP workers participated in all aspects of the preparations and presentations that led to the VPP Star Status award for the PFP complex. The PFP Closure Project also prepared and sent a "Z-News" newsletter to every PFP employee every week, often including progress reports on the 241-Z D&D Project. Site wide communications included the use of the weekly "Fluor Your Information" newsletter that covered articles on all the key transitions of the project and a routine status of the project's progress.

As a result of this unusually strong commitment to frequent and open communications between the 241-Z D&D Project Management team and the employees of PFP, the workers felt that they were part of the 241-Z team and took personal pride in the achievements. This effective use of communications was a prime contributor to the success of the project.

Performance Reporting/Administrative Closure

The Project Management Team worked in partnership with DOE-RL during status meetings, by presenting project progress as part of a monthly review of all Fluor Hanford projects, and by meeting on an as-needed basis with DOE-RL program management representatives assigned to the PFP. This open and effective communication channel resulted in a strong working relationship between DOE-RL and the 241-Z project team.

FH PFP management reported 241-Z Project performance on a regular basis in multiple formats, both internally and to DOE-RL. These reports included a detailed section on 241-Z team performance every month from the inception of the project through completion.

Management and control of all relevant documents including but not limited to drawings, design changes, submittals, and requests for information from offsite contractors, and facility modification packages were maintained via the on-site Hanford document control systems. These records were used in generating the administrative closure records for each end point item, allowing the client to approve payment and providing assurances to the stakeholders that the 241-Z complex was in a stabilized configuration that could be safely maintained with minimal surveillance pending a future decision on final remediation of the below grade structure.

X. PROJECT RISK MANAGEMENT

Risk Management Planning/Identification

There were four distinct types of risk inherent in the 241-Z D&D Project; regulatory risks, industrial safety risks, risk associated with release of radioactive materials to the environment (important to all concerned) and business risk associated with the execution of the project (important to DOE-RL, FH and the 241-Z D&D Project team).

Operations involving plutonium are heavily monitored and regulated by DOE and Washington State. Historically, the discovery of even small quantities of plutonium could result in delays of six months or more while waiting for permits or regulatory approvals. To reduce this risk, the project was conducted under CERCLA, so that all the standards were maintained through an expedited regulatory review process. Good communications with the Regulators allowed changes in conditions or processes to be quickly reviewed, preventing schedule delays.

To support DOE regulatory requirements, the project conducted detailed hazards analysis for all chemical, radiological, criticality, industrial and fire hazards that could impact workers or the environment during the D&D activities. The controls established to mitigate these risks were documented in the PFP DSA and a project-specific health and safety plan (HASP). Every task conducted in the building was evaluated against the DSA and HASP to assure all controls were in place as required.

The radiological risks were controlled on a task-by-task basis with monitoring, protection and process controls established in the Radiological Work Permit approved for each work package. The long-term key to reducing the public's risk was to remove the plutonium and the building in a well controlled manner. By removing a significant amount of residual Plutonium during the clean out of the first two tanks and vaults, the 241-Z Project was able to eliminate the potential of a criticality event during the clean out of the remaining three tanks/vaults, as well as the contaminated building support systems.

In addition, business risks to the 241-Z D&D Project and Fluor Hanford were very real, due to unknown conditions in portions of the below grade tank vaults and the sheer number of high hazard work activities. These risks were important, both in terms of reality and perception, given the level of public scrutiny to which the 241-Z D&D Project was subject. The project team performed and then scrutinized work planning activities in detail, to identify risks to be mitigated, and risks that would be managed to gain schedule and reduce costs. Several major risks were identified during this process:

- High schedule and cost risks due to numerous first time activities associated with vaults cleanup
- High schedule risk resulting from the limited characterization on portions of the tank vaults
- Risks that could be incurred from poor industrial relations with bargaining unit groups
- High cost risk associated with potential delays in vaults deactivation while maintaining a large labor force

Risk Analysis

Project risks were analyzed using a Monte Carlo regression analysis with high-risk items identified for response planning. The Monte Carlo process used established consequences of the various risk events and the probability of occurrence in a simulation to determine the potential impact of each event and the combined impacts of events.

Risk-Response Planning

Based on the complexity and dynamic nature of the risks, the Project Manager and his team developed response plans. Several risk issues that had been anticipated occurred and were managed as planned, and other risk issues required extensive re-planning efforts to mitigate them.

Risk Monitoring and Control

Risk monitoring and control are among the crucial tasks of project management, and are usually the factors that separate the projects that struggle to perform adequately from the ones that substantially beat their cost and schedule goals. The 241-Z D&D Project team did an exceptional job of monitoring performance and reacting to risk events. As a result, trending in virtually all performance metrics accelerated toward the positive, leading to the exceptional cost and schedule performance.

XI. PROJECT CONTRACT/PROCUREMENT MANAGEMENT

Planning/Solicitation/Source Selection

The bulk of the 241-Z D&D work scope was self-performed by FH requiring a limited number of support contracts. Service contracts were used in providing: (1) technical expertise and field support from the vendor providing the equipment for aerosol fog fixative (2) a certified independent Professional Engineer to review the results of the 241-Z RCRA closure activities.

All of the project procurement actions were accomplished in accordance with the Federal Acquisition Regulations, established DOE Orders, policies and guidelines, and followed approved procurement manuals and procedures. Maximum practicable opportunities were given to small, disadvantaged, minority and labor surplus area businesses.

A key innovation was a "Contract In" strategy for the demolition phase of the building. The Fluor Hanford CP D&D organization at Hanford has led the nation in the open-air demolition of plutonium-contaminated facilities.

SUMMARY

The success of the 241-Z Facility Deactivation and Demolition Project was based on many factors, though the commitment by the project team, DOE-RL, and regulatory agencies to see the job completed was foremost. Other considerations that played an important role in the project's success:

- Having the whole project team actively involved in the planning for each task on the project. This participation led to field innovations and a true commitment of the team. In particular, the project demonstrated a continuous and marked improvement in efficiency and performance during the vaults cleanout phase of the project.
- The seamless transition between the deactivation phase of the project and the use of a different work team for the demolition task was the result of excellent planning and communication by the 241-Z Project Manager and his counterpart at FH D&DP.
- The flexibility built into the 241-Z RCRA Closure Plan and its integration with the PFP CERCLA action reduced project risk and cost while successfully meeting regulatory requirements. This strategy was truly a collaborative effort from experienced personnel at WDOE, DOE-RL, and FH.
- Establishment and maintenance of clear lines of communication with regulatory agencies, DOE-RL, FH senior management, and the project team contributed to consistent DOE-RL sponsor support through a difficult funding period.
- The direct involvement of PFP senior management in supporting the considerable challenges that needed to be overcome to staff the deactivation phase of the project.

Ultimately the 241-Z D&D project succeeded because it adhered to the basic tenets described in the PMI PMBOK. The project scope was well defined with risks identified and mitigated, providing the basis for a sound schedule and cost estimate. An excellent job was done of monitoring and reporting baseline performance while managing significant project changes. An outstanding project team was assembled and provided the leadership needed to safely execute a highly hazardous project while exceeding performance and stakeholder expectations.

Attachment A 241-Z Project Images



Preparing for 241-Z Vault Entry



Worker Entering 241-Z Tank Vault Via 39" Opening



Removing Drum of Waste from Containment Tent



Size Reducing Process Pipe in 241-Z Tank Vault (Work Grating Level)



Cleaning a 241-Z Tank Vault Floor



Size Reducing Process Pipe on the Tank Vault Floor

Attachment A 241-Z Project Images



Using Plasma Arc Torch to Cut Access Opening in 241-Z Waste Tank



Using Plasma Arc Torch to Cut Access Opening in 241-Z Waste Tank



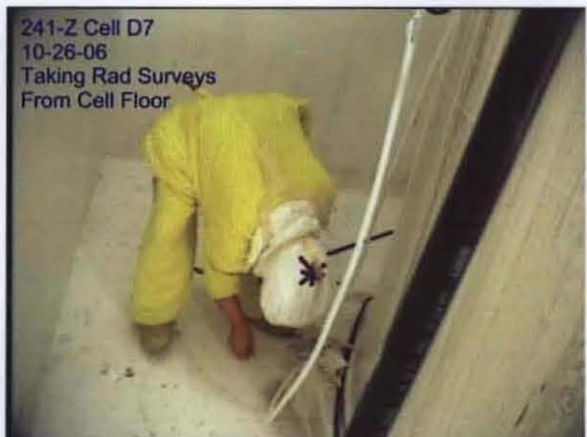
Cleaning Interior Wall of a 241-Z Waste Tank



Cleaning Floor of a 241-Z Waste Tank



Installing Grating Reinforcement for Work Grating in Center Tank Vault

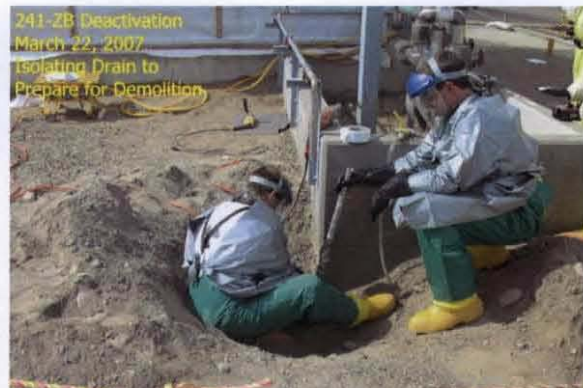


Taking Radiological Surveys from Vault Floor After Cleanup and Painting Completed

Attachment A 241-Z Project Images



Preparing to Fix Contamination on Interior of 241-Z Exhaust Duct



Cutting, Draining, and Capping a Buried Chemical Line to 241-ZB



Removing 241-Z Exhaust Duct from Building to Load in to Special Transport Container



Rigging 241-ZB Caustic Tank for Removal from 241-Z Demolition Site



Demolition of 241-ZA Sample Building



Excavator Pulling Down the 241-Z Structure

Attachment A 241-Z Project Images



Size Reducing 241-Z Rubble



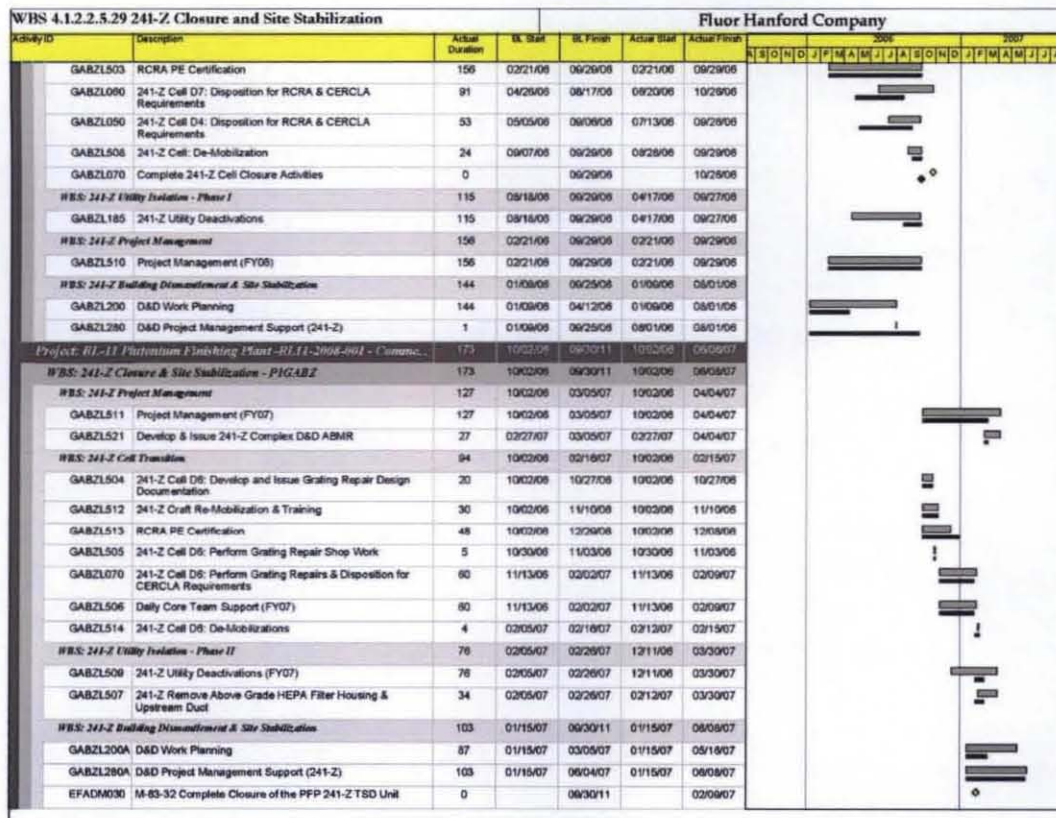
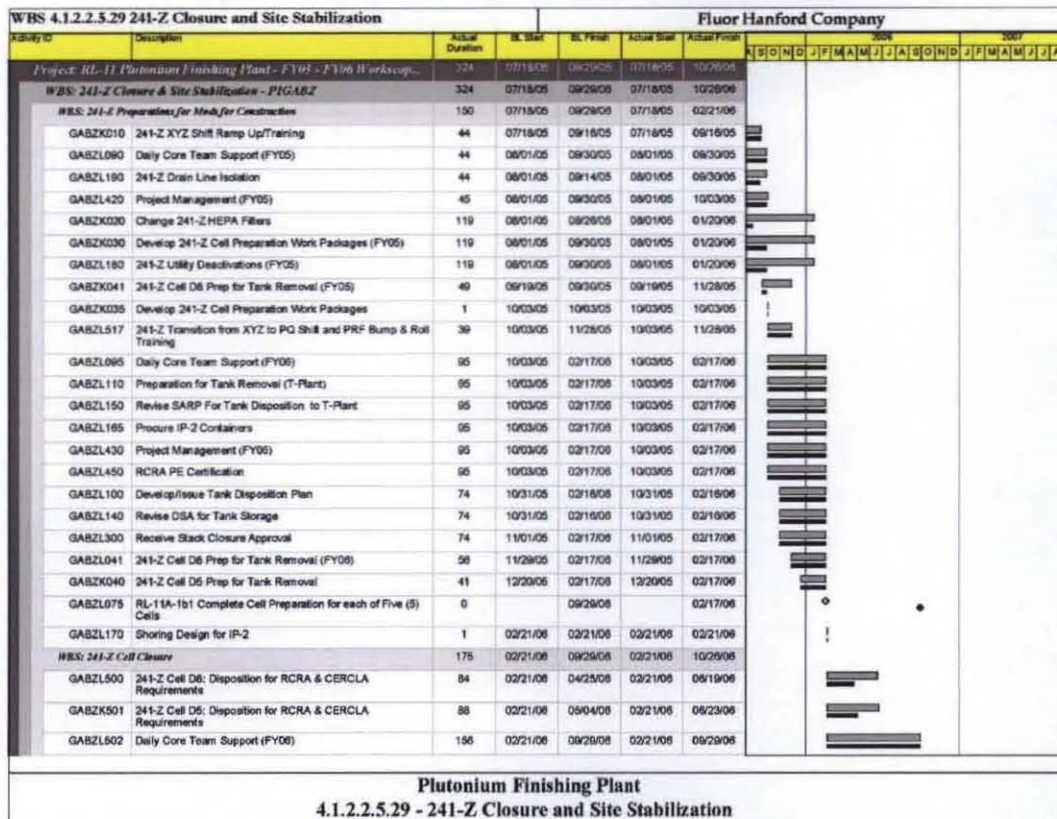
Installing Polyurea Environmental Barrier on 241-Z Slab



241-Z DEMOLITION



Attachment B Planned/Actual Schedules



Attachment B Planned/Actual Schedules

WBS 4.1.2.2.5.29 241-Z Closure and Site Stabilization						Fluor Hanford Company																									
Activity ID	Description	Actual Duration	BL Start	BL Finish	Actual Start	Actual Finish	2004														2005										
							A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A
GABZL380	Complete Closure of the PFP 241-Z TSD Unit	0		03/30/07		02/09/07																									
GABZL210	D&D Mobilization for 241-Z Bldg. Demolition	29	03/05/07	03/14/07	03/09/07	04/13/07																									
GABZL220	241-Z Demolition Preparation Activities	23	03/15/07	03/19/07	03/15/07	04/19/07																									
GABZL230	241-Z Building Decontamination & Decommissioning	40	03/20/07	04/09/07	03/20/07	05/14/07																									
GABZL515	241-Z: Pour CDF in Void Spaces	1	04/10/07	04/15/07	03/29/07	03/29/07																									
GABZL440	241-Z Demolition General D&D Field Work Support	48	03/09/07	05/29/07	03/29/07	05/31/07																									
GABZL240	241-Z Remove Raised Work Deck	16	04/19/07	04/30/07	04/19/07	05/14/07																									
GABZL250	241-Z Survey, Remediate and Stabilize Slab	22	05/01/07	05/14/07	05/01/07	05/31/07																									
GABZL280	CP D&D Demobilization	15	05/15/07	05/29/07	05/15/07	06/05/07																									
EFADM035	M-83-42 Complete Transition & Dismantlement of 241-Z Treatment Facility	0		09/30/11		06/08/07																									
GABZL361	Complete Transition & Dismantlement of 241-Z Treatment Facility	0		09/04/07		06/08/07																									
GABZL371	ARL11.2a 241-Z Demolished to Sub-On-Grade	0		09/04/07		06/05/07																									
WBS: 241-ZA and 241-ZB Facilities		126	11/01/06	04/09/07	11/01/06	05/03/07																									
GDEAK500	PFP Ancillary Demo Planning Project Management	96	11/01/06	04/09/07	11/01/06	03/22/07																									
GDEAK1508	PFP Ancillary Demo Field Support	126	11/01/06	04/09/07	11/01/06	05/03/07																									
EMAAU022	241-ZB Perform Transfer Line Flushing	44	01/22/07	01/29/07	01/22/07	03/23/07																									
GDEAK098A	241-ZA Perform Work (Cold, Dark & Dry)	39	01/29/07	02/29/07	01/29/07	03/23/07																									
GDEAK098	241-ZB Perform Work (Cold, Dark & Dry)	30	01/29/07	02/29/07	02/09/07	03/23/07																									
GDEAK085	241-ZB Building Demolition	36	03/23/07	04/09/07	03/20/07	04/24/07																									
GDEAK085	241-ZB Demolition General Field Work Support	26	03/23/07	04/09/07	03/20/07	04/24/07																									
GDEAK087	241-ZB Demolition Project Management	26	03/23/07	04/09/07	03/20/07	04/24/07																									
GDEAK090	241-ZA Building Demolition	22	04/04/07	04/09/07	04/04/07	05/03/07																									
GDEAK091	241-ZA Demolition General Field Work Support	22	04/04/07	04/09/07	04/04/07	05/03/07																									
GDEAK092	241-ZA Demolition Project Management	22	04/04/07	04/09/07	04/04/07	05/03/07																									

Attachment C Owner/Client Testimonial



Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

JAN 03 2008

08-AMCP-0076

Mr. S. Jones, Vice President of Marketing
Project Management Institute
Columbia River Basin Chapter
P.O. Box 1781
Richland, Washington 99352

Dear Mr. Jones:

PROJECT OF THE YEAR ENDORSEMENT FOR THE PLUTONIUM FINISHING PLANT 241-Z DEACTIVATION AND DEMOLITION PROJECT

The purpose of this letter is to endorse the application by the Plutonium Finishing Plant (PFP) 241-Z Deactivation and Demolition (D&D) Project, to transition the facility to slab-on-grade, for consideration by the Columbia River Basin Chapter of the Management Institute for the 2008 Project of the Year. This is an excellent example of a project team well trained in the Project Management Book of Knowledge protocols, fully meeting and even exceeding the client's needs by safely completing high risk work, both under budget and in advance of multiple commitments to the Tri-Party Agreement and to the U.S. Department of Energy, Richland Operations Office (RL).

The 241-Z Liquid Waste Treatment Facility operated for fifty-five years and is estimated to have treated a total of approximately 400 million liters of highly contaminated plutonium-bearing waste from PFP operations. The primary facility consisted of five 5,000 gallon stainless steel tanks housed individually in ventilated, below-grade, reinforced concrete containment vaults. Tank vault access was through a man-hatch/port opening in the center cover block. The 241-Z operational history included numerous process leaks and spills, including failure of the center tank, into the tank vault areas resulting in extremely high levels of airborne contamination. The project objective was to transition the 241-Z complex to slab-on-grade. Completion criteria included decontamination and stabilization of below-grade structures.

Active portions of the facility were permitted under the Resource Conservation and Recovery Act (RCRA) leading to the challenge of a specific RCRA closure within a complex facility undergoing phased cleanup under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This challenge was successfully managed through an innovative strategy developed through collaboration between experienced personnel at the State of Washington Department of Ecology, RL, and Fluor Hanford, Inc. (FHI). The approach provided a regulatory mechanism within the RCRA closure plan to place segments of the closure that were not practical to address at this time (in the absence of public policy concerning soil cleanup requirements) into future actions under CERCLA. It is anticipated that lessons learned from this strategy will be very valuable to other closure projects to control scope creep and mitigate risk.

Attachment C Owner/Client Testimonial

Mr. S. Jones
08-AMCP-0076

-2-

JAN 03 2008

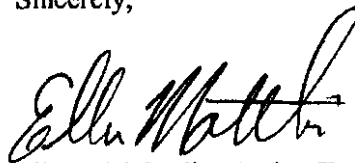
The waste handling costs were significantly reduced through a strategy developed by the 241-Z D&D project management team. The project schedule was structured to support early transition to a criticality 'incredible' status for the 241-Z Facility. The approach eliminated the requirement for real-time assay of individual waste packages thereby greatly improving the efficiency of the cleanup operation.

All the project metrics attest to the success of the 241-Z D&D Project: a) cost, a 5.5 percent positive cost variance; b) schedule, project end schedule variance of zero; c) scope, completed all contract performance milestones from one to three months ahead of schedule and Tri-Party Agreement milestones more than four years ahead of schedule. Moreover, there were no recordable injuries and only one minor reportable skin contamination. This success was achieved despite the uncertainty associated with work performed in some of the most hazardous work environments on the Hanford Site. Ultimately, the project succeeded because it adhered to the basic tenets of the Project Management Book of Knowledge. The project scope was well defined with risks identified and mitigated providing the basis for a sound schedule and cost estimate. Additionally, it was observed that FHI management was committed to supporting active involvement of the entire project team in the planning for each project task leading to field innovations and team commitment. This resulted in continuous and marked improvement in efficiency and performance during the most challenging phase of the project, tank vault cleanout. Management excellence was also demonstrated by nurturing a safety culture leading to the impressive safety record.

RL staff was continually impressed with the responsiveness of the FHI project team. Validation of contractual requirements was facilitated by excellent project documentation and an open and collaborative attitude. It is with pleasure that RL fully endorses this application.

If you have any questions, please contact me on (509) 376-2385.

Sincerely,



Ellen M. Mattlin, Acting Federal Project Director
for Plutonium Finishing Plant Closure

AMCP:SEC

cc: J. M. Ayres, Ecology
G. A. Johnston, FFS
D. B. Klos, FHI
E. M. LaRock, FFS
C. M. Murphy, FHI
L. F. Perkins, EFSH
L. C. Zinsli, FHI

Attachment C Owner/Client Testimonial



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3100 Port of Benton Blvd • Richland, WA 99352 • (509) 372-7950

January 2, 2008

Mr. Stan Jones
Vice President of Marketing
Columbia River Basin Chapter
Project Management Institute
P.O. Box 1781
Richland, Washington 99352

Re: Recommendation for Recognition of the United States Department of Energy Plutonium Finishing Plant (PFP) 241-Z Deactivation and Demolition Project for the Project Management Institutes Project of the Year Award 2008

Dear Mr. Jones:

The Department of Ecology supports the PFP 241-Z Deactivation and Demolition Project as a worthy candidate for the Columbia River Basin Chapter's Project of the Year for 2008.

This project exceeded the commitments of two Tri-Party Agreement (TPA) Interim Milestones for the transition of the 241-Z Liquid Waste Treatment Facility. TPA Interim Milestone M-83-32 required the 241-Z closure plan activities to be completed by September 30, 2011. This milestone was completed four years and seven months ahead of schedule. TPA Interim Milestone M-83-42 required the dismantlement of the 241-Z Facility buildings to slab on grade by September 30, 2011. This milestone was completed four years and four months ahead of the required date. This project was a significant step towards the cleanup of the PFP and reduced potential hazards to the workers, the public, and the environment.

The deactivation and demolition of the 241-Z Facility was managed in a very professional manner. The project did an excellent job of integrating the closure activities with the Comprehensive Environmental Response, Compensation, and Liability Act transition work. The Department of Ecology was the lead regulator for both actions and was kept thoroughly informed via regular project meetings, walk downs of the work site at critical transition points, and the submittal of interim closure documentation.

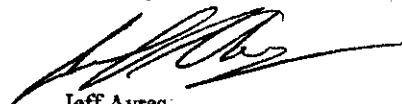
Attachment C Owner/Client Testimonial

Mr. Stan Jones
January 2, 2008
Page 2

The project managed the execution of high risk and hazardous activities in a safe and efficient manner while keeping the work ahead of schedule. In addition, actual costs were below the planned budget. This can be directly attributed to efficient planning and work execution abilities of the 241-Z project management team.

If you should have any questions, please call me at 509-372-7881.

Sincerely,



Jeff Ayres
Nuclear Waste Program

p11

cc: Suzanne Clarke, USDOE
Ellen Mattlin, USDOE
Eric LaRock, FH
Jerry Johnston, FH

Fluor Hanford as the contractor, the Department of Energy as the client and the Washington Department of Ecology as the prime regulator submit that the project is complete and submit this written agreement to assist in preparing a showcase project article (if requested) to be published in the PM Network.

Attachment D – Public Communications

In addition to several local media tours of the 241-Z D&D project to note both the deactivation and demolition phases of the project, the following communications were related to the project:

- The Integration of the 241-Z Building Decontamination and Decommissioning Under CERCLA with RCRA Closure at the Plutonium Finishing Plant, Bloom, Hopkins, Klos, Johnston, Skeels, Mattlin, Charboneau, Waste Management Conference 2007, February 2007.
- 241-Z Plutonium Liquid Waste Treatment Facility Demolished, Gerber, American Nuclear Society Newsletter, Fall 2007
- 241-Z Plutonium Liquid Waste Treatment Facility Readied for Demolition, Gerber, American Nuclear Society Newsletter, Spring 2007
- Articles related to the 241-Z D&D Project scope and status were included in the FYI (Fluor Your Information) the FH Hanford Site Newsletter on the following dates: 11/14/2005, 7/10/2006, 10/23/2006, 3/19/2007, 4/30/2007, 5/7/2007, 5/20/2007, and 6/18/2007.
- A professional video of a typical 241-Z vault entry was made in February 2006 with DVD copies provided to the DOE, regulators, and other stakeholders.