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PUREX Transition Project Case Study

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PUREX/UO_3 Deactivation

In December 1992, the U.S. Department of Energy (DOE) directed that the Plutonium-Uranium Extraction (PUREX) Plant be shut down and deactivated because it was no longer needed to support the nation's production of weapons-grade plutonium. The PUREX/UO_3 Deactivation Project will establish a safe and environmentally secure configuration for the facility and preserve that configuration for 10 years. The 10-year span is used to predict future maintenance requirements and represents the estimated time needed to define, authorize, and initiate the follow-on decontamination and decommissioning activities. Accomplishing the deactivation project involves many activities. Removing major hazards, such as excess chemicals, spent fuel, and residual plutonium are major goals of the project. The scope of the PUREX Transition Project is summarized in Figure 1.

Project Scope

The project includes the following activities:

- Remove high-risk materials, including plutonium/uranium solutions, contaminated nitric acid, N Cell plutonium, and spent fuel.
- Eliminate chemical inventory
- Flush canyon vessels
- Decontaminate/stabilize facility and equipment
- Consolidate heating and ventilation
- Terminate liquid effluents
- Develop implementing processes for the following activities:
  - Transition end points
  - Safety strategy
  - Regulatory strategy
  - Transition to long-term surveillance and maintenance

Guiding Principles

The guiding principles of the project are as follows:

- Eliminate the urgent risks and inherent threats
- Provide a safe work place
- Maintain managerial and financial control
- Become outcome oriented
- Focus on the technology development program
- Develop a stronger partnership with stakeholders.

Regulatory Drivers

Regulatory drivers affecting the PUREX Transition Project included the *National Environmental Policy Act* (NEPA), *Resource Conservation and Recovery Act of 1976* (RCRA) [*Washington Administrative Code* (WAC) 173-303], *Clean Air Act* (CAA), and "National Emission Standards for Hazardous Air Pollutants" (NESHAPs). Agencies routinely involved in the project included the Washington State Departments of Ecology and Health and the U.S. Environmental Protection Agency (EPA). Project personnel teamed with the regulators to develop a number of innovative approaches toward deactivation. Completion of key project tasks was negotiated into *Hanford Federal Facility Agreement* (Tri-Party Agreement) milestones accepted by Washington State, the EPA, and DOE. These enforceable commitments provided a framework within which key activities were to be completed.

Background Information

From the final years of World War II through the Cold War, the Hanford Site in south-central Washington State produced much of the special nuclear material our nation used for defense. With the Cold War over, former production plants at Hanford and other places in the country are no longer needed. Hanford, which is owned by DOE, is the site of the largest environmental restoration project our nation has ever undertaken.

A major part of this environmental restoration effort is the cleanup and dismantling of Hanford's former production plants. The first step in cleaning up and dismantling these plants is called "deactivation." This involves removing nuclear materials and chemicals and shutting off utilities. The plant will then be ready for the final step: decontamination and decommissioning, which can include removing equipment, further cleanup, and demolishing or salvaging equipment or structures.

PUREX and another facility a few miles away, the Uranium Trioxide Plant (UO_3 Plant) are being deactivated as a demonstration project for the DOE Complex under today's environmental regulations. Innovations, cost-saving techniques, and lessons learned at PUREX/UO_3 are being shared to benefit future deactivation projects.

By looking for innovative approaches, involving the public, and teaming with our employees and regulators, we are making better decisions that help us do the right things the first time.

Even though plants like PUREX and UO_3 are no longer needed, they must be constantly monitored and maintained as long as radioactive and hazardous materials from past operations remain inside. This constant surveillance and monitoring is costly. But once the plants have been deactivated and most of the radioactive and hazardous materials are gone and the utilities and systems shut off, that constant monitoring and maintenance will no longer be needed. The plants can be vacated and locked, with maintenance and monitoring needed just four times a year.

Deactivating these plants will greatly reduce the hazard they pose to our employees, the environment, and the public as well as the high cost to monitor and maintain them.

For example, the monitoring and maintenance costs for PUREX and UO_3, which were $34 million a year when deactivation began, will be reduced to $1 to 2 million a year.

Hanford's plan for deactivating the PUREX and UO_3 plants is based on state and federal environmental regulations and milestones in the Tri-Party Agreement for Hanford Site cleanup.

In addition, information on deactivation plans was coordinated with the public early in the planning phase. The public is encouraged to stay involved as key decisions are made during the years it takes to complete the deactivation project.

<u>PUREX/UO_3 Plant History</u>

PUREX Historical Timeline

1952-1955	Design and Construction
1956-1972	Operation
1972-1983	Standby
1983-1990	Operation
1991-1992	Standby
1992	Shutdown Ordered
1993-1997	Deactivation

The PUREX Plant was constructed between 1953 and 1955. Full operations began in January 1956. It represented the third step in plutonium production at the Hanford Site. It processed the nuclear fuel elements that first were fabricated, then irradiated in Hanford's atomic reactors along the Columbia River. Figure 2 shows a schematic of the PUREX canyon facility. Figure 3 depicts an aerial view of the PUREX Facility.

At the PUREX plant, the fuel elements were dissolved in a nitric acid solution, then passed through several more cells, where they were mixed with other chemicals and solutions, separated, remixed, and concentrated. One of the products was plutonium. Another was a liquid chemical mixture of uranium, nitric acid, and other substances. This mixture was known as uranyl nitrate hexahydrate, or UNH for short. The UNH was taken by tanker truck to the UO_3 Plant, about 5 miles away, for conversion to uranium trioxide powder.

Both the plutonium and uranium were ultimately sent to other government sites. The waste product of the PUREX process, millions of gallons of radioactive material, went into huge concrete-and-steel underground tanks.

In December 1992 the DOE issued final deactivation orders for the PUREX and UO_3 Plants. This means they will never operate again.

UO_3 Plant Deactivation

The first major step in the PUREX/UO_3 Transition Project was accomplished in January 1995. The transition of the UO_3 plant was completed 4 months ahead of schedule, saving $800,000. Major hazards such as the residual uranium oxide powder from calciners were removed, and all plant discharges to the environment stopped. Deactivation of the UO_3 Plant reduced surveillance and maintenance costs from $4 million to $40,000 a year. Figure 4 depicts an aerial view of the UO_3 Plant.

An important part of the project was developing a new acceptance-criteria process to help make cost-effective choices for final plant conditions before turnover from operations to the environmental restoration program.

This innovation, which will be standard for future deactivation projects, allows both the new and former "owners" to reach agreement on the final condition of the plant after deactivation.

PUREX Deactivation

Deactivating the PUREX Plant includes several major steps. First, the reactor fuel, plutonium solution, and contaminated acids have been removed and disposed of. The chemicals and contaminated solvents are currently being processed. All systems are being flushed and isolated. These activities are important steps to reduce the hazards and radiological and chemical source term in the facility.

Large amounts of various chemicals were left when the PUREX Plant went on standby in 1990. Hanford developed a process to sell usable chemicals commercially to avoid having to dispose of them. So far more than 3 million pounds of chemicals have been sold; approximately 300,000 pounds were disposed of as waste.

Disposition Plutonium/Uranium Solutions

An important activity focused on 6,000 gallons of liquid containing plutonium and uranium, which was left in the plant when PUREX was put on standby. To reduce exposure to workers, this material was sent to the Hanford Site's underground waste tanks. Figure 5 shows a project metric used to track progress on completing solution transfers.

Remove Spent Nuclear Fuel

A key deactivation activity involved the recovery, packaging, and transfer of all remaining fuel from the PUREX Plant to the K Basins for storage. This activity was completed on October 12, 1995, when approximately 3.5 metric tons of spent nuclear fuel were transferred. The transfer of all fuel out of the PUREX Plant was necessary to reduce the facility radiological source term and eliminate potential hazards. Both aluminum-clad single-pass reactor fuel and zircalloy-clad N Reactor fuel were transferred.

The single-pass reactor fuel was shipped to PUREX in 1969 and stored in the slug storage basin. Almost 3 metric tons of fuel were stored in 4 baskets to await later processing. The fuel was stored in the baskets until December 1994 when the old baskets were loaded into new stainless steel buckets. The fuel was repackaged in the buckets to ensure that it would remain covered with water during the fuel transfer process. The buckets also provided new lifting points for use during fuel transfer.

The PUREX canyon contained 49 pieces of N Reactor fuel and 3 pieces of single-pass reactor fuel in 3 head-end process canyon cells. This fuel had been dropped when container and equipment malfunctions occurred during dissolver fuel charging operations.

EQUIPMENT DEVELOPMENT AND TESTING

Several new fuel-recovery tools and new canister packing equipment were developed to recover the fuel from the dissolver cell floors. The preliminary design for these tools and equipment was initially tested using a computer simulation of the tools and the process canyon cells. This simulation identified some design changes that assisted in later fuel recovery activities. Once fabricated, the tools and equipment were tested using simulated fuel elements in the rail tunnel. The fuel-element grabber tool was used to collect individual dummy fuel pieces and place them on the canister loading table. The table was located in a tank that would normally provide cover water for the fuel. The water was not needed for the test. When both sides were loaded with the dummy fuel elements, the table was lifted and a canister was loaded. This process was repeated many times to check for interferences between the fuel in the canister and the fuel being loaded. The test was successful, so the equipment was moved onto the canyon deck and positioned for fuel recovery. The tank containing the canister loading table and the element wash tank were then filled with water.

DISSOLVER CELL FUEL RECOVERY

The fuel was recovered from the A dissolver cell first. The canyon crane video camera was used to locate the fuel elements on the floor, then a new drag tool was used to move them to an accessible location. The fuel grabber collected the fuel elements one at a time and moved them to the loading equipment on the canyon deck. There, each element was soaked in a water tank to remove any floor debris or chemicals, then was placed on the canyon deck and inspected to assess the condition of the fuel and help determine its approximate size for accountability. After inspection, the element was collected with the fuel grabber tool and placed onto one side of the canister loading table. This process was repeated until either the canisters were full or all the fuel had been recovered. The table was then lifted and the elements were loaded into the canister. The loaded canisters were then moved into the canister rack and filled with water. After all the fuel had been recovered and the floor of the dissolver was inspected, the dissolver cell equipment was repositioned in the process cell. This procedure was repeated for the B and C dissolver cells. Forty-nine pieces of N Reactor fuel between 11.4 and 66 cm (4.5 and 26 in.) long were recovered from the floor of the three dissolver cells and loaded into the four canisters. The canisters remained on the canyon deck to await loading into the rail car for transfer to the K Basins. Three pieces of single-pass reactor fuel found in B cell were recovered using the fuel grabber and placed on the canyon deck. One of the four buckets of single-pass reactor fuel was then moved to the canyon deck near the fuel pieces and they were added to the bucket. The bucket was moved back into the basin for storage.

FUEL PREPARATION

Before the PUREX fuel was loaded into the cleaned cask cars, the water in the single-pass reactor fuel baskets and the N Reactor fuel canister was changed to reduce residual contamination. This ensured that the cask car remained relatively clean and reduced the potential for adding contaminants to the K Basins.

The final step in preparing the fuel for transfer involved installing lids on the refilled canisters of N Reactor fuel. The lids were placed in the tool by a nuclear power operator in the rail tunnel and were attached using spring-loaded ball bearings. The crane operator moved the loaded tool to the canisters and lowered the lid into position. The impact wrench rotated the lid locking bar into place, then tightened the nut until the wrench was forced off the nut. The fuel was then ready for transfer.

FUEL LOADING

Loading the fuel into the cask cars was started by removing all the cask lids from the cask cars and placing them on the canyon deck. The

N Reactor fuel canisters were loaded into the first two casks on the first cask car. The single-pass reactor fuel buckets were then loaded into the remaining cask of the first cask car and into the three casks of the second cask car. The cask lids were then installed and the locking lug was engaged using a crane-operated impact wrench. The lids for the rail cars were closed and the cars' surfaces were washed down with soap and water and wiped to remove contamination. Once the cars exited the gate, the train moved down the tracks to the K Basins. Figure 6 shows the rail engine and two cask cars en route to K West Basin. The train's speed was limited to 32 km/hr (20 mi/hr); the 19-km (12-mi) trip took about 45 minutes. The fuel was unloaded at the K Basins and consolidated with other fuel on the Hanford Site.

Disposition Contaminated Organic

Approximately 20,000 gallons of contaminated kerosene-like solvent remained in the plant for which several disposal alternatives were evaluated. The selected option, considered to be the best in terms of safety and cost effectiveness, was to send the solvent to a licensed, commercial facility in Tennessee. This facility generates electricity from the destruction of the solvent.

Disposition of Contaminated Nitric Acid

The original plan to process about 200,000 gallons of concentrated nitric acid, contaminated with uranium, at the PUREX Plant was replaced with a proposal to ship the acid to a facility in England that could use it. The original project baseline for disposition of the excess 10 molar nitric acid was to sugar denitrate the material to approximately 1 molar acid in the PUREX canyon. This action would eliminate the acid, but provide no beneficial use for the material, and could have present and future environmental impacts. Shipping the acid to England saved $37 million and shortened the PUREX deactivation schedule by 10 months.

Westinghouse Hanford Company (WHC) and DOE sought ways to beneficially use the material to avoid processing the acid as waste. Brainstorming sessions were held to seek innovative ways to use the material. With no use for the surplus acid identified within the DOE Complex, private sector interest was solicited. British Nuclear Fuels private limited company (BNF plc) expressed an interest in having the material.

The concept of shipping the acid to England for use in a process similar to PUREX was previously addressed under the NEPA as a Categorical Exclusion or CX. After additional consideration, DOE determined that an environmental assessment would be prepared to evaluate potential environmental impacts.

Stakeholder participation was essential once DOE decided to prepare an environmental assessment on the proposal. An ad hoc review committee, consisting of representatives from three local interest groups, DOE, and WHC, was formed to facilitate document preparation and review The draft document was sent to more than 200 individuals, states, Indian Nations, interest groups and affected members of the public for comment. Preparation, review, and approval of the environmental assessment took many months.

Public meetings were held on the east coast at the three proposed shipping ports: Portsmouth, Virginia; Baltimore, Maryland; and Newark, New Jersey. During the public comment period more than 50 inquiries for information, clarification, or comment were addressed. A Finding of No Significant Impact or FONSI was approved by the Hanford Site Manager in May 1995. Shortly thereafter the first nitric acid shipments were made to England.

Shipping the Acid to England

The shipping containers used to transport the nitric acid from the Hanford Site to England were designed and fabricated to U.S. Department of Transportation (DOT) specifications, International Atomic

Energy Agency (IAEA) requirements, International Maritime Dangerous Goods (IMDG) requirements, and the "Recommendations on the Transport of Dangerous Goods," prepared by the United Nations Committee of Experts. Shipments are designated Radioactive Material, Low Specific Activity per the DOT regulations.

Each shipping container has a maximum gross weight limit of 52,900 pounds. This includes the container's tare weight and the weight of the contents. The tank was sized to accept 3,725 gallons of acid, which meets both weight and filling limits. The shipping containers are designed to withstand radioactivity and corrosivity from the acid.

Prejob safety meetings were held before the containers were loaded with acid. Containers were top-loaded using a dip-leg and external pump. Figure 7 shows PUREX employees loading contaminated nitric acid into a shipping container.

Sixteen shipping containers were used to optimize the shipping schedule in conjunction with BNFL's processing capacity. Before leaving the Hanford Site each tractor, chassis, and shipping container is inspected to defect-free criteria in accordance with the North American Enhanced Container Vehicle Safety Alliance (CVSA) specifications and requirements. This inspection is not required for this type of radioactive shipment. However, it is used to gather transportation data for statistical purposes. The containers are also inspected by the State Police on arrival at the destination port and each state may inspect the shipments as they enter its borders, as it deems necessary.

A safety meeting is held with the drivers before the shipment leaves the Site. Also, although not required by U.S. Department of Transportation regulation or requirements, each shipment is tracked via TRANSCOM (a satellite tracking system) across the continental United State.

Containers are shipped two per week. They are dispatched from the Site four hours apart, bound for one of the three possible shipping ports. To date, only Portsmouth, Virginia has been used to ship the loaded containers to England and return the empty containers to the United States.

Each week the two containers are loaded onto a ship bound for England. The containers are offloaded at Felixstowe, England, placed on rail cars, and sent to Sellafield. The contents of the containers are offloaded and used in BNF plc's B205 Magnox Fuel Reprocessing facility at Sellafield.

Each round trip from the Hanford Site to Sellafield, England and back takes 56 days. Fifty shipments totalling 187,000 gallons of acid were made. This activity was completed 6 weeks ahead of the December 31, 1995 goal.

Glovebox Stabilization

An important part of the PUREX Transition Project is the cleanout and stabilization of gloveboxes in the PUREX N Cell to remove plutonium oxide powder left from past processing. It was recognized from the start that performing this hazardous work safely would require a dedicated, experienced PUREX crew, well-planned procedures, and careful preparation.

The N Cell area of the PUREX plant contains a series of gloveboxes that house equipment that was used to process concentrated plutonium nitrate into plutonium oxide for shipment out of the plant. The plutonium nitrate was first mixed with oxalic acid to form a plutonium oxalate precipitate. The precipitate was filtered out of solution then converted to plutonium oxide in a two-stage calcination process. The plutonium oxide product was screened, blended, and packaged into cans for shipment out of the plant.

As part of deactivation, small equipment and piping are being disassembled and removed from the gloveboxes to reduce the residual plutonium inventory. The equipment has been rinsed, but it is still highly contaminated with plutonium.

The following bagout procedure is used to prevent contamination spread when removing disassembled equipment from the gloveboxes. Before bagout, the equipment is carefully wrapped in plastic with all sharp corners padded to prevent tears in the bags. The equipment is then placed into a large plastic bag that has been attached to a bagout port. The bag with the equipment inside is pulled out of the glovebox through the bagout port. Once the equipment is outside the glovebox, the bag opening is tightly taped shut. Then the bag is carefully cut in the center of the taped section so that both sections of the bag are still sealed. A damp rag is placed over the taped section as the cut is made to contain contamination. More tape is quickly placed over the cut section of the bag to provide additional contamination control. Gloves and the taped part of the bag are surveyed for contamination before proceeding. The bagged-out equipment is placed in a second bag inside a plastic container and labelled. A new bag is placed on the bagout port over the cut stub of the bag that is left from the bagout. The bag stub is then worked off the bagout port and pushed into the glovebox. The new bag is now ready for the next bagout.

The bagged-out equipment is moved to the assay station in the PUREX canyon lobby where it is placed in a transuranic waste drum. The drum is assayed for fissile material using a segmented gamma scan assay system. The drum rotates as it is slowly moved up and down past the gamma detectors. A computer produces a profile of the drum indicating the amount of fissile material in different segments. After the assay is complete, the full waste drums are sealed and shipped to the transuranic waste storage area. More than 700 bagouts were safely completed and about 4 kilograms of plutonium removed from N Cell. Figure 8 shows a project metric used to track progress on removing plutonium contaminated waste from the gloveboxes.

The inventory of plutonium remaining in the gloveboxes is estimated using portable NDA equipment. A series of readings is taken across the face of each glovebox with a gamma detector and the results are used to calculate the mass of plutonium inside the glovebox. After the small equipment and piping have been removed from the gloveboxes, large equipment will be disassembled when possible and also removed from the gloveboxes. Some of the larger equipment will be cut into smaller pieces to permit removal through the bagout ports. Then the interior surfaces of the gloveboxes and the equipment left inside will be decontaminated by wiping with damp rags. Residual contamination will be fixed or stabilized in place with paint. Penetrations into the gloveboxes will be sealed and the gloves replaced with pie-pan covers. The gloveports will be further sealed with heat-shrink material. As a final step, the glovebox ventilation system will be shut down and isolated from the gloveboxes.

Other glovebox areas, including Q Cell and the Product Removal (PR) room, were also deactivated.

Canyon Vessel Flushing

One of the final steps in PUREX deactivation is flushing the canyon vessels and piping; areas contaminated with radioactive and chemical materials.

Close interactions between DOE and WHC and the regulatory agencies helped determine the most appropriate and cost-effective ways to meet environmental requirements. In flushing contaminated tanks, for example, instead of flushing and sampling each tank individually, a new approach is being used that saved both time and money. Flush solutions are cascaded from tank to tank, then sampled. Flushing continues until samples show that the dangerous waste has been removed.

After flushing is complete, the flushed material went to the underground waste tanks and appropriate utilities can be isolated or capped to prevent any material from flowing into or out of the plant.

Deactivation activities include flushing those tank systems that contained hazardous waste. To reduce the amount of waste water generated, innovative flushing methods are used. The first method involves using waste waters as flush water. The second method involves cascading flush waters through entire process loops instead of flushing each tank individually.

Spent nuclear fuel was routinely stored, under water, in a slug storage basin located inside the PUREX facility. Water in the slug storage basin that was used for storing the aluminum-clad fuel was used to support flushing the U cell vessels. This innovative use of the slug storage basin water for canyon vessel flushing reduced liquid waste volumes by 18,939 liters and helped to reduce the plant radiological inventory.

Tank systems located within process cells are connected through a series of pipe "jumpers" that allow for remote operation. Deactivation of the facility included flushing these systems. Wherever possible tank systems that required flushing were interconnected into loops, which allowed several vessels (tanks, pipes, equipment, etc.) to be flushed using the same flush water. Flush waters were sampled for hazardous characteristics at the end of the loop. By flushing 16 loops, 78 vessels were cleaned to levels below regulatory concern. Compared to the amount of waste that would have been generated by flushing each tank individually, these methods eliminated approximately 200,000 gallons of waste water.

HVAC Consolidation

Also during deactivation, emissions currently discharged through 11 ventilation stacks will be consolidated and discharged through the PUREX main stack.

PUREX Transition Project Successes

During the past 3 years, the project has accomplished a number of key successes. Many of these successes are documented in the lessons-learned document. They include those discussed in the following paragraphs.

Used Project Model. Using a project structure improved the efficiency in performing deactivation work. The organization structure was changed from functional lines of authority to a project-oriented structure culminating in reengineered work teams. These teams are designed to change the mindset that management needs to approve all work and emphasize that the worker has authority and assumes responsibility for his own work. Work teams perform activities within the bounds of clearly defined project goals. Finally, the project has defined start and end dates (October 1, 1993 and September 12, 1997, respectively).

Managed Risk vs. Zero Risk. Deactivation activities were screened against regulations and safety documentation. In most cases it was demonstrated that the deactivation task was bounded by preexisting documentation. This managed the risk and eliminated the need for additional controls or documentation.

Developed Team Approach. From the beginning project personnel stressed using a team approach to resolve project issues. This concept was called the "Troika," which jointly involved DOE Headquarters, the DOE Richland Operations Office (RL), and WHC project managers. The project team also included independent technical experts, stakeholders, and regulators. Involving these team members greatly improved the resolution of project issues.

Identified Innovative Solutions. Innovative solutions to project issues such as the following activities significantly improved project performance by saving $68 million and shortening the project duration by 10 months.

- Nitric acid sale to BNFL
- Chemical reuse and recycle
- End-point process
- Tri-Party Agreement milestones

Integrated Safety into Field Work. Using a graded approach, safety and health was integrated into every aspect of field work. Improved safety awareness was accomplished without delaying field work. During the project, PUREX Personnel worked 902,000 hours without a lost work day case. Resulting safety and health improvements are documented in the *Integrating Safety and Health During Deactivation With Lessons Learned*.

Emphasized Communications. Communication among facility personnel, stakeholders, and regulators was stressed throughout the project. This improved the level of understanding and acceptance of many individuals. In many cases skeptics evolved into project champions.

Conclusion

During the early planning of the PUREX transition project, waste minimization/pollution was emphasized as a primary way of doing business. These waste minimization concepts are ingrained in the way we think. Successful waste minimization efforts employed during the PUREX project have demonstrated that waste minimization pays. Over $68 million were saved by implementing project management techniques, waste minimization concepts, and innovative technical solutions during the PUREX project. The PUREX deactivation project is truly a waste minimization project.

We put enormous care and effort into developing and implementing the PUREX/UO_3 Deactivation Plan. We looked at every piece of work in terms of resources, benefits, and, most of all, safety—the safety of employees, the environment, and the public.

The PUREX/UO_3 Transition Project was set up to be managed as a troika that includes DOE Headquarters, RL, and WHC. This, coupled with ongoing interaction between employees, stakeholders, and regulators has allowed a managed-risk approach to deactivation. The team approach has been stressed from the field level to top management.

We will continue to involve our regulators and the public over the life of this project. We want to make sure that the project meets every applicable standard of public and environmental safety and addresses the expectations and values of the public.

The deactivation of the PUREX and UO_3 plants gives the DOE a golden opportunity to reduce potential environmental and health hazards and save money at the same time.

These are the first facility deactivations in the Energy Department nuclear complex. We are breaking new ground, and we want to do it right. It is important not only to the people concerned about Hanford Site cleanup, but to the entire nation.

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4. DOE/EA-1005, *Environmental Assessment Disposition and Transportation of Surplus Radioactive Low Specific Nitric Acid*, Hanford Site, Richland, Washington, U.S. Department of Energy.

5. WHC-SA-2960-FP, *Disposition of PUREX Contaminated Nitric Acid - The Role of Stakeholder Involvement*, W. G. Jasen and R. A. Duncan, Westinghouse Hanford Company.

6. DOE/EH-0486, *Integrating Safety and Health During Deactivation With Lessons Learned From PUREX*, September 29, 1995, U.S. Department of Energy.

Figure 1. PUREX Deactivation Model.

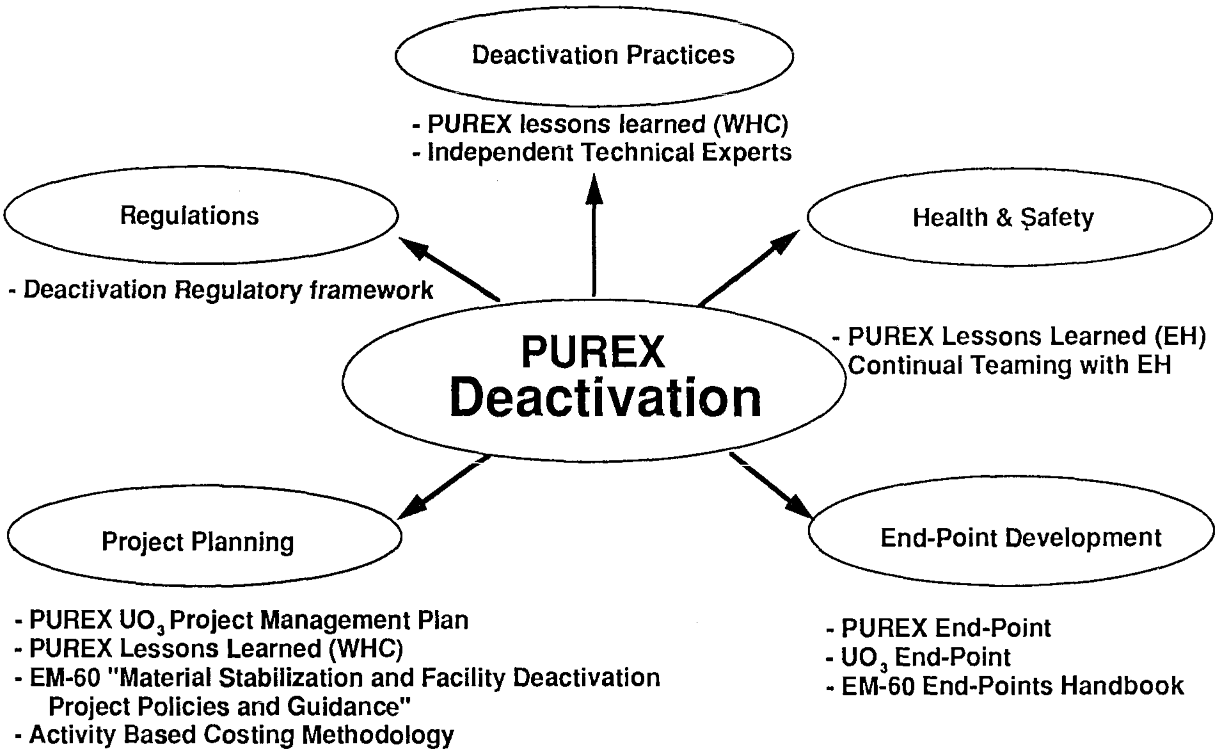

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Figure 2. Schematic of the PUREX Facility.

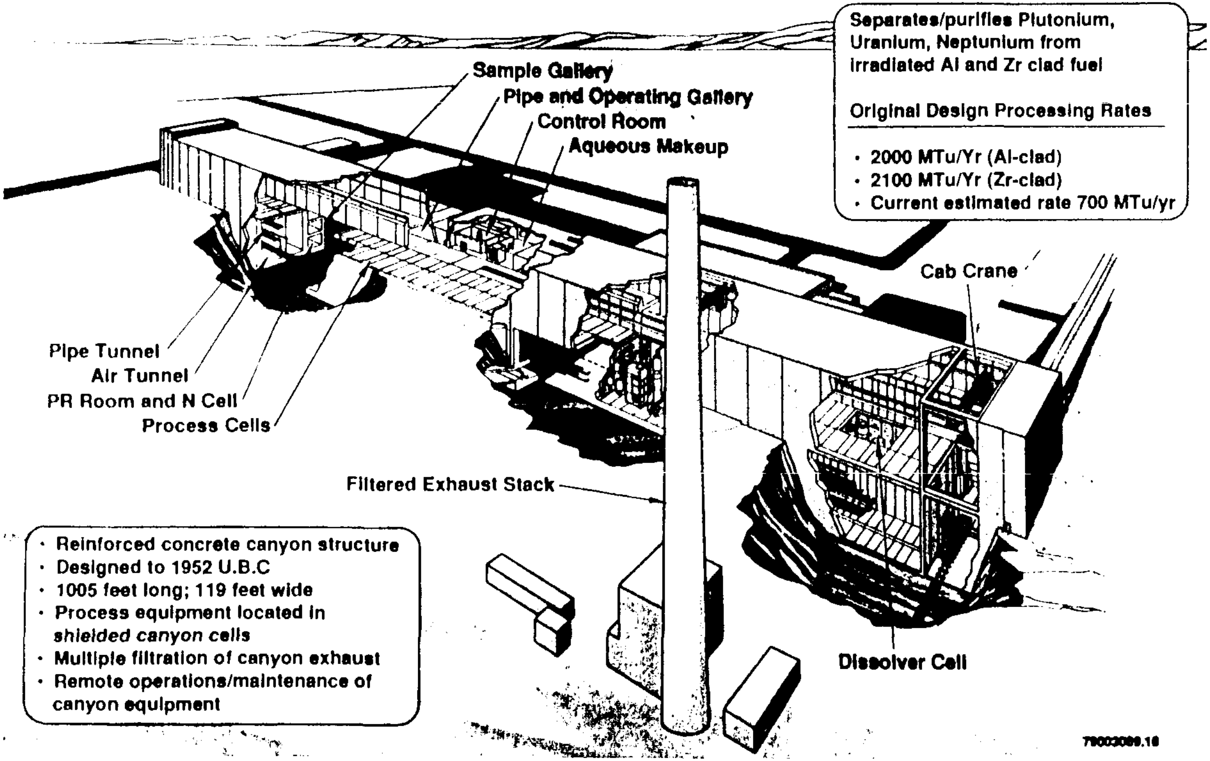
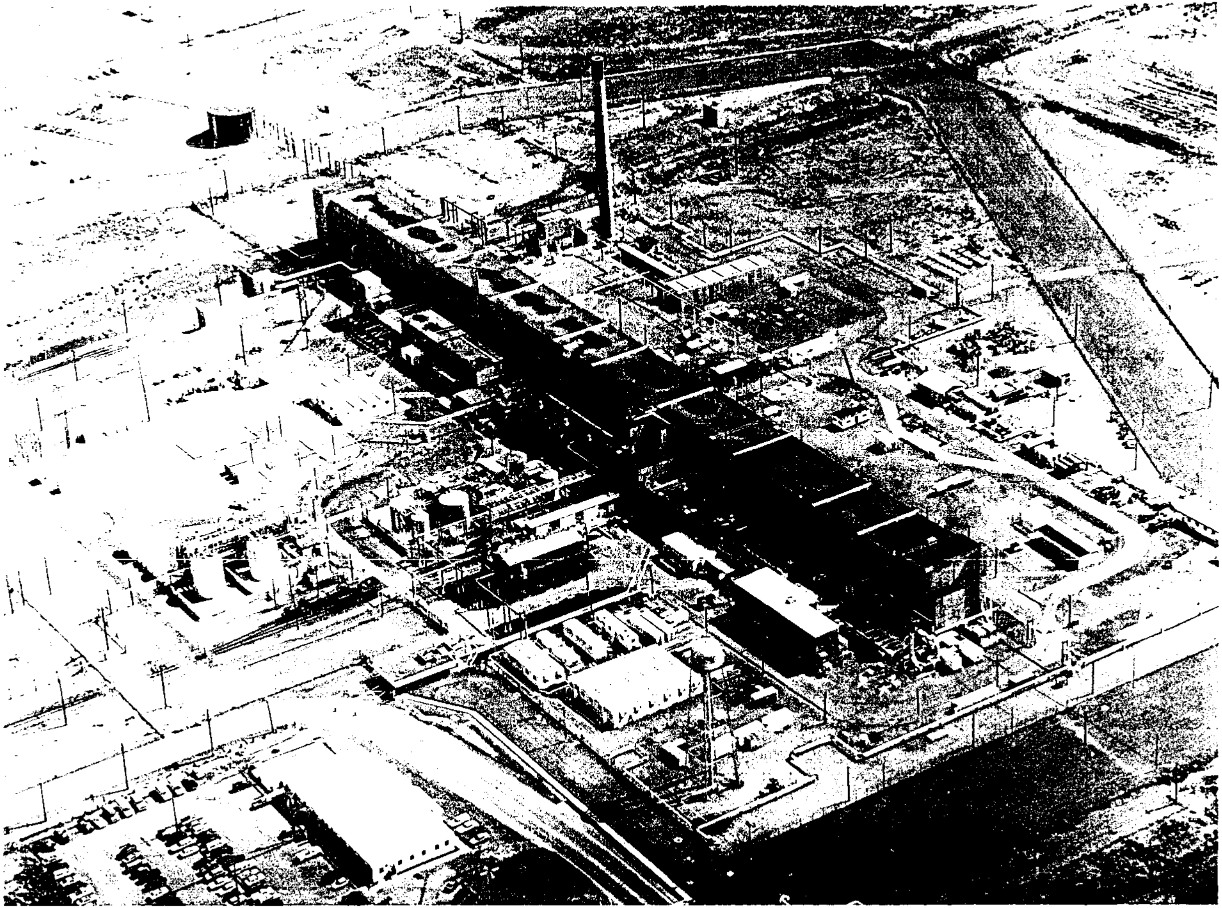


Figure 3. PUREX Facility Aerial View.



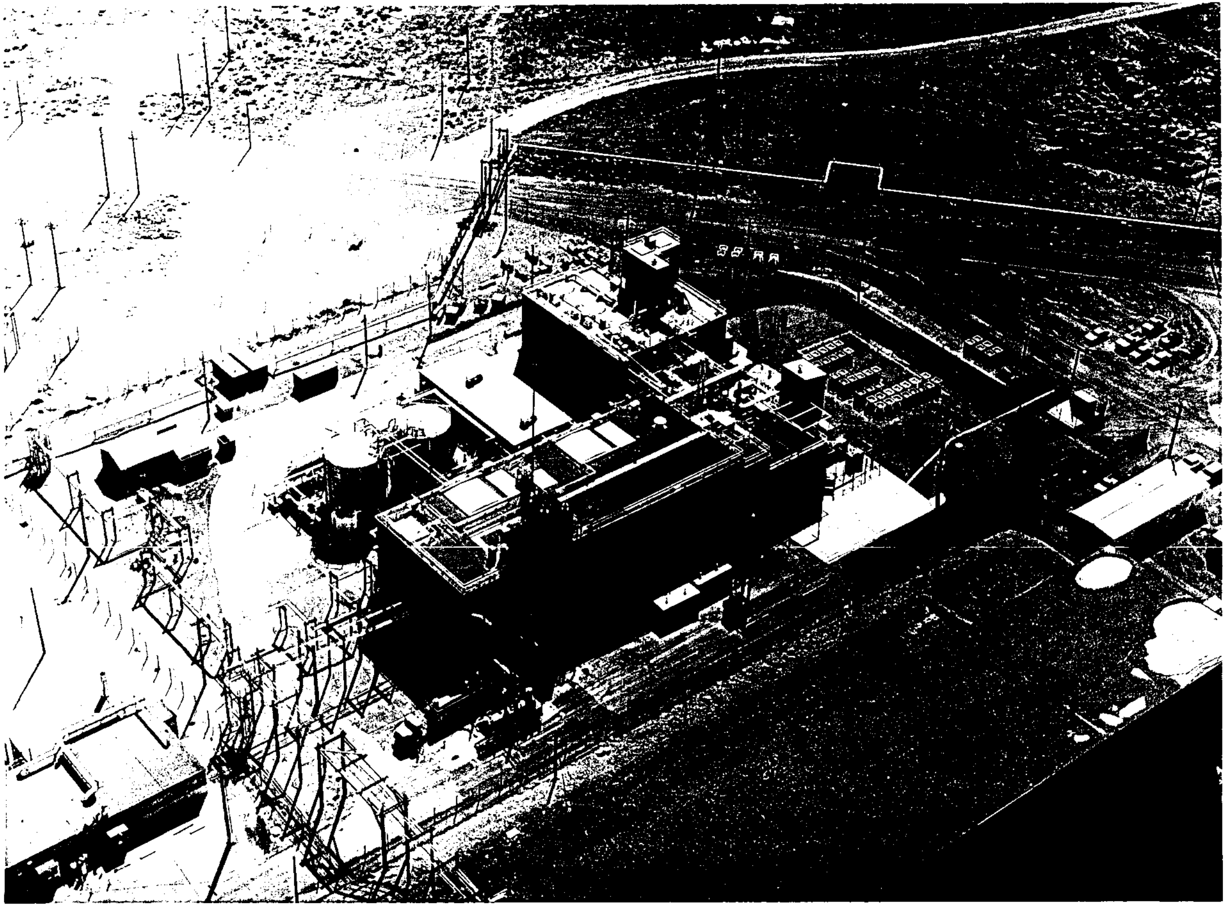
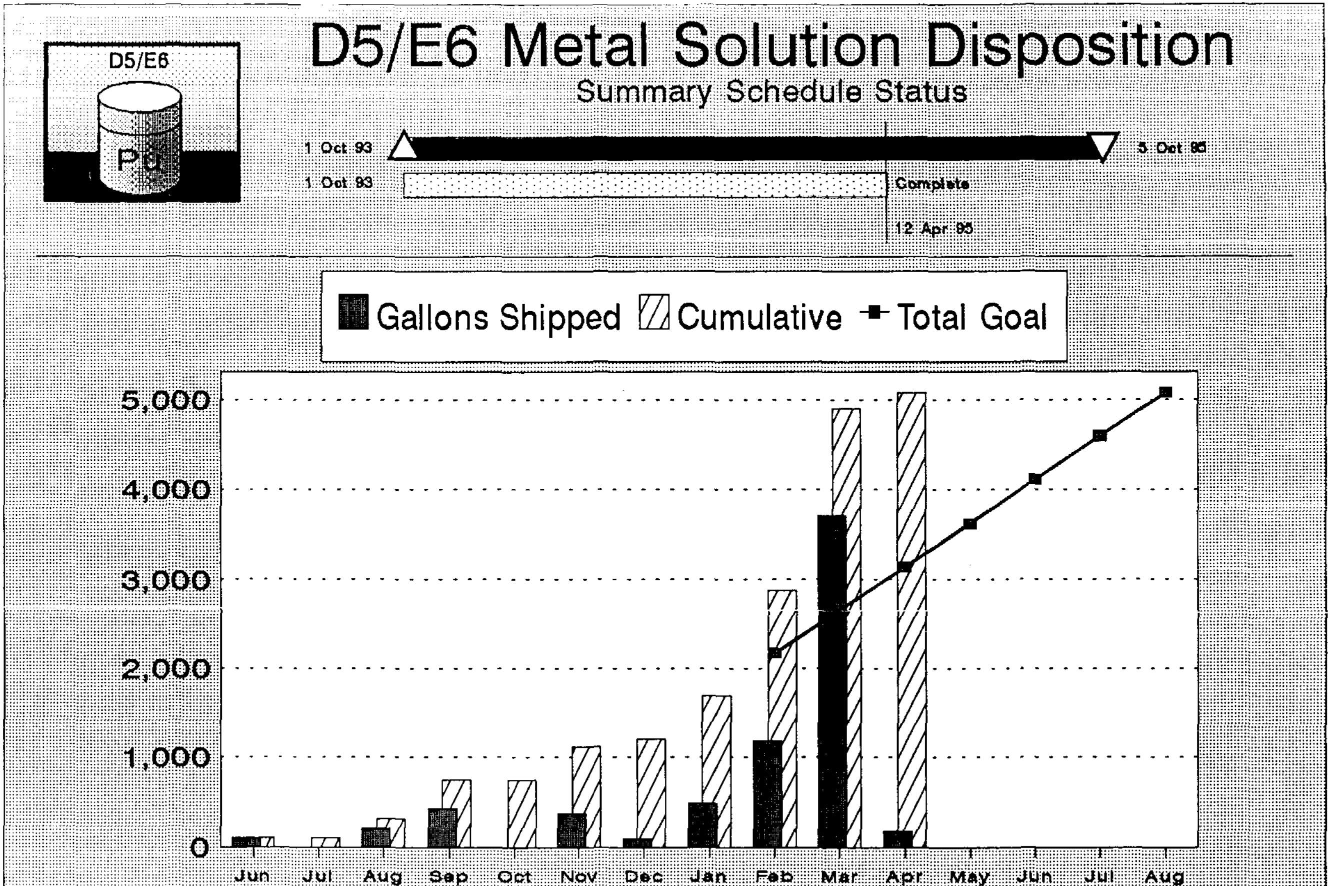


Figure 4. UO_3 Plant Aerial View

Figure 5. Project Metric Showing Plutonium Solution Transfers.



	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Gallons Shipped	106	0	212	424	0	371	93	484	1,187	3,715	175				
Cumulative	106	106	318	742	742	1,113	1,206	1,690	2,877	4,902	5,077				
Total Goal									2,174	2,658	3,142	3,626	4,110	4,594	5,077

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Figure 6. Engine and Two Cask Cars Containing Spent Fuel En Route to K West Basin.

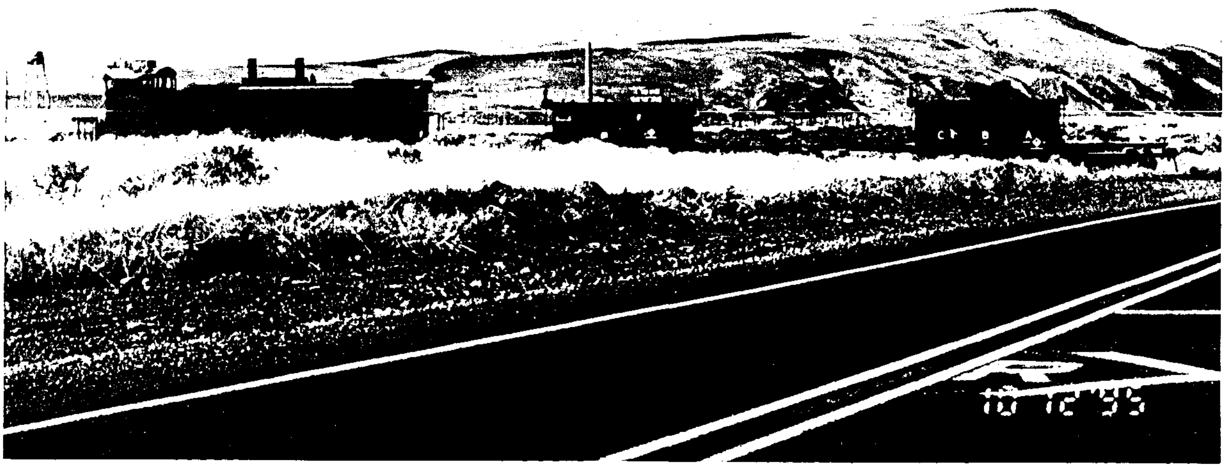
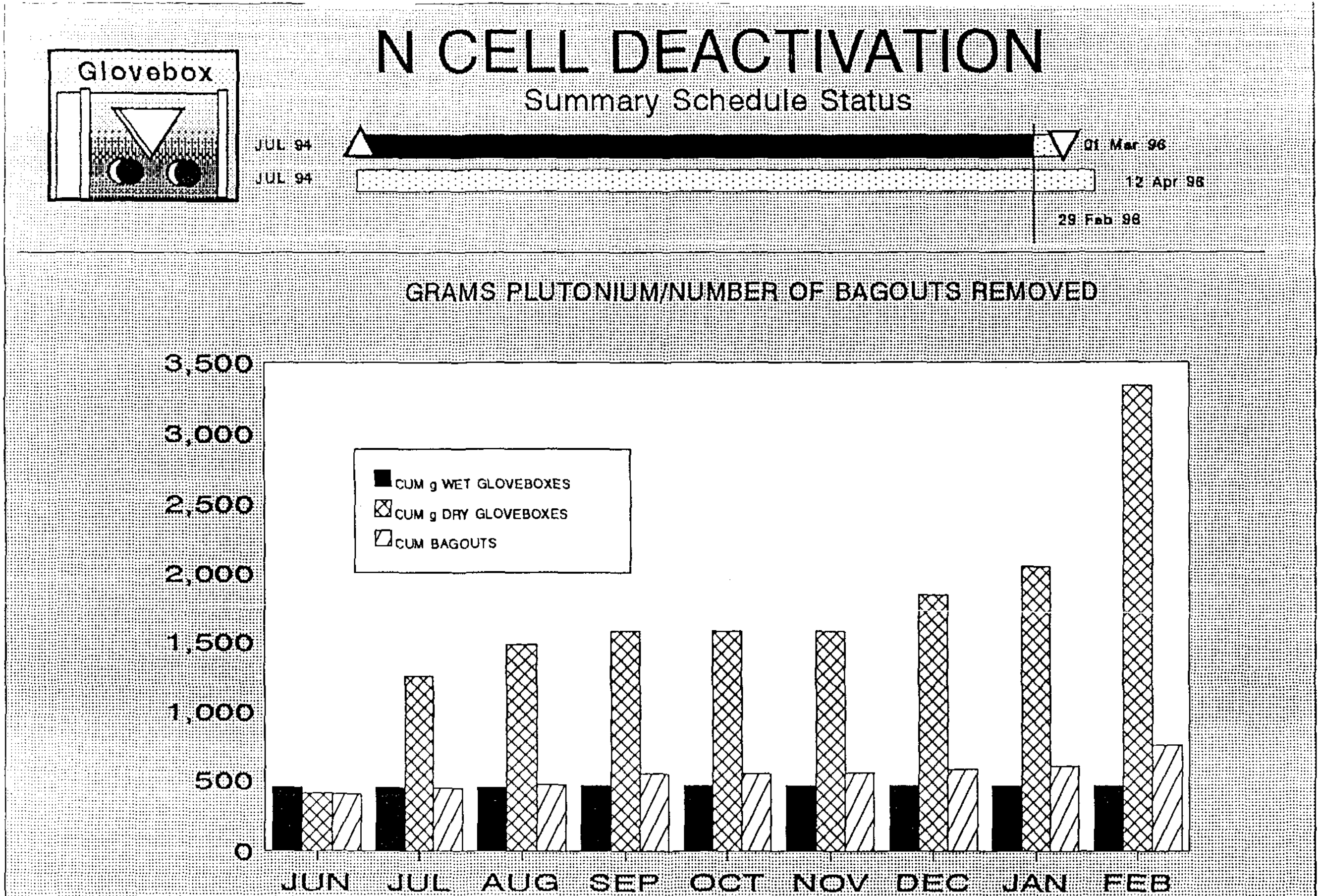


Figure 7. PUREX Employees Loading Contaminated Nitric Acid into a Shipping Container.

Figure 8. Project Metric Showing Removal of Plutonium from N Cell.



	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB
CUM g WET GLOVEBOXES	448	448	448	462	462	464	464	464	464
CUM g DRY GLOVEBOXES	409	1,257	1,482	1,579	1,579	1,579	1,845	2,054	3,337
CUM BAGOUTS	401	445	468	548	548	555	581	604	755

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