River Corridor Buildings 324 and 327 Cleanup

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ABSTRACT

A major challenge in the recently awarded River Corridor Closure (RCC) Contract at the U.S. Department of Energy’s (DOE) Hanford Site is decontaminating and demolishing (D&D) facilities in the 300 Area. Located along the banks of the Columbia River about one mile north of Richland, Washington, the 2.5 km^2 (1 mi^2)300 Area comprises only a small part of the 1517 km^2 (586 mi^2) Hanford Site. However, with more than 300 facilities ranging from clean to highly contaminated, D&D of those facilities represents a major challenge for Washington Closure Hanford (WCH), which manages the new RCC Project for DOE’s Richland Operations Office (RL). A complicating factor for this work is the continued use of nearly a dozen facilities by the DOE’s Pacific Northwest National Laboratory (PNNL). Most of the buildings will not be released to WCH until at least 2009 – four years into the seven-year, $1.9 billion RCC Contract. The challenge will be to deactivate, decommission, decontaminate and demolish (D4) highly contaminated buildings, such as 324 and 327, without interrupting PNNL’s operations in adjacent facilities. This paper focuses on the challenges associated with the D4 of the 324 Building and the 327 Building.

INTRODUCTION

Numerous challenges are associated with the D4 of both the 324 and the 327 Buildings because of their proximity to the City of Richland, the Columbia River, active facilities, and the nearness of public access. Specific D4 challenges also include characterizing the hot-cells in both facilities due to the extremely high radiation fields, some in excess of 20,000 R/hour. While specific radionuclides are known to exist from mid-1990s non-destructive assay scans, most of the characterization was poorly documented, not documented at all, or lost over the years, making it difficult to design cleanup plans without significant site testing and analysis. The WCH employees know from records and other data that many questions have yet to be answered before meaningful site design work can begin. Current methods for fixing/removing the expected high radionuclide waste are expected to include using fixatives and grout, producing large monolithic structures for disposal at Hanford.

Disposition and removal of the larger hot cells in 324 and 327 is also a challenge due to their size and robust design. As an example, the 327 Building Special Environmental Radiometallurgy

Facility (SERF) cell cannot be demolished until shoring can be constructed underneath this structure since the cell's floor is freestanding and thus will require support shoring. The SERF is located in the middle of the other 10 hot cells, thereby creating a unique removal challenge.

A major concern is simultaneously protecting workers at Buildings 324 and 327, the environment, and the workers at the adjacent operational PNNL facilities while cleanup is underway. Further, large quantities of waste will be generated which will create logistics issues to access, containerize and transport the waste while not interrupting PNNL operations.

324 BUILDING

The 324 Building was a major process development and waste management research facility that operated through most of the Cold War era[1]. The original mission of the 324 Building was as a pilot test to the 309 Plutonium Recycle Test Reactor. The building consists of radiological and non-radiological laboratories, support facilities, and administrative areas.

Major construction of the 324 Building in the 300 Area was completed in 1965. Significant additions to the building since the original construction include the high-bay, shop, and offices. The 324 Building is 62.5 m x 71.6 m (205 ft x 235 ft) and 13.7 m (45 ft) in height above ground level and includes a partial basement, first, second, and partial third floors.

The building contains two groups of heavily shielded cells with operating and service galleries and two vaults equipped with tanks for retaining radioactive liquid. In addition, the building houses two engineering development laboratories and a high-bay area that were used for non-radioactive activities. The cells are equipped with cranes, remote manipulators, viewing windows, various types of test equipment, plant off gas systems, and various services including air, water, steam, and electrical power. The cells and vaults are designed to shield the workers from direct radiation and, with the ventilation system and its high efficiency particulate air (HEPA) filters, to confine any radioactive particulate materials.

The basement of the 324 Building is approximately 3,437 m^2 (37,000 ft^2) and 3.7 m (12 ft) below grade. Located in the basement (or at basement level) are the Zones I and II exhaust fans and filter rooms, damper and filter pit (adjacent to C cell), exhaust tunnel, service tunnel, the bottom floor of B-Cell and the B-Cell operating gallery, the storage and laboratory area, tank pit, miscellaneous laboratories, and mechanical and administrative areas.

During the operational history of the facility, the 324-S Wet Storage Basin was centrally positioned in the 324 Building Cask Handling Area (CHA). The basin extended from ground level down to the flooring of the basement below the CHA (near the High Level Tank Vault). The basin was deactivated in the late 1990's by removal of the water, filling the basin with sand, and concreting the surface within the CHA.

The basin's original use was for transfers from the cask handling area and underwater storage of radioactive materials and fuel elements. Shielded transfers of highly radioactive materials from the wet basin were accomplished by two remotely-operated, enclosed mechanical transfer conveyors that are no longer operational. One conveyor interfaced the airlock of the Shielded

Materials Facility (SMF) and the other the airlock of the Radiochemical Engineering Complex (REC). During the history of the facility a special purpose structure was constructed over the top of the basin space after it was deactivated. When the special purpose structure was no longer needed it was dismantled and removed from the facility in the late 1990s.

The first floor is approximately 4,478 m^2 (48,200 ft^2) and comprises administrative areas and radiological and non-radiological laboratories. Within the radiological control area are the REC cells (central portion), the SMF (east portion), associated operating galleries, and the truck lock and CHA (east of the REC cells). The radiological support areas include change rooms, decontamination room, and manipulator repair shops. Within the radiological areas are access ways, via cover blocks in the CHA and manipulator shop, to the high-level vaults (HLV), low-level vaults (LLV), and the damper and filter pit. The south-central and southwest sides of the facility include office and other administrative areas (e.g., conference room, lobby). Located in the northwest portion of the facility are non-radiologically controlled laboratory areas, including engineering development laboratories and the high-bay addition. The 324-C laundry, formerly the experimental lithium enclosure, and the Engineering Development Laboratory (EDL) annex are located on the south side of EDL-101. The craft shop is located on the north side of the building.

The SMF cells, located in the southeast portion of the 324 Building, consist of the airlock cell, south cell, and east cell. The south, east, and airlock cells are joined, forming an "L," and are surrounded by an operating gallery.

The second floor of the 324 Building is approximately 4,153 m^2 (44,700 ft^2). It comprises administrative areas; laboratories; REC cells and the REC cell operating gallery; upper portions of the SMF, the CHA, and radiological support areas; the upper portion of EDL-101; and the EDL-102 and High-Bay Engineering Laboratory (HBEL) second floor mezzanines.

HISTORICAL 324 BUILDING ACTIVITIES

The following sections discuss the historical operations in the 324 Building by room or location. Historically, the 324 Building provided a diversified capability for high-activity radioactive chemical processing studies, metallurgical engineering studies, and non-radioactive waste treatability pilot-scale studies. The work performed in the building changed as programs began and concluded. Typically, 30 to 50 projects were in progress at any one time.

Shielded Material Facility (SMF)

The SMF consists of three interconnecting cells (south, east, airlock) surrounded by an operating gallery (Room 139). Cell operations normally were conducted from the operating gallery using through-the-wall, master-slave manipulators; remotely operated in-cell bridge cranes; a periscope; and electromechanical manipulators. Operations were aided by direct viewing through lead-glass and oil-filled viewing windows. The SMF historically was used for detailed evaluation of irradiated fuel and materials, source fabrication, shipping and receiving onsite and offsite radioactive materials, and other radioactive test programs. The facility handled a large variety of irradiated materials, test assemblies and samples, and segregated radioisotopes.

Radioactive/fissionable materials in varying forms and geometry also were handled. The SMF hot cells and airlock have a 136,000:1 cesium to alpha ratio and a 68:1 cesium to strontium ratio.

Periodic personnel entry into these cells was required for maintenance, calibration, and repair of equipment and to support stabilization and deactivation activities. To minimize the contamination spread and exposure from cleanup activities, additional containment was normally provided in the cell for activities involving nonclad or nonenclosed radiation sources, such as cesium source fabrication.

Nondestructive examination and destructive examination on tritium-bearing components were performed in a secondary enclosure. Examinations also were performed on irradiated cesium chloride or strontium fluoride capsules and on cesium chloride source capsules manufactured for industry. Useful fission products were processed and encapsulated using solution and powder processing; however, this work was limited to four compartments specially constructed to contain any contamination. These compartments were designed with smooth stainless steel walls for easy decontamination. Air in the compartments was exhausted through a roughing filter and a single-stage non-testable HEPA filter before it reached the final stage of the building HEPA filters. By controlling operations in this manner, personnel entry is possible simply by removing the irradiated material from a cell or placing the irradiated material in shielded in-cell storage facilities and decontaminating the encapsulation compartments.

The following are typical projects reflecting the range of work historically performed in the SMF cells:

- Conducted in-cell testing on various irradiated structural materials such as zirconium, stainless steel, and refractory metals
- Performed gamma scanning on cesium chloride capsules, Fast Flux Test Facility fuel pins, Experimental Breeder Reactor-II fuel pins, and SP-100 fuel pins
- Performed in-cell profilometry on cesium chloride capsules, Fast Flux Test Facility fuel pins, Experimental Breeder Reactor-II fuel pins, SP-100 test pins, and other cylindrical irradiated specimens
- Performed macro- and microphotography on fuel pins, cesium chloride samples, and miscellaneous structural material specimens
- Performed radiography of encapsulated radioactive materials (e.g., gamma radiation or heat sources)
- Cleaned Fast Flux Test Facility test canisters, sorted test assembly specimens, and processed materials open-test assembly experiments
- Performed post-irradiation examinations on tritium-bearing components and experiments, including sectioning/partitioning, gas recovery, and sample analysis

Radiochemical Engineering Complex (REC) Cells

The REC cells and associated service areas provided space for engineering evaluation of processes involving aqueous and solid radioactive and hazardous material. Metallographic investigations of highly radioactive material were also performed. Cells equipped with manipulators, remote-operated bridge cranes, closed-circuit television, and shielded viewing windows permitted complex experiments to be performed involving highly radioactive and hazardous material. Two cells equipped with periscopes with optical magnification performed detailed examination of materials. The airlock cell is equipped with bridge cranes that facilitate (and are still available for) remote installation, maintenance, and operation of equipment. Non-testable HEPA filters and an electrostatic precipitator (before the filters) are installed (and are still used) in B-Cell for use during size reduction and cleanup activities. The REC Hot Cells and REC Airlock average a 426:1 cesium to alpha ratio and a 69:1 cesium to strontium ratio.

The following are typical projects reflecting work historically performed in the REC cells:

- Developed and demonstrated treatment technologies from laboratory-scale to pilot-scale systems for conditioning gaseous, liquid, and solid radioactive and hazardous waste, including Hanford defense waste
- Developed and characterized borosilicate glass waste forms for immobilization of Hanford defense waste
- Characterized the long-term storage behavior of spent nuclear fuel
- Developed and demonstrated mechanical systems for packaging and handling containerized borosilicate glass
- Demonstrated in-cell, electrolytic decontamination of cylinders containing processed power reactor waste
- Conducted nondestructive examination and destructive examination on irradiated spent light-water reactor fuel

Both A-Cell and C-Cell equipment removal has been completed; however, high levels of radioactive and potentially hazardous contamination remain. More recent activities in the REC cells include cleanout of B-Cell. During more than 30 years of research and development activities, B-Cell accumulated a significant amount of radioactive and mixed waste, of which a large portion was in a potentially dispersible form. The scope of work for the 324 B-Cell cleanout included (1) packaging and removal of a significant amount of equipment and material, (2) removal and disposal of all old pilot-scale equipment systems, (3) disassembly and size reduction of the B-Cell racks, (4) completion of many other smaller decontamination and disposal activities, and (5) removal of spent nuclear fuel assemblies. Future work includes spent nuclear fuel rack removal and water-wash decontamination.

Engineering Laboratories

A modular-sectioned Engineering Design Laboratory (EDL) and the High Bay Engineering Laboratory (HBEL) provided space for engineering development of non-radioactive physical, chemical, thermal, electrical, and biological processes, instrumentation, and process and mechanical equipment ranging in size from laboratory to full-scale. The major focus of work carried out in the EDL was engineering development systems or chemical processes in a non-radioactive environment. Laboratories also were available for wet and dry chemical experiments. The laboratories were used for sample preparation, materials characterization, and bench-scale treatability experiments.

Following are examples of projects that have been performed in the EDL and supporting laboratories:

- Conducted pilot-scale and bench-scale evaluations of biological processes or systems for removal of organic and inorganic hazardous material from waste streams or groundwater (The systems grew and concentrated naturally occurring, noncontagious microorganisms, e.g., bacteria and fungi.)
- Determined erosion and corrosion rates in full-scale feed preparation, tank waste recovery, and pipe slurry transport systems
- Conducted laboratory and/or bench scale in situ vitrification studies of non-radioactive hazardous material and mixed waste, and simulated waste from Hanford Site underground tanks and other underground tanks
- Developed processes and equipment for pretreatment, decontamination (e.g., double-shell tanks), organic removal, and immobilization of simulated TRU waste; evaluated solutions and developed equipment for decontaminating and removing the process equipment
- Tested prototype characterization equipment, prepared samples, and determined chemical and physical characteristics of simulated radioactive and mixed waste and hazardous waste and treated waste forms

324 Building Liquid Waste Management System

The 324 Building has four liquid waste systems: the sanitary sewer system, the process sewer system, the retention process sewer system, and the radioactive liquid waste system (RLWS). Non-radioactive, hazardous liquid waste is collected in the building in temporary storage areas and then transferred from the facility for ultimate disposal.

Sanitary Sewer System: The sanitary sewer system serves only the restrooms, lunchrooms, and change rooms that have a low probability of contamination. The sanitary waste is discharged into the 300 Area sanitary sewer system.

Process Sewer System: Process sewage consists of cooling water, process water, and other non-sanitary liquid that does not contain radioactive or hazardous materials. In the 324 Building, non-hazardous, non-radioactive water waste from EDL-102, the CMU area, the HBEL, and the ventilation and equipment room is routed to the 300 Area process sewer system.

Retention Process Sewer System: The retention process sewer system receives non-regulated waste liquid, such as equipment cooling water, laboratory waste liquid, and floor drain liquid. These liquids are not contaminated but have the potential for contamination. A system of primarily steel piping in the 324 Building is routed to a diverter station that provides automatic diversion to the RLWS sump in the event that radioactive contamination is detected. The RWLS sump automatically pumps to LLV tank 102. Thus a diversion prevents radioactive effluent from leaving the building. A diverter station consists of a counting instrument and an automatically operated three-way valve and associated alarms for diverting liquid flow from the retention process sewer system if radioactivity in the waste exceeds 5,000 pCi/L cesium equivalent level. After passing the diverter, 324 Building retention process sewer system liquid is discharged to the 307 Retention Basin or the 310 Treated Effluent Disposal Facility (TEDF).

Radioactive Liquid Waste System: The RLWS is a system of pipes that drain to holding tanks in the 324 Building. The system excludes the diverter stations monitoring the retention process sewer system. The RLWS transfer lines from the 324 Building to the 340 Waste Neutralization Facility have been isolated. During upset conditions, which could generate contaminated liquid waste in the retention process sewer system, the detection system will activate the flow diverters, causing flow to the RLWS sump, which automatically pumps to LLV tank 102.

Effective October 1, 1998, the contents of LLV tanks 101 and 102 could no longer be transferred to the 340 Waste Neutralization Facility (i.e., the transfer lines were isolated at the RLWS valve box and steam was isolated to steam jets).

BUILDING 327

The 327 Building, referred to as the Post-irradiation Test Laboratory (PTL), is located near Building 324. Services historically performed in the 327 Building from 1953 to 1996 were carried out in one of the 11 shielded, standalone cells equipped with viewing windows, manipulators, and special equipment[1].

Currently the building is undergoing stabilization and deactivation operations to prepare it for decommissioning before fiscal year (FY) 2009. These operations include limited activities focusing on the removal of radioactive materials, equipment, waste from the building's hot cells and storage areas. No programmatic activities other than deactivation, stabilization, and surveillance and maintenance are currently identified for the 327 Building.

The nearest nuclear facility is the 325 Building, a Hazard Category 2 nuclear facility located approximately 90 m (300 ft) south of the 327 Building. The 326 Building, a radiological facility is located approximately 75 m (250 ft) southwest of the 327 Building.

The 327 Building is a single-story structure with a partial basement. Maximum dimensions are 65.6 m (215 ft) by 43 m (140 ft) and 9.8 m (32 ft) in height. The total work area of the building is approximately 2,340 m^2 (25,200 ft^2) with 930 m^2 (10,000 ft^2) of laboratory and work areas, 195 m^2 (2,100 ft^2) of offices, 223 m^2 (2,400 ft^2) of storage areas, and 975 m^2 (10,500 ft^2) of common areas containing ventilation and auxiliary equipment.

Ventilation systems are generally designed to draw air from areas of lesser contamination potential through areas having greater contamination potential before being filtered through HEPA filters and exhausted from the stack.

HISTORICAL 327 BUILDING ACTIVITIES

Services historically performed in the 327 Building included physical and mechanical properties measurement and testing, metrology, metallography, ceramography, auto radiography, fission product gas extraction and sampling, microdrill sampling, sampling for burnup and chemical analysis, encapsulation and disassembly of irradiated test modules, and encapsulation of irradiated structural materials for further irradiation testing. Irradiated fuels examined consisted primarily of fuel pins containing plutonium oxides and uranium oxides. Other fuel forms such as metals, carbides, and nitrides were handled occasionally. In addition, extensive sampling and analysis have not indicated the presence of residual beryllium in the building.

Examination, testing, and processing operations were carried out in the shielded cells equipped with viewing windows, manipulators, and special equipment. Materials to be examined or processed were received in shielded shipping casks and transferred to one of the cells or stored temporarily in the large water basins. These historical activities involved handling waste within cells and between cells. Waste minimization techniques (e.g., compacting) were also implemented to minimize the amount of waste generated.

The individual shielded cells in the 327 Building were configured to support a variety of programs. Some of the cells were configured to facilitate cell entry to meet program needs and to maintain test specimen cleanliness for subsequent analysis. Other cells could also be easily reconfigured through the use of plug-mounted equipment. The configuration of the cells changed frequently to accommodate program requirements. Some projects involved more than one location, such as material disassembly or sectioning in one cell and examination (microscopy/metallography) in another cell.

The following historical description of each 327 Building cell provides insight to the specific use of the cells and the variety of hazards associated with the stabilization and deactivation activities planned for the cells. Most of the following cells are currently involved in stabilization and deactivation activities.

A-Cell: Used for visual examination, sectioning and cutting, and packaging for disposal of irradiated fuel and high-level waste for transfers from the facility. A waste repackaging system is also installed in the cell for disposal of transuranic (TRU) waste. The remote handled waste is packaged for disposal/storage as contact handled TRU waste. A-Cell will be heavily used for waste processing to support deactivation of the other cells.

B-Cell: Used for structural materials postirradiation testing including preliminary preparation for transmission electron microscopy and immersion density measurements of cladding and structural samples. Irradiated materials from experiments in the Fast Flux Text Facility (FFTF) and the Experimental Breeder Reactor (EBR-II) have been processed, as have materials from production reactors and light water reactors. A lead-brick shielded cell called the "density cell" is connected to B Cell.

C-Cell: Used for metallography (including preparation and examination) of irradiated fuels and materials from experiments in the FFTF and EBR-II. Fuel/cladding sections from light water reactor fuel rods and sections of N-Reactor fuel elements/process tubes have also been examined.

D-Cell: Used for material property tests of fuel pin cladding sections from EBR-II and FFTF experiments. Capabilities included radio frequency heating and gas pressurization to simulate in-reactor accident conditions. Remote extensometry, in-cell welding, and macrophotography were also performed during specimen preparation and examination.

E-Cell: Capabilities similar to C-Cell.

F-Cell: Used for recovery of test samples from test capsules, recovery of fuel from cladding to prepare test specimens for density measurements, "rough-cut" sectioning of fuel elements for preparation of material property test specimens, and sectioning and examination of fuel materials from N Reactor and light water reactors.

G-Cell: Used for precision sample sectioning (remotely) of material property test specimens (e.g., tensile, fracture toughness, etc.) and testing of N-Reactor fuel elements at elevated temperatures. N-Reactor fuel handling included the drying of whole inner or outer fuel elements (containing up to 16 kg of uranium), and conversion of uranium hydride to uranium oxide (passification). Components also were sectioned and ignition tests performed on samples of the uranium fuel.

H-Cell: Used for physical property tests of irradiated fuels and materials. Activities included thermal conductivity, helium leak testing, inerting cell interior for capsule disassembly, lithium reacting, gas sampling, high temperature tensile testing, and cesium reservoir spark tests of irradiated specimens from experiments (space power) in the EBR-II and FFTF.

I-Cell: Used for corrosion tests of irradiated fuel from waste repository studies. Fuel was exposed to controlled conditions of heat and moisture in long-term (years) tests. A lead-brick shielded cell called the "Evaporator Cell," is adjacent to I-Cell.

Special Environmental Radiometallurgy Facility (SERF) Cell: Used for fission gas collection, precision sectioning of irradiated fuel pins, metallographic preparation and examination, and microhardness testing of fuel pin sections from experiments irradiated in the EBR-II or the FFTF. An inert atmosphere (nitrogen) is currently maintained in the cell with oxygen levels monitored continuously.

Decontamination Cell: The decontamination cell was historically used to decontaminate shipping and transfer casks and to decontaminate equipment removed from the shielded cells for repair or storage. The cell is equipped with an out-of-service filtered drain to the Radioactive Liquid Waste System (RLWS) and has its own exhaust ventilation system that is described in the building ventilation section. Water and steam were provided in the chamber for use in decontamination.

327 Operating Area

The primary operating area is on the main floor of the building and includes the area around the shielded cells (canyon) and the various bays connected to the canyon in which auxiliary operations are performed. The transfer and storage area at the west end of the building is physically separated from the canyon by a wall and large doors. The canyon area contains shielded cells and associated cell operating stations and consoles. Bridge cranes are used to transfer drums or casks containing radioactive structural materials or fuel between the cells and the shipping and receiving areas, or between the cells. Bridge cranes also are used for general lifting and transfer services in the canyon.

The SERF Cell is in a bay located on the north side of the canyon. Other bays adjacent to the canyon contain a machine shop, manipulator repair area and decontamination room. A 5-ton electric elevator is adjacent to the northeast corner of the decontamination room and is used for moving large objects to and from the storage area in the basement.

There are a number of mobile air radiation monitors stationed in several places in the canyon and basement areas. Area radiation monitors (ARMs) have been removed from the facility. If necessary for future activities, portable ARMs will be provided for specific work.

Hot Cells

Materials that would not be affected by exposure to air were historically examined and tested in shielded cells with an air atmosphere. Cells A through I are classified as air cells. Cells B and I each have a lead-brick shielded air cell. The lead-brick cell attached to B Cell was developed for density determination and is referred to as the “Density Cell”. The lead-brick cell adjacent to I-Cell was used for deposition of thin surface films for electron microprobe studies and is referred to as the “Evaporator Cell”. The other shielded cells are shop-fabricated from cast iron. These shielded cells rest on a reinforced concrete floor, and segments are fitted together by a groove-dowel, lock-together design. If direct access to one of these cells is required, a wall may be removed (with proper review and approval) to permit maintenance or changes in process or handling equipment. Two cells also have doors for access.

Spaced symmetrically about the iron cell walls are interchangeable plugs that lock into place with expanding retaining rings. Services and viewing ports are supplied through special plugs and, if possible, equipment is designed so that it can be plug mounted. Operating equipment is designed to be located entirely within the cells, with controls mounted on the outside. Most operations in the cells are performed with manipulators.

Exhaust from each of the cells is routed through two stages of HEPA filtration. The Density Cell exhausts directly into the adjacent B Cell. Evaporator Cell exhaust is provided by a small pipe that penetrates the canyon floor and joins with the I Cell exhaust prior to filtration per the two stages of HEPA filters.

SERF Cell

The SERF Cell was designed as an examination and storage facility with a nitrogen atmosphere to protect specimens affected by air. The cell consists of an upper operating area and a lower storage area.

A detachable shielded enclosure at the north end, with access to the operating cell, houses a remote metallograph formerly used for photomicrography, microhardness testing, and sample viewing at high magnification. Two airlocks provide access for entry or removal of test materials, supplies, equipment, and waste without compromising the integrity of the cell atmosphere. Operating equipment was designed to be located entirely within the cell. Cell operations are performed with manipulators.

The SERF Cell's lower storage area is located in the basement and is connected by a transfer tube to the operating area. A manipulator is provided to permit positioning and retrieval of materials in the storage area. Three storage racks are located in the cell, on the wall opposite of and on the two walls adjacent to the operating face of the cell.

The SERF Cell is a sealed enclosure that provides radiological containment/confinement, and at the same time, maintains the purity of the atmosphere in the cell by preventing the diffusion of air into the enclosure. Nitrogen is continuously supplied to the SERF Cell and is exhausted through the HEPA-filtered exhaust system. The pressure inside the SERF Cell is maintained negative relative to that of the canyon. The atmosphere of SERF Cell is continuously monitored for oxygen. In-cell power is shut off automatically when oxygen levels exceed 20,000 parts per million and restored when oxygen levels are less than 15,000 parts per million. While the nitrogen no longer provides a necessary process function for the SERF Cell, it is used to support the ventilation balance of the SERF Cell. The nitrogen system is planned to be deactivated.

Transfer and Storage Area

The transfer and storage area is located in the west end of the canyon and is used for: 1) shipment of irradiated materials, 2) storage of irradiated materials, and 3) decontamination of equipment removed from the shielded cells for repair or service. A large roll-up door at the west end of the building provides access to the storage pad and vehicle entry into the transfer area. To minimize impacts to building air balance when the outside roll-up door is open, metal doors can be positioned to isolate the transfer area from the remainder of the canyon. Irradiated fuel and structural materials may be stored in a Dry Storage Carousel and a large wet basin. A small wet basin is used for material transfer and cask loading/unloading. The large wet storage basin also was used to hold incoming material before examination and outgoing material scheduled for recovery or disposal. A basin water purification system consisting of a pump, cuno filters, molecular absorption filters, and two mixed bed deionizers maintains basin water purity in order to prevent corrosion of stored materials and to minimize waterborne radioactivity. The mixed bed deionizers contain mixed resin and are replaced when resistivity monitoring indicates that resin change is required. The mixed bed deionizer containers are shielded and mounted near the west wall of the Decontamination Cell. Two jib cranes, one serving each basin, are used to transfer materials in the basins. A transfer tube connects A-Cell and the small basin. A mechanical sample carrier in the tube provides for sample transfers between A-Cell and the basins. A LLW compactor and a decontamination cell are also located within the transfer and storage area.

The Dry Storage Carousel (adjacent to A-Cell) was used for storing small samples that had been processed. The carousel also stored structural material test specimens removed from irradiated assemblies. The carousel is a steel-lined; reinforced concrete tank that extends into the basement, with the top mounted flush with the canyon floor. Inside the concrete tank is a five-shelf "Lazy Susan". The shelves are positioned by mechanical linkage with the aid of a position-indicating device. A periscope is provided for identifying and examining the cans in storage. Specimens for storage were sealed in cans in the shielded cells and were introduced into or removed from the storage carousel using a transfer cask.

The Dry Storage Carousel exhausts through two stages of HEPA filtration. Negative pressure is maintained in the storage cavity to prevent contamination of the work area during transfers. A drain to the RLWS removes any liquids that may flow into the Dry Storage Carousel in the event the system will accommodate spilled liquids until the volume of the lines and sump is exceeded at which time the system will overflow the RLWS sump into the canyon basement.

A storage pad, located at the outside northwest corner of the building, and other outside posted radiological storage areas, store casks, waste containers, and other equipment that would not be affected by exposure to the elements. An enclosed storage facility, known as the 3723 Building, is located on the storage pad. Additional non-radiological storage areas, including conex boxes, are located outside the building.

327 Building Basement

The 327 Building basement is divided into three areas: 1) equipment room, 2) canyon basement area, and 3) storage room. The equipment room is maintained as a radiological buffer area while the remainder (and largest area) of the basement contains high radiation areas, radiation areas, and contamination areas.

The equipment room contains most of the building's active ventilation equipment (e.g. supply fan System A, exhaust fan Systems B and C, ventilation controls, etc.); stack monitoring equipment and related vacuum pumps; air storage tanks; an emergency air compressor; and other miscellaneous equipment.

The canyon basement area contains the majority of the building's shielded hot cell HEPA filters. This basement area also contains HEPA filters that service areas such as the Dry Storage Carousel; the low-level (room 15) fume hood; several canyon exhaust grille locations, including the north end transfer and storage area; and the basement exhaust HEPA filters. The System C exhaust duct can be routed through large charcoal filter housing for removal of radiohalogens from the exhaust air stream. However, because radiohalogen inventories are not sufficient to require charcoal filters to mitigate accident consequences, charcoal filters are not installed at this time. Fire detectors are located directly downstream of the charcoal filter housing.

The storage room contains the bottom portion of the SERF-Cell, miscellaneous deactivated systems associated with the SERF-Cell (e.g. SERF-Cell exhaust re-circulation system, vacuum pumps, etc.), elevator shaft, elevator machinery room, several building HEPA filters, and shelving for equipment and general storage.

327 Building Liquid Waste Management System

The 327 Building has four liquid waste systems: the sanitary sewer, process sewer, retention process sewer (RPS), and the RLWS. These systems serve areas with different potentials for contamination. Only the RPS and RLWS systems are involved in the diversion liquid system.

The sanitary waste system serves only the change room, lunchroom, and office areas that have very low probability of contamination. The sanitary waste is discharged into the 300 Area sanitary sewer system.

The process sewer removes liquids with little potential for radioactive contamination (e.g. ventilation "spray wash" system for evaporative cooling) and discharges to the 300 Area TEDF.

The RLWS historically served areas with high potential for contamination, such as the shielded cells, fume hoods and decontamination cell. Liquid wastes from the RLWS were collected at the 340 Building waste management facility for processing and disposal. The 340 Facility has been isolated from the 327 Building RLWS at the southeast corner of the canyon basement. This dead headed system cannot accept any flow from its sources because a means of quick disposal is not available at this time. As a result, in an accident scenario, with sufficient flow, the RLWS will back up into the 327 RLWS sump, which is not in service. If sufficient liquid waste is discharged, the sump will fill to capacity (~400 gallon) and spill into the canyon basement. Since the 340 Building is no longer operational for processing and disposal of liquid wastes, 327 Building management will provide for disposition of the liquid wastes thru the 2025-E Effluent Treatment Facility.

There is one RLWS sump located in the northwest end of the canyon basement (hot side). This sump contains one pump, which is not operable, connected to the RLWS main line running in the canyon basement (hot side). Since no liquid can be pumped to the RLWS main line, a sump overflow could happen. The RLWS drain line, which runs from the diverter assembly (cold side) to the building exit point on the south wall of the canyon basement, still passes through the old diverter station. This station is tagged out of service and is only used for flow path to the RLWS main line. The current configuration has a blind flange at the diverter assembly (cold side), which prevents diverted RPS from flowing into the RLWS drain line.

These liquid waste systems and components, when in service, were to ensure that the waste was being properly moved/monitored and sent to the proper waste system to minimize release to the environment.

324/327 BUILDING D4 ACTIVITIES

The scope of the 324/327 engineering evaluation/cost analysis (EE/CA) includes performing closure of a Resource Conservation and Recovery Act (RCRA) closure unit in the 324 Building. In the mid-1990s, it was determined that dangerous waste and waste residues were being stored for greater than 90 days in the 324 REC and the HLV/LLV tanks. Through the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) Milestone M-89-00, agreement was reached to close the non-permitted RCRA unit in the 324 Building.[2] The *324 Building Radiochemical Engineering Cells, High-Level Vault, Low-Level Vault, and Associated Areas Closure Plan* (DOE/RL-96-73) describes the RCRA closure requirements. The requirements contained within the closure plan for the non-permitted RCRA unit will be completed as part of the CERCLA removal action.

Characterization of the 324 and 327 Buildings has started. Each building has been divided into four areas for characterization purposes: office, industrial, gallery and hot cells. In 1996, a RCRA Closure Plan was developed and approved for portions of the 324 REC cells. Although this plan provided a baseline to close the 324 REC, it assumed that the cells would be decontaminated and demolished to free release standards. This would have placed personnel in extremely high radiation fields even with remote D4 operation techniques. As such, RL and WCH proposed a new strategy that would forego the free release criteria for the hot cells and utilize the use of fixatives and/or flood grouting techniques to decommission these structures. In order to utilize this strategy, the RCRA Closure Plan will be integrated with an Environmental Protection Agency (EPA) CERCLA documentation.

As part of the RCC Contract, RL has determined that the facilities have no further use. The potential threat of release of hazardous substances in the facilities poses a substantial risk to human health and the environment and therefore justifies use of CERCLA removal action authority in accordance with section 300.415 (b)(2) of the National Contingency Plan. An action memorandum, which will be developed from a future EE/CA, is expected to document and authorize implementation of the removal action that is selected for the facilities.

Disposition and removal of the larger hot cells in 324 and 327 is also a challenge due to their size and robust design. As an example, the 327 Building SERF cell cannot be demolished until shoring can be constructed underneath this structure since the cell's floor is freestanding and thus will require support shoring. The SERF is located in the middle of the other 10 hot cells, thereby creating a unique removal challenge. Currently, a critical lift engineering study has been undertaken to detail options for SERF cell removal. Included in this study is the erection of a foundation that will allow the SERF cell to be unfastened from its current mooring and become a free-standing unit.

A major concern is simultaneously protecting workers at Buildings 324 and 327, the environment, and the workers at the adjacent operational PNNL facilities while cleanup is underway. Further, large quantities of waste will be generated which will create logistics issues to access, containerize and transport the waste while not interrupting PNNL operations. WCH and Battelle, operator of PNNL, have developed a comprehensive communications strategy to keep PNNL employees informed of work in the 300 Area. This includes communication of the long-term strategy for demolishing buildings, the near-term schedule for adjacent buildings, notification of potential interruptions to available infrastructure, information on detailed characterization of hazards in all buildings to be demolished, and monitoring data for hazardous and radioactive materials during demolition. WCH and PNNL managers conduct periodic meetings to communicate the information, as well as post the information on an employee web site, and respond to individual questions submitted via email or a telephone hotline.

The RCC Contract offers significant opportunities for subcontracting. WCH can self-perform no more than 40 percent of the value of the contract, and 30 percent of the total value of the contract must be performed by small businesses. Stated differently, at least 60 percent of the contract must be subcontracted, and at least 50 percent of the subcontracted amount must be performed by small businesses. WCH has implemented an aggressive subcontracting strategy to meet the 60 percent subcontracting goal. The company held a procurement seminar the first month of its contract and will hold similar events throughout the life of the contract. Potential subcontracts can register on the WCH procurement web page www.washingtonclosure.com. The procurement page also lists upcoming procurements, as well as specific technology needs and requirements for the project.

REFERENCES

1. Hoober, William A. and David O. Jenkins. Interviews with author, Richland, Washington, September 2005.
2. U.S. Department of Energy, U.S. Environmental Protection Agency, and State of Washington Department of Ecology, *Hanford Federal Facility Agreement and Consent Order*, 1989 as amended.

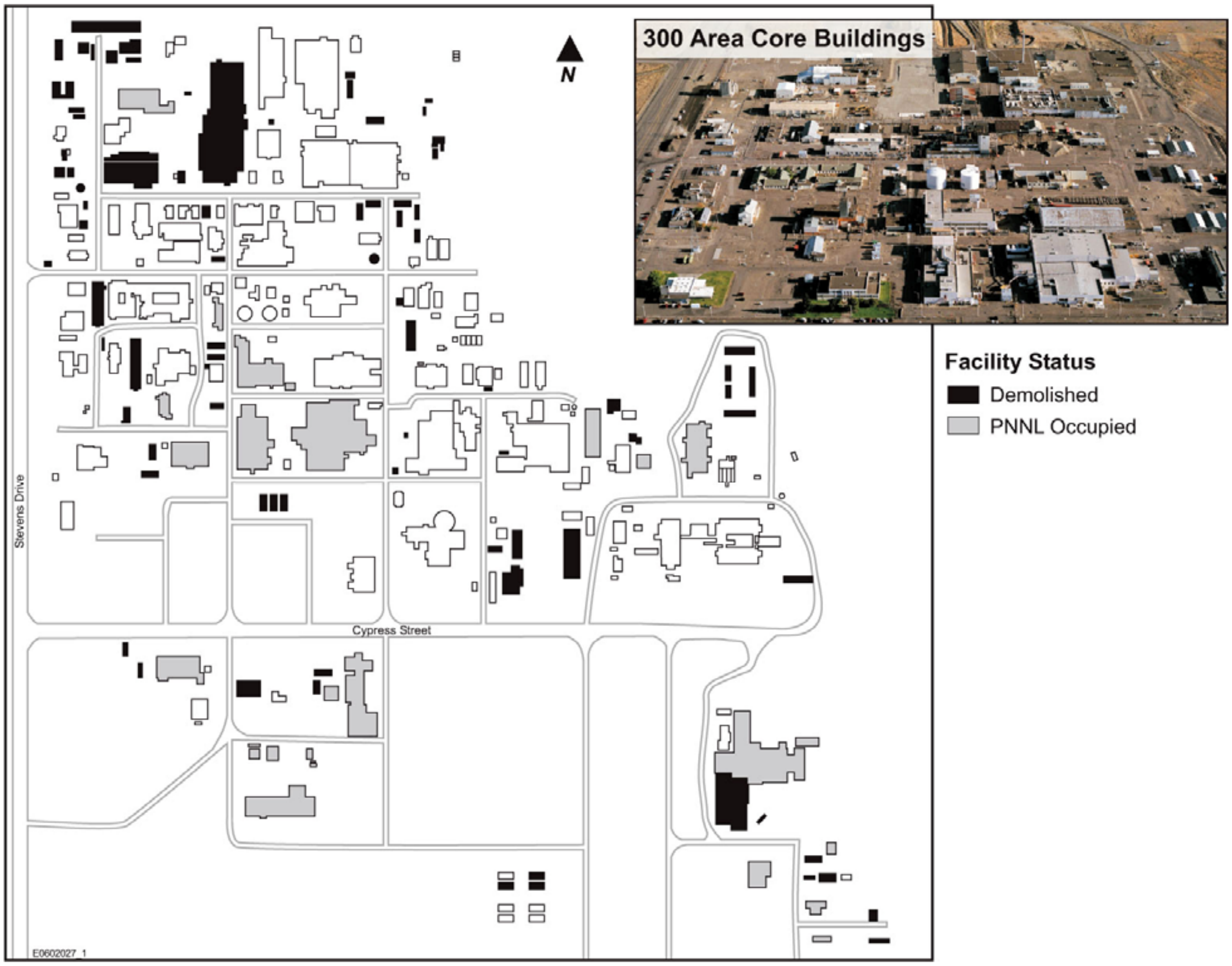

Fig. 1. Hanford 300 Area map and facility status

Fig. 2. Building 324 Radiochemical Engineering Complex (REC) B-Cell

Fig. 3. 327 Canyon Hot Cells