High-level Waste Relocation Requires Use of New Technology in Aging Nuclear Facility – 15269

Heatherly Dukes**, Joe Ebert**, Dan Meess**, Lettie Chilson**, David Kurasch**, Cynthia Dayton**, Daniel Sullivan*
* US DOE-WVDP
** CH2MHILL B&W West Valley, LLC

ABSTRACT

The West Valley Demonstration Project (WVDP) is preparing to relocate 278 canisters of vitrified high-level waste (HLW) from their current location inside the Main Plant Process Building (MPPB) to an outdoor pad for long-term, on-site storage. The waste was produced at the WVDP between 1996 and 2002 and was originally placed in interim storage inside the MPPB in anticipation of off-site shipment for disposal. Relocation of the canisters to a new on-site location is now necessary as part of WVDP Phase 1 Site Decommissioning work to enable pre-demolition activities inside the MPPB to proceed. The logistics of packaging and moving the HLW canisters within an aging facility to another on-site location has provided numerous technical challenges with subsequent innovations. Significant preparations have taken place to resolve structural inadequacies, including sub-surface soil subsidence issues, antiquated equipment, and facility reconfigurations to support up to 134 metric ton (148 ton) loads. To perform the transfer and storage of the HLW canisters, new equipment and fabrications were required including a robust storage system consisting of stainless steel canister overpacks within steel-reinforced concrete storage casks, three specialty cask transporters, a remotely operated welding system and construction of an outdoor engineered storage pad to store the 56 casks containing the relocated HLW canisters. Packaging and relocation of vitrified canisters is scheduled to begin in 2015.

INTRODUCTION

The West Valley Demonstration Project (WVDP) is located on the Western New York Nuclear Service Center (WNYNSC) that comprises 3,300 acres of land used for the commercial reprocessing of spent nuclear fuel. Between 1966 and 1972, commercial nuclear fuel reprocessing was conducted within the Main Plant Process Building (MPPB). In 1972, commercial nuclear fuel reprocessing ceased and was never resumed.

On October 1, 1980, President Carter signed the West Valley Demonstration Project Act (WVDP Act) that provided the roadmap for cleaning up the site. The WVDP Act authorized the DOE to demonstrate solidification of approximately 600,000 gallons of High-Level Waste (HLW) left behind at the site by the reprocessing operations. The WNYNSC is owned by the New York State Energy Research and Development Authority (NYSERDA), with DOE given temporary possession of approximately 200 acres referred to as the “Project Premises” to complete their responsibilities under the 1980 Act. Upon completion of their responsibilities under the Act, DOE will return possession of the 200 acres to NYSERDA. The following table provides the WVDP Act requirements for DOE and their current status:

WVDP Act Activity Requirement	Status
1) Solidify the high level radioactive waste by vitrification.	Complete
2) Develop containers suitable for the permanent disposal of the high level waste solidified.	Complete
3) Transport the solidified waste to an appropriate Federal repository for permanent disposal.	Incomplete – no HLW repository available
4) Dispose of low level radioactive waste and transuranic waste produced by the solidification of the HLW under the project.	In progress for part of the waste inventory
5) Decontaminate and decommission, in accordance with Nuclear Regulatory Commission (NRC) requirements, the tanks and other facilities in which the HLW was stored, the facilities used in the solidification of the waste, and any material and hardware used in connection with the project.	In progress for most of the facilities (the HLW storage tanks, the Construction and Demolition Debris Landfill and NRC-Licensed Disposal Area (NDA) are deferred until a later decision making process is completed).

A multi-year effort is underway at the West Valley Demonstration Project in Western New York to partially complete #4 and #5 of the WVDP Act which is to deactivate and demolish the MPPB and the Vitrification Facility and their surrounding infrastructure. Since the HLW vitrified canisters are located in the MPPB and there is no current repository to ship them to, the canisters must be relocated to an interim storage location. CH2M HILL Babcock & Wilcox West Valley, LLC (CHBWV), the prime contractor to the U.S. Department of Energy at the site, will initiate removal of the canisters from their current storage location and load them into storage casks for on-site relocation in 2015. The canister relocation work is part of the Phase I Decommissioning and Facility Disposition activities being undertaken by CHBWV.

The conceptual plan for canister removal from storage in the MPPB changed significantly since the HLW was first placed in storage in 1996. Changes in infrastructure, deterioration associated with an aging facility, radiological sources and contamination, the evolution of dry storage cask systems and the lack of a HLW repository contributed to a change in philosophy for retrieval and storage of the HLW canisters. As a result, the WVDP is moving ahead with interim on-site storage using a robust passive outdoor storage system. Canister relocation preparations have included a series of investigations, analyses and design evolutions to integrate HLW retrieval and packaging with the existing infrastructure.

Planning, design and preparations were initiated in late 2011 with the initiation of major procurements in August of 2012 and final design of the HLW Storage System completed in December 2012. Physical construction activities on-site began in mid-2013. In preparation for facility modifications and equipment deployment, several investigations were performed to verify operational strategies and to allow adjustments and optimization where necessary. The investigations and analyses conducted involved indoor and outdoor locations and overhead and subsurface areas, as well as integration reviews for new equipment with existing equipment. Surface and subsurface soil testing was conducted to determine reinforcement requirements for underground utilities and culverts along the haul path to support conveyance of the 79 metric ton (87 ton) loaded casks. Utilities, the operation and life-expectancy of existing equipment, and gaps identified to complete safe retrieval and packaging of the canisters were all taken into consideration.

In 2013, major activities were initiated for the fabrication of HLW overpacks, fabrication of the cask transporters, fabrication of the steel & concrete vertical storage casks, and construction of the storage pad. In 2014, major activities included fabrication of the overpack welding system, MPPB facility upgrades to support cask loading, improvements to 0.8 kilometer (0.5 mile) of on-site roadways, and evaluation and fabrication of a canister decontamination system and procurement of the equipment necessary to support canister loading.

The new storage configuration has a design life of 50 years and provides secure, passive storage of the HLW canisters in compliance with all state and federal regulations. The CHBWV team is on track to initiate canister relocations in 2015, with relocation completed in 2018.
A discussion of the components and facilities involved with HLW Canister packaging and relocation and the analyses and controls implemented follows.

OVERALL APPROACH

This project will mark the first time in U.S. history that vitrified HLW will be placed in long-term outdoor passive storage. The technical approach was designed to maximize available "off-the-shelf" technologies and methods to minimize design efforts, risk and overall cost and schedule impacts. The project based the HLW canister storage design on the spent nuclear fuel (SNF) dry cask storage systems in use in the U.S. and abroad with only minor modifications for long-term storage of vitrified HLW. The robust storage system includes stainless steel canister overpacks within reinforced, steel-lined concrete storage casks that are placed on an outdoor engineered storage pad. Design modifications included having the stainless steel overpack with a basket that accommodated only 5 canisters which have significantly wider diameters at 0.6 meter (2 feet) and the overall height of the overpack and cask being shorter to accommodate the 3 meter (10 feet) canisters versus up to 4.1 meter long SNF. Because the modifications are minimal, the overall fabrication process and analyses for transport have been readily amended. Similar to SNF loading, a series of transporters are used to move casks to and from the loading zone.

However, the HLW canisters are located in dry "hot cells" versus in underwater fuel pools and required a revised approach for loading. For SNF, it is loaded underwater into an overpack, dried and welded, and then transferred to a storage cask which is then transported to an outdoor storage pad. For the West Valley HLW, the empty overpack is loaded outdoors into the cask and then transported to the facility where it is transferred to an in-plant cask transporter that carries the cask to a rail cart that then carries the cask into the hot cell for direct canister loading. Once loaded, the rail cart carries the cask back out of the hot cell where it is prepped for transport by the in-plant transporter to be carried to the welding station and then prepped for transfer to the outdoor transporter that takes the cask to the Cask Storage Pad. Attachment A provides a flow diagram of the cask path from outdoors, through the facility to the rail cart in the tunnel that connects to the hot cell where the HLW canisters are stored.

When a repository becomes available, the overpack will be transferred from the storage cask into a shipping cask and transported off-site via rail or truck.

The HLW Storage System Needs and Conditions

The 278 canisters containing vitrified HLW are 3 meters (10 feet) long and 0.6 meters (2 feet) in diameter. The average dose rate is 2,665 R/hr with a dose rate range of 1,100 to 7,460 R/hr. To store these canisters, the HLW storage system consists of a stainless steel overpack within a reinforced concrete cask and stored on an engineered storage pad. The storage system has been designed to be <1 mrem/hr @ 30 centimeters (1 foot) on average and to allow storage for up to 50 years which at that time, the overpacked canisters can be shipped with no modifications. Both vertical and horizontal storage systems were considered for use. A "best value" major procurement process was conducted which culminated in the NAC International vertical storage system being selected. The NAC contract included the design of the cask storage pad, with the construction of the cask storage pad competitively bid and subsequently awarded to Butler Construction Company of Western New York. The following sub-sections describe the process for providing the vertical storage casks, the overpacks, and the cask storage pad in more detail.

Vertical Storage Cask

The WVDP High-Level Waste Vertical Storage Casks (VSC) are modified from an existing NAC SNF storage design. The significant differences are that the HLW canisters are shorter than SNF and have a lower thermal output and radiological dose rate. Therefore the West Valley cask is shorter and has no air inlet or outlet openings as none are required to maintain the required thermal performance. This totally enclosed design also eliminates the potential dose rate “hot-spots” that are typical of a vented system and provides greater protection for the overpack, and its contents, across a wide range of external threats.

Without the air vents and associated temperature monitoring or daily walk around inspections to ensure air vents are unobstructed, the West Valley casks are virtually maintenance-free and are designed for a minimum 50-year lifetime. VSC specific physical characteristics include:

- 4 meters (161 inches) tall with lifting lugs
- 3 meter (120 inch) diameter, 0.5 meter (20 inch) concrete with a 10 centimeter (4 inch) thick steel liner
- Unloaded weight: 67 tons (133,500 pounds)

The cask liner is fabricated at a Utah facility by a sub-tier subcontractor to NAC International. To ensure flowdown of requirements, specific hold points for inspection have been incorporated into the fabrication process for CHBWV to witness. Once accepted at the fabricator’s facility, the liners, cask lid and rebar are shipped to the West Valley Demonstration Project for the casks to be constructed on-site by NAC International and their sub-tier contractors. CHBWV utilizes a subcontractor oversight plan to verify essential quality elements are met with a Site Technical Representative and safety oversight delegate assigned full-time. To date, 16 casks have been constructed, with 40 liners currently in various stages of the fabrication process. Overall, the fabrication of the liners and construction of casks has gone very well.

Fig. 1. Cask liners delivered, fitted with rebar, and concrete placed to form the West Valley casks.

Canister Overpack

The overpacks are being fabricated at a Utah facility by a sub-tier subcontractor to NAC International. To ensure flowdown of requirements, specific hold points for inspection, testing and fit-ups have been incorporated into the fabrication process for CHBWV to witness.

The specific physical characteristics of the overpacks include:

- Stainless steel 304/304L
- 9.5 millimeter (3/8 inch) walls
- 5 centimeter (2 inch) bottom plate

- 10 centimeter (4 inch) thick welded lid
- 1.8 meter (70.5 inch) diameter, 3.2 meters (126 inches) tall
- Unloaded weight: 6.6 metric tons (14,500 pounds)

The fabrication of the overpacks has gone very well with two improvements identified during welding testing evolutions on the overpack mockup that have been incorporated:

- A backing ring is utilized to help the lid fit-up to the overpack. During subsequent testing with the welding process, the worst case spacing between the lid and overpack body was utilized for the initial backing ring design and was determined to be difficult to weld. To accommodate easier welding and likely higher weld success rate, the backing ring design was revised to provide a smaller gap between the overpack lid and body.
- For the overpack cleaning process, glass bead blasting was being utilized. However, the silica grit from the glass was being embedded into the overpack surface and was extracted during the welding process as imperfections. To remedy this, the surfaces of the overpacks to be welded are grinded to remove embedded grit and provide a better welding surface.

With these improvements, the first 8 overpacks have been delivered and loaded into casks with 48 additional overpacks in various stages of fabrication. The extensive use of fit-up testing and mock-ups allowed early identification of improvements and incorporation for future loading and transfer operations.

Fig. 2. Basket cell inspection, lowering canister into basket, and lowering basket into Overpack.

Fig. 3. Overpack being loaded into a cask

HLW Cask Storage Pad

The West Valley cask storage pad design is based on the commercial nuclear design for Independent Spent Fuel Storage Installation (ISFSI). The West Valley pad features an at-grade design capable of supporting the weight of 57 loaded storage casks [each weighing 80 metric tons (87 tons)].

During the planning and construction of the storage pad, several changed conditions were encountered that were not depicted on available drawings for the configuration found. The issues encountered and remedied included the following:

- For the construction of the pad, up to 4.6 meters (15 feet) of material was excavated to reach soils that met the required parameters. The depth required was determined via sampling and geotechnical analysis and was deeper than originally planned since the area had been used as a construction debris landfill and not documented.
- Radiological contamination was found during excavation and associated with materials placed there when used as a debris landfill. Additional survey controls were put into place during excavation to identify and disposition any additional contamination found.
- An abandoned 1928 pipeline [consisting of separate 15 centimeter (6 inch) and 20 centimeter (8 inch) lines] which previously transferred oil to the surrounding community, passes through the West Valley Site and subsequently was discovered to pass directly through the pad site. Once discovered, these lines had to be excavated, tell-taled, drained, cut for removal, and the area backfilled and compacted.

The excavated pad area was backfilled first with 2,413 metric tons (2,660 tons) of granular fill and then with 7,484 metric tons (8,250) tons of permeable fill. Once the compaction was completed the 0.9 meter (3 foot) thick pad itself was constructed with 120.7 metric tons (133 tons) of rebar for the bottom and top mats and the placement of 1,376 cubic meters (1,800 cubic yards) of concrete. The pad itself is 44 meters (144 feet) long and 33.5 meters (110 feet) wide.

Fig. 4. HLW Cask Storage Pad during construction.

An adjoining pad structure includes an approach apron that allows the transporter to take the cask onto the pad and place it (eliminates critical lifts). Once the pad was constructed, the apron area was excavated and 4,159 metric tons (4,585 tons) of fill was placed, 100 metric tons (110) tons of rebar installed, and approximately 688 cubic meters (900 cubic yards) of concrete placed. During the construction of the apron, the design-specified permeable fill did not allow the area's groundwater to transfer through at an adequate rate and resulted in the fill experiencing subsidence. To correct the subsidence, permeable fill had to be replaced and compacted before continuing the construction. In addition, a drainage system specifically for the apron area was installed to direct groundwater flow through and around the apron area. The apron is 52 meters (170 feet) long and 30 meters (98 feet) wide.

In addition to the apron, the pad has two engineered crane pads that are approximately 8 meters (26 feet) wide by 44 meters (144 feet) long. A grounding system was also installed for grounding the pad and associated electrical components needed for lighting and security features. The pad was designed to support canister storage casks for a minimum of 50 years.
Though the pad design was based on commercial ISFSIs and allowed efficient design and construction, the field conditions and configuration dictated special considerations, which may be somewhat expected, especially at older sites.

Fig. 5. The completed storage pad and approach apron.

HLW System Support Equipment

Cask transporters and a welding system are major components required to support the relocation of the canisters in the HLW storage system.
Three transporter systems will be used to transfer the casks to the MPPB, within the facility, and to the HLW Cask Storage Pad. All of the equipment was sized to ensure operations could be conducted within the facility's constraints, notably, dimension limitations.

Vertical Cask Transporter (VCT) - The 35 metric ton (39 ton) VCT is a mobile hydraulic gantry crane that will be used for the heavy hauling operation of the casks outdoors. Design of the Vertical Cask Transporter, which is specifically made for outdoor movement and positioning of the West Valley casks, is based on similar transport equipment used for moving spent nuclear fuel in concrete storage casks at nuclear power plants. The VCT operates entirely outdoors, where it transports the storage casks to the MPPB and the 79 metric ton (87 ton) loaded casks from the MPPB for approximately 0.8 kilometers (0.5 miles) to the Cask Storage Pad. It is equipped with a diesel engine for lifting the casks, but will be towed by a separate GT50 aircraft tow tractor, which is commonly used to move airplanes. The VCT is designed to operate under the wide temperature and humidity ranges that exist at the West Valley. Its maximum loaded speed is approximately 3.2 kilometers per hour (2 mph).

Fig. 6. Vertical Cask Transporter and GT50 Tugger positioning a cask

The majority of commercial transporters used to transport SNF use a track system whereas the West Valley version uses a wheeled system with the wheels having a diameter of 1.5 meters (5 feet). The VCT design was also adjusted to accommodate the shorter HLW casks. During fabrication, inspections were performed as well as witnessing a robust functional test of the system before being shipped to West Valley. Upon delivery, the VCT was tested and then later utilized to move several casks. However, during the test and later during initial cask movements, the equipment experienced problems that the vendor has remedied. Because the West Valley cask transporter was a unique version of a wheeled system not utilized often, the system required minor modifications to operate as designed. The robust functional testing and initial operation by the vendor identified these issues early for remedy with no project impacts.

The specific physical characteristics of the VCT include:

- Overall height: Fully extended 6.7 meters (21.75 feet)
- Maximum width: 5.4 meters (17.75 feet)
- Wheel diameter: approximately 1.5 meters (5 feet)
- Unburdened transporter weight: approximately 35 metric tons (39 tons)
- Rated lifting capacity: 82 metric tons (90 tons)
- VCT weight with loaded cask: 114 metric tons (126 tons)

TL220HD In-Plant Cask Transporter (TL220) - An In-Plant Cask Transporter (called the TL220) is a boom-type hydraulic lifter provided with extendable counterweights to allow for the lifting of an 82 metric ton (90 ton) load. The TL220 is utilized to lift and transport the cask through two radiological areas of the building and load the cask onto a specialty rail cart. The TL220 has a propane engine and travels at a maximum speed of 0.7 kilometers per hour (0.42 mph). Similar to the VCT, the TL220 is based on similar transport equipment used at nuclear power plants and during fabrication, inspections were performed as well as a robust functional test of the system before being shipped to West Valley. Upon delivery, the TL220 was tested and will be utilized to move several casks in support of training and readiness activities.

The specific physical characteristics of the TL220 include:

- 82 metric ton (90 ton) lift capacity

- Weighs 56 metric tons (61 tons) unloaded
- Weighs 134 metric tons (148 tons) with loaded cask
- 3 drive motors/5 axles
- 4.2 meters (13 feet, 10 inches) tall and 3 meters (10 feet) wide
- 10.5 meters (35 feet, 2 inches) long w/boom extended for cask

Fig. 7. TL220 Cask Handling Transporter

Because of limited space for maneuverability of the TL220 within the facility, an air pallet is utilized to transport the cask from the VCT drop-off point to the TL220.

Low-Profile Rail Cart - The Low Profile Rail Cart is a transporter specially-designed for West Valley to move casks into and out of the highly contaminated hot cell where the HLW canisters are stored on the existing rail system. The TL220 places the cask onto the rail cart and the rail cart transports the cask to the hot cell where five canisters are loaded into the overpack within the cask and then transported out. The Low Profile Rail Cart has been designed to carry the cask in a low position on 8 axles to allow the heavy load to fit through the cell entrance while meeting the structural load limitations across the threshold. Because this is a unique piece of equipment specific to the West Valley project’s needs, the lessons learned from the VCT have been incorporated with additional inspections and testing, including testing in a clean area at the site to allow any modifications to be identified before installing in the radiological area.

The specific physical characteristics of the Low Profile Rail Cart include:

- 82 metric ton (90 ton) capacity
- Weighs 27 metric tons (30 tons) unloaded
- Weighs 106 metric tons (117 tons) with loaded cask
- 2 independent battery powered drive motors/ 2 driven axles per motor
- 11 meters (36 feet) length and 3 meters (10 feet) wide
- Remote radio controlled

Automatic Welding System - During canister packaging, 5 HLW canisters will be inserted in a single stainless steel overpack that will then be welded shut prior to relocating the Vertical Storage Cask to the interim storage at the WVDP. A robotically-operated Tungsten Inert Gas (TIG) welder has been designed and fabricated to seal the WVDP Overpacks closed. The welding process is guided by trained and certified operators, who will control welder setup and operation using a touch screen computer control module. The computer interface is capable of monitoring and controlling welder amperage, voltage, travel speed, wire feed speed and the hot wire current. The articulating robotic arm's movement is also controlled by the computer control panel.

The welding process will involve multiple passes of the welder head over the lid/Overpack joint to seal the container shut. The weld integrity will be verified and inspected to meet Quality Assurance parameters.

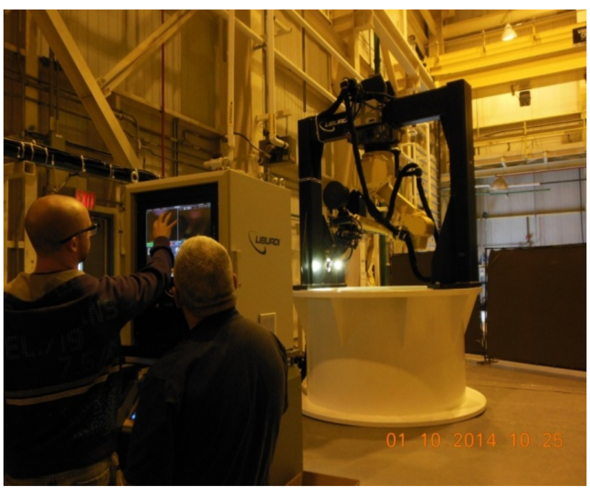
Once again, West Valley has maximized the use of off-the-shelf equipment where possible. NAC and Liburdi Automation are supplying West Valley's Automatic Welding System that includes the Liburdi Gold Track® VI Hotwire power supply, FireView® Control Console that allows the operator to weld remotely, and G-Head front end. The G-Head front end is a proven design with thousands of hours of operating time but due to the high radiation fields, radiation hardened motors were added and is denoted as the H-Head. The welding head is mounted on a Fanuc robotic arm suspended from a lifting frame that is secured to the top of the Vertical Storage Cask. The revised design has all of the same functionality as the original but the geometry has been optimized to maximize clearance with the cask inner diameter and shield plate.

With the Fanuc Robot Arm as the base of the motion platform, West Valley has the capability to move the weld-head to a service position several feet past the canister wall. This significantly reduces the radiation fields the operator is required to work in if access to the end of arm tooling is required, by increasing the distance from the cask top, as well as providing the opportunity to place additional shielding between the operator and the canister. As part of the planning for this project, a Local Repair Tool was required for removing weld defects. With the ability to move the weld-head to a service position, heads may be switched without uninstalling the entire system or an operator having to complete the operation directly in the higher fields.


Fig. 8. and Fig. 9. FireView® Control Console. Robotic welding system installed on mockup of the VSC and overpack.

Automatic Welding System Attributes

- Fully integrated robotic arm and welder head that provide a precision weld
- Dual camera setup delivers real-time visual access of leading and lag weld area
- Pre-programmed welder operation parameters offers repetitive welding precision
- Full robotic operation that distances operators from welding sequence and reduces exposure to radiological source



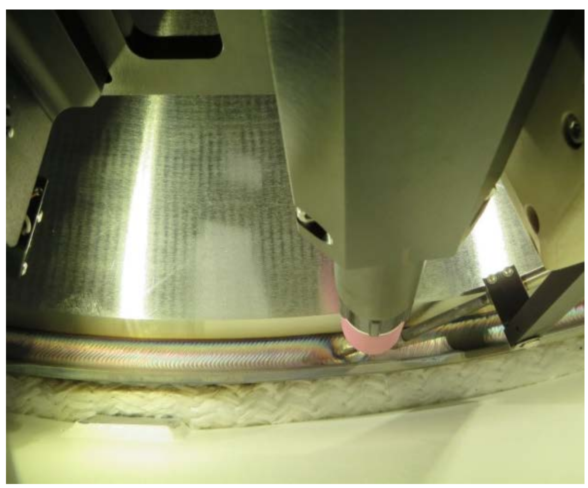


Fig. 10 and Fig. 11. Welder in use on mockup of VSC and overpack. Close-up of overpack weld.

Site/Facility Modifications

The MPPB facility was built in the 1960s and has been upgraded as necessary for the various activities since the commercial reprocessing mission. The last significant upgrade was performed in the 1990s for HLW glass vitrification. With the latest mission to relocate the HLW canisters, numerous modifications and upgrades to the existing infrastructure were identified and discussed in the following sections.

***Equipment Decontamination Room (EDR)* -** The EDR is the radiological area where the cask gets off-loaded from the TL220 to the rail cart and sees point loads of 33 metric tons (36 tons) (see Figure 7). The loads associated with transporting casks are higher than the original reprocessing facility design anticipated and warranted review. Elsewhere in the facility, floating slabs were previously noted as “settling” and the EDR was suspected of having similar soil subsidence issues that were undetected since the floor was keyed into the walls versus floating.

Numerous borings were drilled to allow soil sampling and geotechnical testing. Use of a boroscope confirmed that significant soil subsidence had taken place 2.5 to 9.5 centimeters (0.5 to 3.75 inches). A detailed structural analysis was performed that subsequently required the subsurface void space (created from the soil subsidence) to be filled with a flowable grout. In addition, additional core borings were performed to allow a chemical grouting process to be used to create structural grade beams in the fill material under the EDR’s slabs to ensure enough structural floor and soils integrity for the transporters and cask loading. This modification was significant since it was implemented within high contamination and high radiation zones and required unique sub-surface modifications at a shallower depth than normally performed. To verify the grout mix and technique, numerous mockups and testing were performed to ensure floor heaving was avoided while achieving the strength needed for the grade beams to carry the anticipated loads.

In addition to the subsurface strengthening, a large soaking pit measuring 3.7 meters (12 feet) wide by 6.7 meters (22 feet) long by 5 meters (16.5 feet) deep, used for decontaminating equipment, had to be grouted and a rebar reinforced concrete cap added.
Overall, the analysis and engineering was extensive to prepare this area of the facility for the new mission to load and transfer the heavy casks.

Fig. 12, Fig. 13, Fig. 14 and Fig. 15. Draining pit, core boring, subsurface soil testing, and grouting the void spaces in a high contamination and radiation area.

***Chemical Process Cell (CPC, also known as the HLW Interim Storage Facility)* -** The Chemical Process Cell is a hot cell previously used for reprocessing SNF. In the 1990s, it was decontaminated and set up as an interim storage location for the vitrified HLW canisters. To prepare the facility for cask entry and canister loading, three major evolutions took place:

- A canister decontamination system was developed and installed to remove the most readily dispersible surface contamination from both the lid and the upper shoulder area of the HLW canisters prior to loading into the HLW overpack. The system uses remotely-deployed microfiber cloths and a commercially available cleaning solution to perform the wet/dry decontamination.

- The cell's cranes were rebuilt to allow them to continue performing their function in the very high radiation zone.
- A new method for performing a remote survey of 10% of the canisters had to be developed and tested. The survey is necessary to provide a representative non-fixed contamination profile for the packaged canisters.

Fig. 16 and Fig. 17. Canister decontamination system mockup and decontamination pad carrier.

In addition, a detailed review of the hot cell was conducted to review for cracks and other potential issues. To perform this review, an inexpensive off-the-shelf battery operated camera system, GoPro®, was utilized on the crane to take close-range video footage of the canisters, shielded windows, walls, and ceiling. The clarity of the images provided views not previously available. Remarkably, the camera withstood the very high radiation rates and has been used multiple times.

Fig. 18 and Fig. 19. GoPro® camera and close-up image of a HLW canister.

Load-In Facility (LIF) **-** The Load-In Facility (LIF) is the location where the cask is brought in by air pallet from the VCT and transferred to the contaminated rail area by the TL220 transporter (see Figure 20) and where loaded casks are brought to allow the Overpack to be welded and final preparations performed for transfer to the Cask Storage Pad.

The air pallet requires a very flat surface to properly operate and floor modifications were required to raise and flatten the west side of this facility. In addition, plating was installed over the length of the TL220 pathway to facilitate load distribution.

A portion of this facility is dedicated to the cask preparations necessary for protection against contamination. The project tested and adopted a commercially available shrink-wrapping process for the first layer of protection.
Minor modifications were required for installing the welding system. Since this portion of the facility is not normally HEPA ventilated, a specialty welding curtain was designed and fabricated to ensure air flow was directed to a new portable HEPA ventilation unit.
As with other aspects of the project, the use of commercially available technology was maximized for the modifications and operations within the LIF.


Fig. 20 and Fig. 21. View of the LIF steel plate runway and shrink wrap demonstration.

***Outdoor Haul Path* -** The haul path required upgrades from the cask fabrication area to the Load-In Facility and from the Load-In facility to the HLW Cask Storage Pad. Upgrades were determined using structural analysis, geotechnical data from soil sampling as well as test runs of unloaded equipment to identify compound slope issues. Due to the width of the VCT transporter, 427 meters (1,400 feet) of roadway had to be widened, a portion of the road replaced, and 488 meters (1,600 feet) resurfaced. In addition, plating was installed to protect utilities that crossed under the roadway and a “cask transfer pad” constructed to allow a cask to be transferred from the VCT to an air pallet outdoor of the Load-In Facility.

The arrival of winter weather delayed paving of the haul path until early spring. To accommodate paving at the earliest possible date, infrared heaters will be attached to the pavers to allow the road surface temperature to meet the requirements for asphalt paving. The use of this innovative technique allowed the project to maintain its schedule for construction and startup.

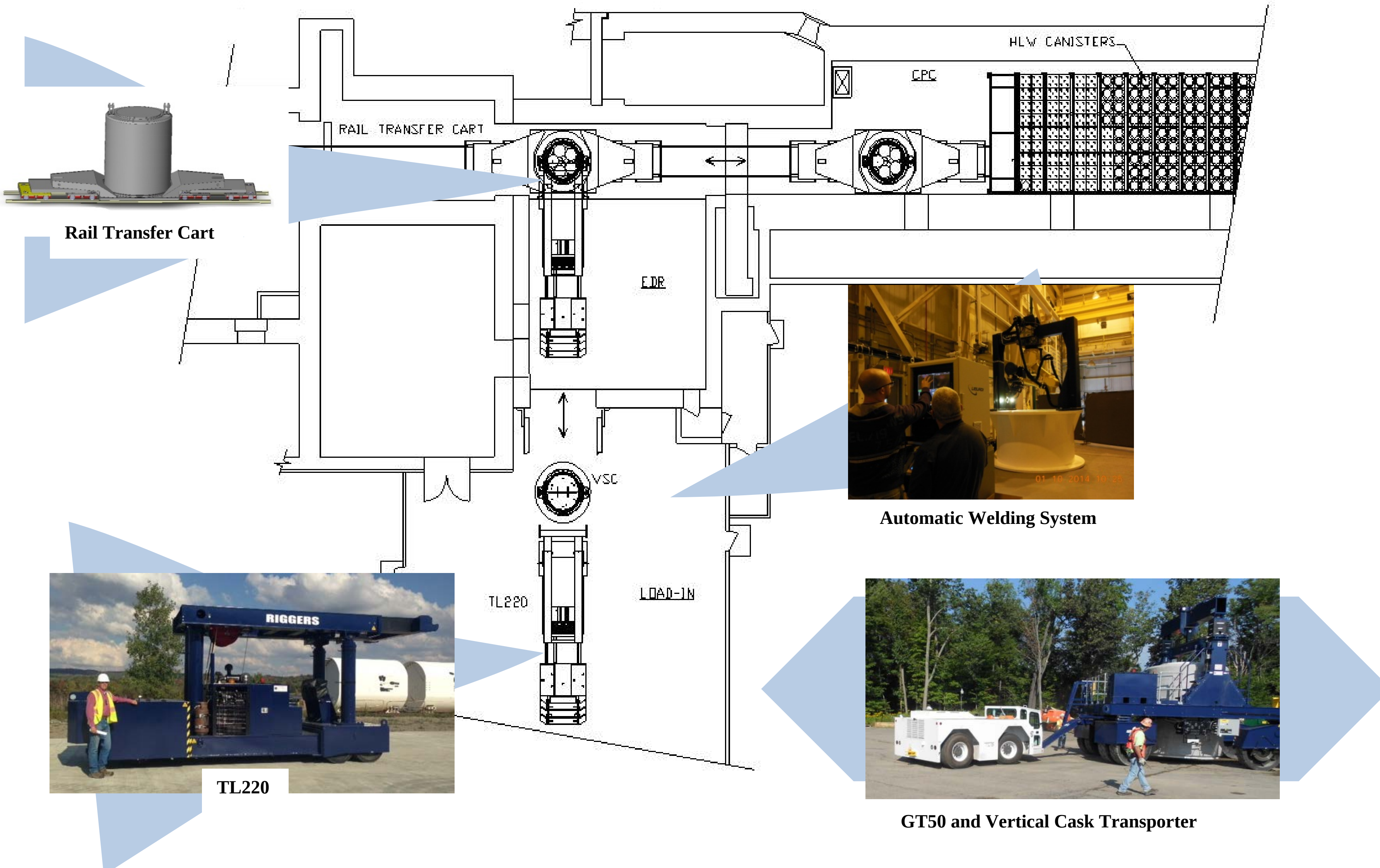
CONCLUSION

Accommodation and incorporation of the new technology required for HLW canister packaging and relocation required significant evaluation and integration with existing WVDP facilities. Although off-the-shelf technology was used throughout this project, the techniques and processes that were used required retrofitting due to the hot cell dry storage configuration of the HLW canisters (as opposed to wet storage of SNF) and the aging and contaminated condition of WVDP facilities.
The WVDP has completed readiness activities and testing of the equipment and techniques that will be used to retrieve, decontaminate, package and relocate the HLW to on-site storage. It is on track to begin packaging and relocation of the first HLW canisters in June 2015.

REFERENCES

1. West Valley Demonstration Project Act; Public Law 96-368; S. 2443 (October 1, 1980)
2. U. S. Department of Energy Record of Decision; Final Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center (January 29, 2010)
3. U. S. Department of Energy Contract DE-EM001529 with CH2M HILL Babcock & Wilcox West Valley, LLC (July 1, 2011)

Attachment A



Rail Transfer Cart

Automatic Welding System

TL220

GT50 and Vertical Cask Transporter