

## **DESIGN/CONSTRUCTION OF A REMOTE-HANDLED WASTE FACILITY AT THE WEST VALLEY DEMONSTRATION PROJECT**

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### **ABSTRACT**

The Western New York Nuclear Service Center (WNYNSC) is located in West Valley, about 30 miles (50 kilometers) south of Buffalo, New York. It is the site of the only commercial nuclear fuel reprocessing facility ever to have operated in the United States. The plant was in operation from 1966 to 1972 and during that time generated approximately 600,000 gallons (2,270 cubic meters) of high-level liquid radioactive waste. On October 1, 1980, President Carter signed into law the West Valley Demonstration Project (WVDP) Act. The Act directs the Secretary of Energy to conduct a high-level radioactive waste management demonstration project at the WNYNSC. The WVDP is managed by the Department of Energy (DOE) and is operated by West Valley Nuclear Services Company (WVNSCO). WVNSCO is part of the Energy and Environment unit of Washington Group International, Inc. Part of the mission of the WVDP is to dispose of low-level waste (LLW) and Transuranic (TRU) waste resulting from high-level waste (HLW) solidification and the decontaminating and decommissioning of the facilities used for HLW solidification. Decontamination activities will generate additional LLW and TRU waste also requiring disposal at off-site locations.

Over the last 20 years, facility operations and decontamination and deactivation (D&D) activities at the WVDP have resulted in the removal of a wide variety of high-dose and highly contaminated vessels, piping, and equipment. As items were removed, the waste materials were placed in a variety of convenient containers because disposal locations and packaging requirements were not known. These shielded TRU and LLW waste containers are currently stored on site and will require varying degrees of sorting, resizing, and repackaging prior to off-site shipping and disposal. Because of the high dose rates and high contamination levels, these wastes must be processed in a shielded facility outfitted with extensive contamination control features. The processing work to be done will be completed in the most cost-effective manner possible if the work is conducted in a facility expressly designed for sorting, resizing, and repackaging. These considerations led DOE to design procure, and construct the Remote-Handled Waste Facility (RHWF).

The highly radioactive waste items will be moved inside the RHWF to be prepared for off-site shipping and disposal. This preparation includes lifting, opening, inspecting, sampling, size reducing, segregating, and packaging, among other operations. Operators remotely perform the work using state-of-the-art overhead and wall-mounted cranes, floor conveyors, and powered dextrous manipulators with replaceable end effectors — all within the RHWF's shielded Work Cell. Operations are supported by advanced sensor, optical and control device technologies. The RHWF includes the latest industry features, equipment and technologies to maintain and monitor safe, efficient operations.

A benchmarking study completed by project personnel shows that the RHWF is a unique collection and arrangement of remote handling technologies within the DOE complex. It handles a broad range of incoming waste streams (with varying waste type, size, weight, contamination levels) to meet the needs of the WVDP. It also has designed-in features that allow for future expansion of processing capabilities, if

needed. The RHWF is similar in purpose to facilities owned and operated by British Nuclear Fuels Limited (BNFL) at Sellafield, England. However, the RHWF remains unique in terms of the size and weight of waste components handled, and the type of disposal containers used and their method of loading. The components installed for bagless transfer of waste-filled boxes out of the facility is particularly unique.

Other DOE sites have identified the need to perform many of the functions of the RHWF. Savannah River, Oak Ridge, Hanford and Idaho sites all have retired nuclear processing facilities with large inventories of obsolete, inactive, and highly contaminated piping, tanks and nuclear process equipment. It is envisioned that eventually these wastes will need to be handled and packaged for disposal. By beginning such remote handling operations years before anyone else in the DOE Complex, the RHWF will be in position to demonstrate the technologies and lessons-learned to the other DOE sites. The design of the RHWF was completed in 2001 and construction will be completed in early 2004. The facility is scheduled to begin radioactive operations in June 2004.

## INTRODUCTION

Thirteen separate waste streams have been identified as needing remote processing at the WVDP. Much of this waste was not fully characterized at the time it was packaged in the 1980s and the containers do not meet current transportation regulations. Some of the waste was packaged in large unshielded containers requiring significant remote handling to prepare this waste material for shipping. In order to accommodate the interim storage of vitrified High-Level Waste (HLW), it was necessary to decommission and decontaminate the remotely operated Chemical Process Cell (CPC) in the former spent fuel reprocessing facility at the WVDP. In refurbishing the cell, significantly contaminated vessels, materials, and piping systems were removed, packaged into 22 steel waste boxes and stored in the Chemical Process Cell/Waste Storage Area (CPC-WSA) awaiting future size reduction and repackaging. Two of the boxes contain spent nuclear fuel (SNF) dissolvers that have high exposure rates (~107 R/hr) and high contamination levels (>1E+06 dpm/100cm<sup>2</sup>).

The type of waste to be processed in the RHWF are provided in Table I. After processing, the bulk of the waste is expected to be classified as LLW, contact-handled transuranic (CH-TRU), remote-handled transuranic (RH-TRU) and small amounts of mixed low-level waste (MLLW).

Table I Waste to be processed

X	Cylindrical vessels
X	Jumpers (piping rigged for remote installation)
X	Long shafted Waste Tank Farm pumps
X	HEPA filter encased in grout
X	Spent resins
X	Water filters
X	Crane components
X	Electrical components
X	Scrap metal and floor debris
X	Wood cribbing and Herculite sheeting
X	Hazardous constituents such as lead, mercury and PCBs

The Remote-Handled Waste Project (RHWP) was created to develop and implement a strategy to meet the need for a remote-handled waste processing system. The initial development of the project was enhanced through the establishment of an integrated team approach that had been initiated at the WVDP in 1996. The

RHWP was one of the first large project applications of this approach at the WVDP and included establishing a full-time core team and a part-time expanded team to include all needed disciplines and expertise.

Out of the many possible processing strategies for the remote-handled waste, it was concluded that a “ship as-is” strategy was not viable for the CPC/WSA waste due to the need to open containers in a shielded area for final characterization, the need to design and license a new type B shipping container, and the fact that there is no alternative DOE site identified to receive and further process such material. Therefore, an on-site remote processing system was required.

The team evaluated location alternatives for this on-site remote-handled waste system. The initial alternatives screening looked at the use of existing facilities on-site, as well as construction of a new facility. Several existing facilities were considered. Each of these provided one or more attractive features in the form of existing cranes, ventilation, space or low contamination levels. In the final analysis, the detailed comparisons, technical evaluations and cost studies concluded that a new stand-alone facility was the most economical way to process the waste.

The conceptual design process for the new facility took several iterations and two years to complete. During that time, WVNSCO completed a benchmarking study, a siting evaluation, a value engineering study, and two formal design reviews. WVNSCO design reviews and evaluations utilized experts from across the DOE complex, private industry and independent consultants.

The benchmarking study completed by project personnel shows that the RHWF is a first-of-its-kind within the DOE complex. It is a full-scale production facility with integrated applications of waste handling and management technologies. It handles a broad range of incoming waste streams (with varying type, size, weight, contamination levels) to meet the needs of the WVDP. It also has designed-in features that allow for future expansion of processing capabilities, if needed. The RHWF is similar in purpose to benchmarked facilities owned and operated by BNFL at Sellafield, England. However, the RHWF remains unique in terms of the size and weight of waste components handled (BNFL typically handles bucket and drum-sized packages) the type of disposal containers used and their method of loading (Washington Group International has designed a first-of-its-kind process for loading rectangular boxes).

The benchmarking study also looked at other facilities in the DOE Complex including the Transuranic Waste Remediation Facility (TWRF) at Oak Ridge National Laboratory and the Advanced Mixed Waste Treatment Facility (AMWTF) at the Idaho National Engineering and Environmental Laboratory.

The TWRF includes wet waste processing (sludges/supernatant), as well as solid waste processing. The solid waste is comprised of contact-handled TRU/LLW and remote-handled TRU/LLW, similar to the RHWF. However, the TWRF waste has a higher fraction of compressible waste such as paper, cloth and plastic. Therefore, TWRF utilizes a compactor for most of the solid waste. The majority of RHWF wastes are non-compressibles. Unlike the RHWF, TWRF has no decontamination system, but the TWRF does include Resource Conservation and Recovery Act (RCRA) waste treatment technologies such as microencapsulation, macroencapsulation and mercury amalgamation, which are not required in the RHWF.

The AMWTF is a large, multifunctional processing facility that will handle more than 3 million cubic feet of varied waste including metal debris, graphite, organic debris, heterogeneous debris, inorganic debris, ceramic debris, paper, rags, plastic, rubber and soil. In addition to the facility size and waste inventory differences, the processing technologies are substantially different from RHWF. AMWTF includes a shredder, multiple gloveboxes, a macroencapsulation system, a supercompactor, and an active-passive

neutron assay system. The facility also includes an analytical laboratory and utility building dedicated to the AMWTF.

## **FACILITY DESIGN**

The design of the facility provides the capabilities to sort, segregate, size reduce, and repackage all 13 remote-handled waste streams in a single, stand-alone facility. When completed, the facility will operate for approximately six years to process approximately 75,000 cubic feet (2,124 cubic meters) of waste. The resultant processed waste containers will be characterized as LLW, mixed LLW, or TRU waste and will meet the waste acceptance criteria for the applicable waste disposal site.

The RHWF is designed to safely handle and process nuclear waste material with high dose rates and high levels of radioactive contamination. Such highly radioactive waste items (which include such items as tanks, piping, and equipment) are moved inside the facility to be prepared for off-site shipping and disposal. This preparation includes lifting, moving, characterizing, sampling, cutting into smaller pieces, and packaging, among other operations. To maintain the safety of the operators, the majority of these operations are performed in a hands-off manner (i.e. "remotely.") The operators perform their work using custom robotic tools and devices installed in the facility's main shielded Work Cell. These tools and devices are controlled from work stations on the opposite side of thick shield windows and reinforced concrete walls.

The RHWF will handle, characterize, cut up and package highly contaminated obsolete and inactive nuclear process equipment, components, and materials. To accomplish this, the facility is designed with state-of-the-art overhead and wall-mounted cranes, floor conveyors, and powered dextrous manipulators with varied replaceable tool heads. Operations are further supported by advanced sensor and control device technologies. The facility also includes the equipment and technologies to maintain and monitor safe and efficient operations.

The main process flow for the RHWF is through a central corridor of three connected rooms: the Receiving Area, the Buffer Cell and the heavily shielded Work Cell. These rooms are built with 30-inch-thick (76-centimeter-thick) reinforced concrete walls for shielding and are separated from each other by heavy, movable doors. Packaged waste materials exit the Work Cell through the Waste Packaging System to the Load-Out Truck Bay. Other support areas of the facility include maintenance rooms, sampling stations, operating areas, and an attached office area. Overall, the footprint of the facility is about 190 feet by 90 feet (58 by 27 meters). The four main areas within the RHWF are described below.

### **Receiving Area**

- X Purpose: Receive containers of waste transported in a shielded transport trailer, or an open trailer, or with a custom-made shielded forklift. Allows shielded and contained movement of waste into the facility. Performs dual duty as the clean bridge crane storage and maintenance area. Acts as a secondary buffer area to ensure confinement of radioactive contamination. Provides weather protection for unloading transport vehicles.
  
- X Physical Description: Sufficient area to accommodate the largest waste box (except for the Waste Tank Farm mobilization pump box). A sheet metal building extension allows an uncoupled full-length trailer to be parked inside, protected from the elements. The floor of the Receiving Area is at grade to allow containers to be rolled off a transport vehicle onto the roller conveyor on the floor of the Buffer Cell, which is at an elevation of 4 feet (1.2 meters). A second roll-up door allows access for unloading containers with a shielded fork lift.

- X Major Equipment: The clean 20-ton (18-metric ton) bridge crane can travel the full length of the Receiving Area (and into the Buffer Cell). Tall shielded sliding equipment doors and horizontal swinging contamination control doors separate the Receiving Area from the Buffer Cell. A powered roller conveyor transfers containers into the Buffer Cell.

### Buffer Cell

- X Purpose: Acts as an airlock between the Receiving Cell and the highly contaminated Work Cell. Allows contained movement of waste containers into the Work Cell with some shielding provided. May be used for dual duty as a radiologically controlled area for contact-handled operations such as repackaging, overpacking, or removing large-sized waste boxes when radiological conditions do not mandate remote handling operations.
- X Physical Description: Space with sufficient area to accommodate the largest waste box. The floor of the Buffer Cell is at the same height as the floor of the Work Cell to allow waste containers to be remotely moved inside using the powered roller conveyor.
- X Major Equipment: The clean 20-ton (18-metric ton) bridge crane can travel the full length of the Buffer Cell. A powered roller conveyor transfers containers into the Work Cell. A shield window is located in the east wall and allows direct observation of operations within the Buffer Cell. At both ends of the Buffer Cell, shield doors (two levels high) and horizontal swinging contamination control doors separate the Buffer Cell from the Receiving Cell and the Work Cell.



Fig. 1

## Work Cell

- X Purpose: Primary work zone within the RHWF for fully remote handling, surveying, segmenting, decontaminating, and repackaging operations.
- X Physical Description: Shielded space (55 feet long by 22 feet wide by 26 feet high [17 by 7 by 8 meters] to the bridge crane rails) with sufficient area to work on the largest and longest waste boxes, including a 50-foot-long (15-meter-long) pump box from the Waste Tank Farm. Space is provided to operate at two work stations. There is also additional space for staging incoming waste containers and temporary storage of waste disposal drum or box liners. A Crane Maintenance Area is accessible to personnel on the ground level and on the third level.
- X Major Equipment: Powered roller conveyors move containers into the Work Cell. There is a 30-ton (27-metric ton) bridge crane with rails that extend the full length of the Work Cell and two PaR arms on telescoping masts supported by a second bridge crane. One jib crane with a PaR arm can be moved on rails installed along the wall. These cranes allow movement of the PaRs anywhere in the cell. The PaR arms are the remote handling equipment that operate a full range of fixtures and tools for handling, surveying, segmenting, and repackaging waste. Portable work platforms allow simultaneous waste processing operations for two operators. The work platforms are directly above the 24 primary high-efficiency particulate air (HEPA) filters. The major air flow in the Work Cell is exhausted from the work platform area, drawn through the filter intake housing positioned along the north wall, and then ducted to the heating, ventilation, and air conditioning (HVAC) secondary filter system located on the first level below the Operating Aisle.

Operator Control Stations are located at the two shield windows located in the east wall. These allow direct observation of operations across the Work Cell. A station is located at a third shield window in the south wall for operation of the bagless transfer system in the southeast corner of the Work Cell. This station is designed to load out a 55-gallon (208-liter) drum liner and a B-25 box (4 feet by 4 feet by 6 feet, [1.2 meters by 1.2 meters by 1.8 meter]) liner. This shield window also allows a direct observation down the full length of the Work Cell. This window will also be used when a remote radiation survey of a waste item in the survey/sample area is performed behind the survey shadow shield. An ion exchange system is located on the south end of the cell for processing water that is used for decontamination of the Work Cell between waste campaigns and decontamination of the cranes prior to hands-on maintenance.



Fig. 2

### **Waste Packaging System (WPS)**

- X Purpose: The WPS is an essential part of the RHWF. It provides a physical shielded boundary and a method to remove liners filled with sorted and segmented waste items from the Work Cell. The liners are then placed into containers that meet shipping and storage requirements without having to bag out each liner (i.e., bagless transfer). The WPS is standardized to 55-gallon (208-liter) drums for TRU and B-25 boxes for LLW.
- X Physical Description: The WPS is located inside the south end of the RHWF at ground level. It consists of an enclosure that is made of 6-inch-thick (15.2-centimeter-thick) carbon steel, and is equipped with shield covers on top for the drum and box ports and shield doors on the east wall for the drum and box transfer carts.
- X Major Equipment: Other items inside the WPS include a Box Transfer Port, a Drum Transfer Port, a Box Transport Cart w/Lift Table & Turntable, a Drum Transport Cart with Lift Table, and miscellaneous equipment to take swipe samples and dose readings.

### **TURNKEY PROCUREMENT**

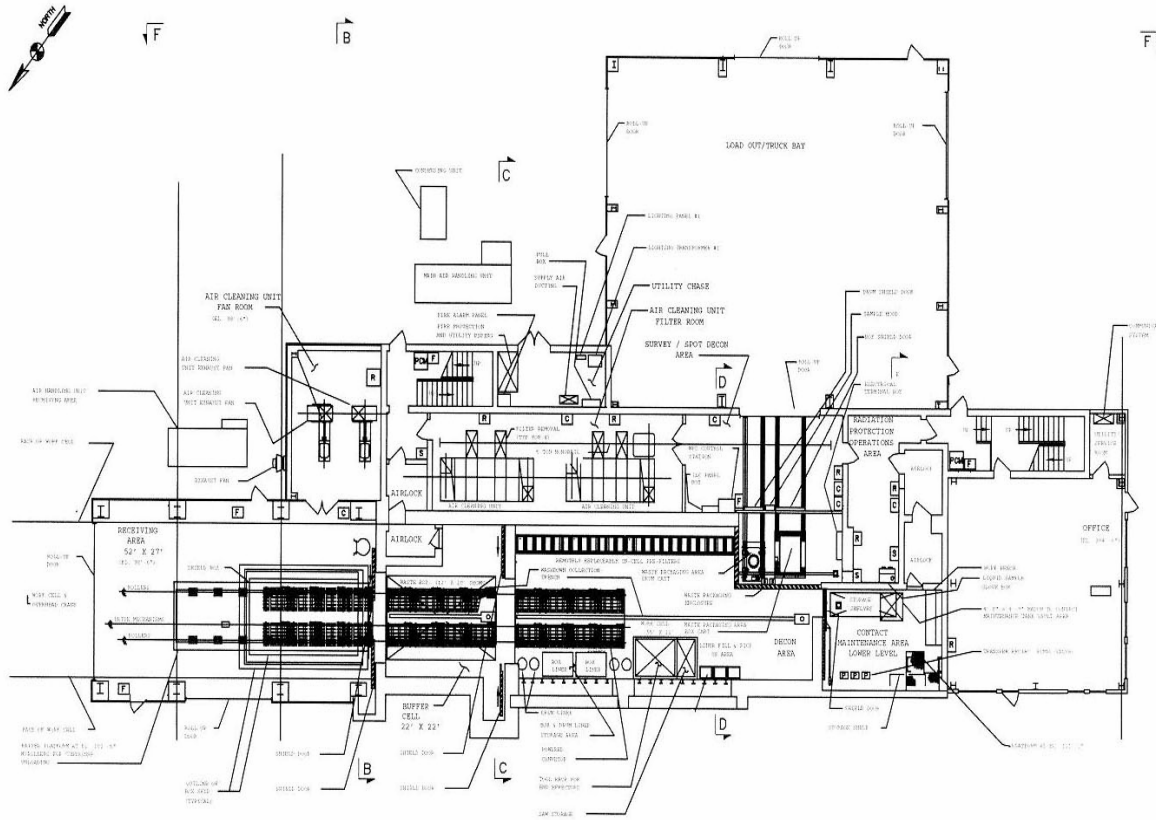
The WVDP objective for procurement of the RHWF was to contract with private industry for services necessary to provide the new on-site facility. The contract was to include the installation and functional testing of all equipment necessary to process a predefined set of radioactive waste streams for packaging, transporting, and off-site disposal.

A project team was formed to accomplish the task of preparing a bid package for a “turnkey” contract to design, construct, commission, and start-up of a new RHWF. The project team’s charter was to assist with the development of the bidder’s list, establish the prequalification evaluation criteria to evaluate the Technical Proposals to determine which bidders met the minimum technical requirements, and prepare a schedule. The team also provided the framework of the planned two-step approach for the acquisition process.

Based upon the necessity to perform evaluation of prior experiences and performance, conduct oral and written discussions, determine responsibility of prospective offerors, and ensure that the prospective offerors completely understood the technical requirements, a negotiated procurement was determined to be appropriate for this solicitation.

The prospective bidders were advised in the solicitation that the award of the contract would be conducted in two distinct phases: 1) a technical prequalification phase, and 2) a pricing phase. In the technical prequalification phase, bidders were requested to submit a technical prequalification proposal (i.e. no pricing information) to demonstrate their firm’s ability to perform design, construction, equipment acquisition and installation, and plant start-up and commissioning of a RHWF as described in the request for proposal. An evaluation of the proposals was conducted to determine if the bidder met the minimum requirements as specified in the prequalification evaluation criteria. Only those bidders that were determined to meet the minimum requirements were eligible to participate in the pricing phase. As part of the pricing phase, the final conceptual design for the RHWF was provided. The technically qualified bidders were requested to submit a firm fixed-price proposal (FFP) and other optional pricing that was requested. A design/construction team led by a local small business, Butler Construction Company (BCC) of Western New York, submitted the lowest, responsive, responsible bid and received the award. Butler engaged a number of specialty subcontractors to design and construct specific parts of the facility including Quackenbush Company Inc., Ferguson Electric, and Quality Inspection Services, Inc. Butler also contracted with Raytheon Engineers and Constructors to integrate the component parts of the design and establish the interfaces between the individual systems.





PLAN AT FIRST LEVEL

Fig 3

**CONTRACT MANAGEMENT**

WVNSCO decided to employ a “commercial-like” philosophy in execution of this contract. The framework of the philosophy included taking a hands-off approach to the design and construction of the RHWF, physically fencing off a portion of the WVDP and turning over control of access and security to the contractor, and limiting the amount of oversight.

The fixed-price nature of the contract provided the subcontractor a profit incentive to shorten the duration of the contract—reduced general and administrative expenses could be converted to profits. The benefits of early completion were determined by WVNSCO to be sufficient to offset a fast-track approach to complete the design, while earlier phases of construction were already under way. During early design reviews, it became clear that the Butler team would adopt much of the WVNSCO conceptual design in further development of the design for the facility. This shortened the duration of the initial design phase and allowed the preliminary design to be completed early in June 2000. A key event that helped compress the schedule was an interactive design review led by Washington Group International. Other members of the Butler design-build team participated, as did WVNSCO stakeholders, external reviewers and owner representatives. This staged approach to completion of final design would allow the start of construction of the civil/structural portion of the facility in less than three months after completion of the preliminary design. The FFP nature of the contract would reduce the total length of the contract, which would in turn reduce general overhead and administration costs. This incentive was deemed sufficient enough to take on the risk of rework associated with an incomplete design. Additionally, early evidence of physical

construction encouraged greater ownership of the facility outside of the project.

The construction site was completely fenced off from the rest of the WVDP. This strategy was key in providing the contractor the ability to set its own construction schedule and reduce site transactional inefficiencies. Direct access to its own construction site eliminated the need to bring all the construction vehicles through the WVDP main gate — a potential bottleneck. All other WVDP-related work traffic, which includes vendors entering/exiting the WVDP site and waste shipments leaving the facility, is directed through this gate. Additional traffic from the RHWF construction project would have severely impacted the timely delivery of goods and services to the WVDP, as well as goods and services to the RHWF. Control of the construction site also allowed the contractor to limit access from observers without a role in the work who were curious about the progress being made. This allowed workforces on both sides of the fence to remain focused on project completion. Just prior to start of construction, clarification agreements were developed to clearly establish the type and amount of oversight that WVNSCO would provide during the construction phase. This reinforced the notion that the contractor had the ultimate responsibility for safety and quality assurance at the construction site and that WVNSCO would take an arms-length oversight role. OSHA construction safety regulations, coupled with the contractor's safety and health program, became the governing safety requirements for this project. This approach eliminated the approvals required from other WVDP representatives and further streamlined the work process.

Shortly after BCC started construction in September 2000, it became known that the level of funding committed to within the contract could not be provided. The project's new focus became an increased emphasis on completion of the final design, continued progress on completion of the concrete shell for the facility, and a delay in the purchase and installation of equipment for the facility. This resulted in a lengthening of the project schedule and an increase in the overall cost. Equally disconcerting, this also resulted in a loss of momentum.

Washington Group International assigned an on-site design representative to aid in communication of design changes to the construction contractor and WVNSCO. This proved helpful for field changes early in construction, as well as relating changes from the preliminary design to the ultimate user. Reviews of different approaches to align the detailed design elements with the contract specifications were facilitated by the Washington Group International on-site design representative in order to deliver the optimal product to the client. For example, an area of the design that proved troublesome was the development of a "first-of-its-kind" process for bagless transfer of rectangular boxes. Though an option to pursue a proven bagout system was provided in the scope of work, the contractor chose early on to take on the development risk and put forth a concerted effort to design and fabricate this system. The contractor team visited the DOE Hanford site near Richland, Washington, to discuss the design and operation of Hanford's unique bagless transfer system for drums and obtain lessons learned. The team fabricated a full-size wooden model of the waste packaging structure in order to finalize its design.

The final design for the RHWF was completed in August 2001 after a second interactive review. Representatives from organizations with a stake in the facility participated as they did previously; however, additional working-level people from WVNSCO engineering, maintenance, and operations organizations were assigned to review subteams in order to build worker feedback into the design. One of the most significant changes suggested by these reviewers was an increase in the size of a door opening that allowed more free space around manipulators being passed through it. The final design consisted of 403 design documents including drawings, calculations and, most importantly, procurement specifications for equipment. A large number of comments resulting from the final design review demonstrated a need for better communication between the contractor and WVNSCO in terms of what equipment was actually going

to be acquired and installed in the facility. Resolution of these comments involved an increase in scope for the facility to better match the needs and expectations of the end users.

An emerging issue, resulting from a lack of funding, was the contractor's inability to maintain its place in line for manufacturing/assembly orders for long-lead time equipment, including the Work Cell package of cranes and powered dextrous manipulators and the facility's motor control centers. This resulted in the contractor exploring other options for expediting this equipment including new suppliers for this equipment causing more inefficiencies in terms of redesign during facility construction.

Construction continued with its phased approach with the completion of the concrete shield walls in November 2001. The construction was phased to allow continued progress on supporting structures and systems while waiting for procured equipment to arrive. The five ancillary metal support buildings were erected by April 2002, while the labor-intensive stainless steel liner and conduit installation continued within the building. Installation of mechanical equipments (e.g. blowers, compressors) began in Fall 2002, and fabrication began of the shield doors, the bagless transfer system shield walls, shield windows, and the emissions stack. The pace of construction quickened with the delivery and installation of these items in the late spring and early summer of 2003. The expedited Work Cell cranes and manipulators were installed in August 2003. Physical construction of the facility will be completed in early 2004.



Fig. 4

## PREPARATION FOR RADIOACTIVE OPERATIONS

In parallel with construction, many activities were taking place to prepare for radioactive operations, which are on track to start in June 2004, four months ahead of schedule. The Safety Analysis Report, Process Hazards Analysis, System Testing, Operator Training, Line Management Self-Assessment (LMSA), and Operational Readiness Reviews (ORR) represent a significant scope of work to be done before any waste processing can take place in the completed RHWF. Below is a summary for each of those tasks.

## Safety Analysis Report

As stated in 10 CFR 830, Nuclear Safety Management, a Documented Safety Analysis (DSA) is a documented analysis of the extent to which a nuclear facility can be operated with respect to workers, the public, and the environment, including a description of the condition, safe boundaries, and hazards controls that provide the basis for ensuring safety. The Safety Analysis Report (SAR) for the RHWF was developed to fulfill the requirement to develop a documented safety analysis. The SAR included an extensive Process Hazards Analysis (PHA) as described below.

## Process Hazards Analysis

This is a systematic analysis of hazards associated the RHWF. The PHA provides a qualitative analysis of the hazards associated with the RHWF and relevant preventive and mitigative feature. The RHWF is a new nuclear facility at the WVDP and is classified as a Hazard Category 3 facility. The hazards associated with the RHWF are like those of other waste management facilities with relatively simple operations (i.e., no chemical processes - operations are essentially entirely mechanical in nature). These include:

- Fires/Explosions
- Spills (Container breach/rupture)
- Exhaust ventilation system HEPA filter damage/failure
- Criticality (Nuclear Criticality Safety Evaluation documents that inadvertent criticality is not credible at the RHWF)
- Beyond Design Basis Seismic Event (Often included to assess residual risk associated with seismic phenomena)

## System Testing

Precommissioning, commissioning, and performance tests will be completed prior to hot (radioactive) operations. Precommissioning and commissioning tests have been performed by subcontract personnel. System performance testing was performed by WVNSCO and documented by start-up test documents. The RHWF has been divided into 16 major systems as shown in Table II.

Table II RHWF systems

Remote Processing	Civil/Structural
Waste Packaging	Electrical Distribution
Radiation Shielding	Compressed Air
Radiation Protection	Demineralized Water
Radiation Monitoring	Fire Detection & Suppression
Waste Collection and Transfer	Instrumentation and Control
Decontamination	Security
HVAC	Communications

## **Operator Training**

- X Initial training programs are established to ensure that the operating organization and maintenance personnel are qualified to perform job requirements. This is achieved by using a systematic approach to training as defined in the site Performance-Based Training Program Manual.
- X Continuing training programs are established to maintain and enhance the knowledge and skills of operating organization personnel who perform functions associated with engineered safety features as identified in the Safety Analysis Reports. Continuing training is conducted on a two-year cycle and is accomplished by successful completion of comprehensive written examinations, operational evaluations, oral qualification boards or a combination of these as applicable to the position.
- X Qualification programs will normally require completion of both classroom and on-the-job training phases. Upon completion of the training phase, certain job positions may require one or more final activities which may include: written examinations, on-the-job training, an oral board, and operational evaluations. If any of these activities are required and not satisfactorily completed, the person fails to qualify for that position and may not perform work unsupervised in that job position.
- X Facility personnel must maintain proficiency in accordance with the requirements of DOE Order 5480.20A. Proficiency Demonstrations are designed to provide an increased margin of safety and provide an increased depth within the organization to assure that the facilities are staffed with confident and competent individuals. Proficiency Demonstrations/On-The-Job Training (PROJT) and development training materials provide guidance on proficiency and job performance measures. This is accomplished by providing proper targeted training on critical knowledge and skills, then reinforcing them through a carefully defined program of repetition, reinforcement and feedback. The critical knowledge and skills cover a broad range of applications that may include, but is not limited to, the following:
  - system/component operations;
  - supervisor skills;
  - product/process quality;
  - regulatory compliance;
  - emergency response;
  - radiation safety practicals.

Drills are conducted to maintain personnel proficiency and improve response time to abnormal or accident situations, in accordance with operations team building and training.

## **Line Management Self-Assessment**

This review is required to demonstrate it is safe to start operations in the Remote-Handled Waste Facility and process the containers included in the 13 planned waste streams. The readiness of personnel, equipment, programs and procedures to operate the Facility will be established. Core requirements in applicable Department of Energy orders, standards and guidelines will form the basis of the review. Training, proficiency, numbers of personnel, safety systems, process systems, safety basis implementation,

operational formality, maintenance, integrated safety management, quality assurance and other elements necessary to demonstrate readiness are included. Evaluations are conducted to the extent necessary to confirm waste streams that are beyond the design envelope or the safety envelope will be properly evaluated before processing in the facility.

The capability to process containers representative of those included in the waste streams will be demonstrated. The results of these demonstrations are considered to be indicative of operational readiness for processing of subsequent waste streams. Additionally, preliminary plans for processing unusually challenging containers in two of the 13 waste streams will be reviewed. The two waste streams containing more challenging containers are as follows:

- Vent Filters in Cement
- Waste Tank Farm Pumps.

The completion of the LMSA is a prerequisite for the Operational Readiness Review (ORR).

### **Operational Readiness Reviews**

The scope of the WVNSCO and DOE ORRs includes readiness of the facility/equipment, personnel, and systems to process thirteen target waste streams. Focus will be on Management Systems, Operations, Procedures, Safety Systems, and Training.

Major activities that are to be validated in the ORRs are as follows:

- Relocating containers from storage locations on the site of the West Valley Demonstration Project to the receiving area of the RHWF.
- Relocating containers from the receiving area, through the buffer cell and into the work cell of the RHWF.
- Conducting operations in the work cell including opening containers, removing materials from those containers, collecting required samples, recording radio-assay measurements, reducing the size of materials and placing the processed materials in the appropriate liners.
- Packaging the filled liners into over-pack containers which conform to WVNSCO requirements for storage and eventual disposition.
- Relocating the over-packed containers from the work cell into the load-out area of the RHWF.
- Relocating the over-packed containers from the load-out area of the RHWF to storage locations elsewhere on the site.

With the successful conclusion of the ORRs, DOE will approve the start-up of facility operations. The RHWF is scheduled to begin radiological operations in June 2004.

## **CONCLUSION**

The design, construction, and start-up of a “first-of-its-kind” nuclear facility presented many challenges and opportunities. This facility, once operational, can be used as a model for the safe processing of Remote-Handled Waste across the world.

## **FOOTNOTE**

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