CONF-960443--2

LA-UR-96-91

Title:

Decontamination and Demolition of a Former Plutonium Processing Facility's Process Exhaust System, Firescreen, and Filter Plenum Buildings

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Submitted to:

American Nuclear Society
Best of D&D . . .
Decontamination & Decommissioning Topical Meeting
Chicago, Illinois
April 14–17, 1996

Los Alamos
NATIONAL LABORATORY

DECONTAMINATION AND DEMOLITION OF A FORMER PLUTONIUM PROCESSING FACILITY'S PROCESS EXHAUST SYSTEM, FIRESCREEN, AND FILTER PLENUM BUILDINGS
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ABSTRACT

The Los Alamos National Laboratory (LANL) Decommissioning Project has decontaminated, demolished, and decommissioned a process exhaust system, two filter plenum buildings, and a firescreen plenum structure at Technical Area 21 (TA-21). The project began in August 1995 and was completed in January 1996. These high-efficiency particulate air (HEPA) filter plenums and associated ventilation ductwork provided process exhaust to fume hoods and glove boxes in TA-21 Buildings 2 through 5 when these buildings were active plutonium and uranium processing and research facilities. This paper summarizes the history of TA-21 plutonium and uranium processing and research activities and provides a detailed discussion of integrated work process controls, characterize-as-you-go methodology, unique engineering controls, decontamination techniques, demolition methodology, waste minimization, and volume reduction. Also presented in detail are the challenges facing the LANL Decommissioning Project to safely and economically decontaminate and demolish surplus facilities and the unique solutions to tough problems. This paper also shows the effectiveness of the integrated work package concept to control work through all phases.

Keywords: plutonium, work package, health and safety, characterization, filter plenum, engineering controls, body glove, decontamination, demolition, transuranic waste, waste minimization, and volume reduction.

I. INTRODUCTION

Many of the challenges of the TA-21 Filter Building Decommissioning Project are not unique to LANL, and their solutions can be applied to other decommissioning projects and programs elsewhere. The TA-21 Filter Building Decommissioning Project presented safety, personnel exposure, and contamination control challenges that required extra care to ensure that rigorous radiation protection practices were followed by project personnel. The project goals were as follows: 1) the removal of as much plutonium holdup as possible through decontamination and component removal to downgrade from a *Category 3 Nuclear Facility* rating to a *Radiological Facility* rating; 2) the removal of all process exhaust systems including 1500 linear ft of ductwork, glove boxes, and hoods from Buildings 3 and 4 North to the firescreen; 3) the decontamination and demolition of the firescreen; 4) the decontamination and removal of the filter plenum and glove boxes from the Rotary Filter Plenum Building (Building 146); 5) the removal and disposal of the HEPA filter bank from the Main Filter House (Building 324); 6) the demolition of the stack; 7) the free release of all remaining cement slab foundations and outer support structures; and finally 8) classification of most of the radioactively contaminated demolition debris as low-level radioactive waste (LLRW) rather than transuranic waste through decontamination.

Because of the existing ^{239}Pu holdup (approximately 1 mCi/ft) the process exhaust system, which includes the firescreen and filter plenums, was regarded as a Category 3 Nuclear Facility. Paramount to the success of the project, the downgrading from the Category 3 Nuclear Facility rating to a Radiological Facility rating was needed at the beginning of the project. This downgrading was accomplished through the initial elimination of 75 to 80 percent of the plutonium holdup through decontamination and component removal (firescreens) from the Firescreen Building (Building 329) and the decontamination of the main filter plenum in Building 146. The decontamination objective was to reduce the plutonium source term below a certain level and not to free release the structures. The subsequent downgrading from a Category 3 Nuclear Facility to a Radiological Facility eliminated much of the initial engineering work (that is, Engineering Analysis, Title I and II Engineering Project Plans) required for a Category 3 Nuclear Facility.

Decontamination methodology is discussed in detail including decontamination equipment, decontamination techniques, decontamination effectiveness, solid and liquid radioactive waste generation, waste minimization techniques, and waste volume reduction.

A. Background

During the last 20 years, 12 decommissioning projects have been performed at LANL. Early cleanup programs were performed as voluntary cleanups under the U.S. Department of Energy's Defense Program. Some programs, such as those involving removal of industrial lines and reactors, were included in the Formerly Utilized Surplus Remedial Action Program and/or the Surplus Facility Management Program. Since 1988 decommissioning work has been conducted under the Department of Energy's EM-40 Environmental Management Program.

Past projects include the removal of three nuclear reactors, contaminated waste lines, septic tanks, and filter buildings. Additional work included decontamination of laboratories and removal of glove boxes and other equipment. The emphasis was on cleaning up radioactive contamination, such as uranium, plutonium, tritium, cesium, and strontium. Regulations for cleaning up contamination from hazardous materials were not formulated until the 1980s; consequently, some old sites are being revisited and sampled to determine whether hazardous contaminants exist.

B. Current Projects

The Defense Programs (DP) West Site at TA-21 was developed in 1945 to replace the original plutonium facility at TA-1. Nineteen buildings, consisting of laboratories, filter buildings, a liquid waste treatment plant, and ancillary structures, are scheduled for decommissioning. Most of the buildings were constructed in 1944 and 1945 to produce metal and alloys of plutonium and other transuranic elements from nitrate solution feedstock, to fabricate precision shapes from these metals, and to house recycling operations so that scrap materials from experiments could be reused. Primary contamination consists of uranium, plutonium, tritium, asbestos, lead, mercury, and silver-based components. Decommissioning is ongoing and is expected to be completed by the year 2001 The enriched uranium processing facility was decommissioned in 1994 through 1995.

The high-pressure tritium facility was constructed in 1955 to house tritium experiments in support of nuclear weapons research programs. In 1990 operations at the building were suspended. The main facility is constructed of reinforced concrete. Ancillary structures include a small building, associated waste lines, and a sump. Contaminants include tritium, asbestos, lead, mercury, and silver-based components. Characterization activities are ongoing, and remediation is expected to start next year, if funds are available.

The High-Explosive (HE) Facility Decommissioning Project consists of 25 abandoned buildings constructed during 1944 and 1951. The original activities carried out in these buildings were associated with the Manhattan Project and early cold war weapons development programs. One building has some uranium contamination. All the other buildings are contaminated with HE. The primary types of HE used were HMX, RDX, TNT, PETN, DATB, and various mixtures of these components. Other contaminated materials include asbestos, mercury switches, and lead acid batteries. Preplanning is complete, and remediation is schedule to start this year.

The Phase Separator Pit Decommissioning Project involves three facilities: the main laboratory building, the phase separator pit that houses a wet/dry filtering system, and a building that houses the HEPA filtering system and associated stacks. The phase separator pit has process equipment and filters that were used to separate exhausted liquids and gases from hot cells, two experimental reactors, and some research laboratories. Contaminants include mixed fission products, uranium, plutonium, and asbestos. Planning is complete, and remediation is ongoing.

C. Program Management

1. Strategy. Our strategy is to perform work that affects long-term cost savings, reduces environmental liabilities, promotes quick success stories, enhances regulatory compliance schedules, and/or removes Resource Conservation Recovery Act (RCRA) action requirements. The bottom line is to perform actual cleanup work quickly.

We remove sources early to eliminate or mitigate releases or potential releases. Close working relationships with the landlords and transition facility are essential so that sources can be addressed during the life of the facility. Expedited removal actions also serve to downgrade nuclear facilities to radiological facilities and to reduce or allow graded nuclear safety oversight and associated documentation. Surveillance and maintenance requirements are not the responsibility of the LANL Decommissioning Project.

Allowing degradation of facilities may or may not be desirable. If there are no environment, safety, or health concerns and if future reuse (refurbishment) is not contemplated, then the option of taking no action until funding is available can be a desirable option. Periodic (quarterly or annual) checks may still be required.

2. Waste Management. Decommissioning operations should take the lead if waste management personnel are unable to determine solutions and alternatives for treatment, recycling, storage, or disposal of low-level radioactive, hazardous, mixed, or transuranic decommissioning wastes. This approach also applies to waste characterization, certification, and waste minimization efforts. Teaming of waste management and decommissioning personnel is preferable, and turning waste operations over to a waste management group should be the goal. The Decommissioning Project at LANL has been proactive in trying to develop programs for recycling reinforced concrete, compacting waste, and disposing of wastes off-site.

3. Contracting. At LANL, using an on-site maintenance contractor provided quick response and flexibility. The trend will be to solicit bids and contract future work. The burden of coordinating work, having an adequate supply of trained people and proper equipment, and having a quick response capability will be shifted to contractors.

The decommissioning process should take into account the viewpoints and needs of the landlord, the Department of Energy, and private industry. Procurement contracts should strive for a pool of prequalified contractors on which to draw for competitive and fixed-fee awards. Contractors should be allowed to determine the amount of characterization information required, methods of decommissioning, and methods and documentation needed to meet applicable regulations and orders. Sufficient but not necessarily detailed characterization information should be available to contractors performing the work. Some level of risk resulting from uncertainty is acceptable. Unnecessary site rules, policies, directives, orders, and regulations should be reduced, and guidance and goals for contractors should be established.

4. Stakeholders. Our strategy is to solicit, integrate, and disseminate information and to coordinate decommissioning activities with LANL groups (such as engineering; facility landlords; environment, safety, and health groups; and waste management), the Department of Energy, the state, the Environmental Protection Agency, and citizen groups, as appropriate. The object is to perform discrete cleanup projects and not to become landlords. Ultimate responsibility for the site resides with the site or facility landlords. Decommissioning personnel are temporary residents whose sole responsibility is the decommissioning project. To avoid disruption and delays, work schedules, activities, and documentation are integrated with the activities of the landlord and personnel conducting RCRA activities.

Currently, decommissioning is not performed under the Comprehensive Environmental Response, Compensation, and Liability Act or RCRA; therefore, we do not attempt to meet the public involvement requirements of those statutes. Our public information efforts are limited to presentations given to news media (newspapers and television).

D. History of TA-21

DP West began operations in September 1945. Its main purpose was to provide the capability to produce metal and alloys of plutonium from the nitrate solution feedstock provided by other production facilities. This process involved several acid dissolution and chemical precipitation steps to separate the plutonium and other valuable actinides from the feedstocks. A major research objective at DP West was the development of new purification techniques that would increase the efficiency of the separation processes. These separation techniques used a wide range of chemicals from the periodic table. In conjunction with improving purification techniques in the main process lines, research was conducted into reprocessing the waste produced to further enhance recovery. In addition, other operations, such as nuclear fuel reprocessing, were performed occasionally at DP West. Activities unrelated to plutonium processing also occurred at DP West (Fig. 1).

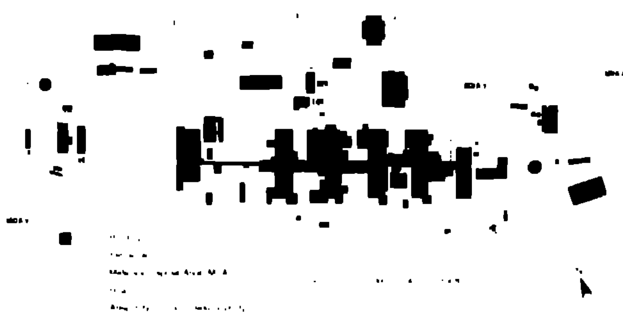

Fig. 1. Diagram of TA-21 Site, DP West.

The main plutonium purification processes were contained in Buildings 2, 3, 4, and 5 and later in Building 150. Uranium and plutonium metal produced in these buildings was secured and stored in Building 21, the old vault. Research into methods of recovering additional plutonium from waste streams was conducted in Building 33. Additional research on the properties and uses of plutonium was conducted at Building 210, the plutonium research building.

In 1977 a transfer of work to the new plutonium facility at TA-55 began, and much of the DP West complex was vacated. At the time, cleanup of the old process lines was initiated. This cleanup included removing contaminated equipment and material from Buildings 2, 5, and 150 and from parts of Buildings 3 and 4. The buildings were then remodeled for use by other groups at LANL.

E. Filter Buildings

The filter buildings provided process exhaust to Buildings 2, 3, 4, 5, and 21 at TA-21. The process exhaust filter system consisted of the following: the Firescreen Building (Building 329); the Rotary Filter Plenum Building (Building 146); the Main Filter House (Building 324), and the Main Stack (Fig. 2).

Fig. 2. Firescreen Building (Building 329), Rotary Filter Plenum Building (Building 146), Main Filter House (Building 324), and Main Stack.

Ductwork exited Buildings 3 and 4 North and ran along elevated stanchions until it reached the firescreen. The exhaust stream entered this structure, which was an elevated, sheet metal enclosed building containing screen filters and washdown equipment. A transparent glass line exited the sheet metal enclosure and discharged into a liquid waste transfer line, which ran to the on-site liquid waste treatment plant. The exhaust then entered Building 146, a concrete block building that housed a large, circular HEPA filter array and a glove box assembly for changing out the filters (Fig. 2). The HEPA filter array consisted of an octagonal filter bank containing eight sets of three filters housed in a drum. The drum assembly rotated so that new filter faces could be presented to the airstream, thus reducing by a factor of eight the downtime needed for change out. The exhaust stream then entered Building 324, the filter house, which was added to the flow path in 1973. It contained 20 HEPA filters in parallel. Exhaust was then released through the stack at the north end of the building (Fig. 2).

Decommissioning of the filter buildings involved the removal of hoods, glove boxes, and interior process exhaust ductwork from Buildings 3 and 4 North; the elevated ductwork that ran into Building 146; the HEPA filters and glove box and drum assemblies in Building 146; the firescreen, all ductwork, and the stack in Building 146; the HEPA filters in Building 324; and all ductwork and the stack in Building 324. Both buildings were then demolished.

LANL was responsible for overall project management, health physics, environmental compliance, criticality engineering, and waste management. Subcontractor oversight in the areas of engineering and health and safety also were performed by LANL. Dismantlement and demolition activities were performed by the on-site maintenance subcontractor, Johnson Controls World Services, Inc., who also provided industrial hygiene services and was instrumental in developing work packages.

II. INTEGRATED WORK PROCESS CONTROLS

A key element to the success of the project was the application of the integrated work process control called the work package. Work packages typically included a specific task work procedure, a Task Hazard Analysis (THA), a Radiological Work Permit (RWP), and an ALARA Job Review, if required.

A THA was also developed for each specific task and was an assessment of all nonradiological workplace hazards. The THA along with the RWP was the basis for developing work procedures and documenting the need for special permits and controls. The THA was signed by each employee who worked on the task, including supervisory personnel, and generally included the following:

- general information including historical sampling data related to the task;
- task description including procedures required to minimize hazards;
- descriptions of specific hazards;
- hazard control measures including personal protective equipment (PPE), permits, and training;
- any special decontamination procedures not covered by the RWP (for example, chemical decontamination); and
- spill prevention, containment, and response and/or accident mitigation.

As part of the work package, all decommissioning work that had a potential for personnel internal or external radiation exposure and/or contamination spread required an RWP. The RWP places controls on personnel entry into controlled and radiological areas. The RWP identified the specific work activity, evaluated potential radiological exposure conditions, and established appropriate levels of radiological control technician job coverage, monitoring instructions, action levels and hold points, PPE, radiological controls for demolition, and dosimetry assignment for entry.

Work packages were typically developed within days of the actual work by the site superintendent, construction supervisor, lead radiological control technician, and other key health and safety personnel. This process provided project personnel a *usable* work plan, which included a detailed task procedure, a work evolution hazard assessment, personnel protection based on the hazard assessment (confined space permits, burning/welding permits, engineering controls, respiratory protection, PPE, and dosimetry), and all contamination controls. One key benefit from this approach is that the work package was developed in real time. Therefore, recent and pertinent survey data, lessons learned, and personnel experience obtained from preceding job evolutions were continuously incorporated into new work packages.

III. CHARACTERIZE-AS-YOU-GO METHODOLOGY

Characterization of the entire facility was not conducted. Instead, LANL uses a characterize-as-you-go methodology for decommissioning projects. Rather than extensively characterizing the entire project, enough data are collected early in the project through surveys, historical documentation search, and interviews conducted with individuals who have historical knowledge of the site. Types of important information include the specific processes conducted at the site, chemicals and radionuclides used in the various processes, and locations of any spills and releases. Detailed work procedures are developed as the work progresses, and additional information is collected as necessary. This process avoids efforts that can be rendered useless by newly discovered problems, but it requires flexibility in scheduling and completing activities. This section discusses the application of this approach to the filter buildings.

Important to the characterize-as-you-go methodology is the detailed project characterization directory developed and revised as the project progresses. The characterization directory is a living document that includes digital photographs of key areas, rooms and system components to be decontaminated and/or decommissioned, diagrams, any historical information on the key system or component, survey data points, and any other pertinent information. This directory is updated continuously as information is made available. Key uses of the directory are to write the work packages, conduct prejob briefings, and orient new project personnel.

Engineering data requirements consisted of utility and structural information. Specifically, the locations of all utilities and any necessary reroutes must be identified. Structurally, the characterization effort had to ascertain whether the Building 146 drum assembly would rotate. The drum had not been turned since the 1970s, and seal integrity and the opposite filter banks were items of concern. Existing drawings were collected for reference and were annotated to identify the as-left facility condition. Historical records were reviewed to identify any abandoned utilities and any facility modifications that could affect decommissioning.

Knowledge regarding types and quantities of contaminants is essential for decommissioning operations and waste handling. Radioactive waste may be either low-level or transuranic, whereas chemical contamination may result in hazardous or mixed waste. Potential contaminants have been identified from the remedial action work plan, operating summaries, decommissioning summaries, and historical interviews. Radionuclides of concern were ^{235}U, ^{238}U, ^{238}Pu, ^{239}Pu, ^{99}Tc, ^{241}Am, ^{243}Am, ^{237}Np, ^{232}Th, and ^{231}Pa. Chemical concerns included asbestos (146 HEPA filters), metals (146 HEPA filters), polychlorinated biphenyls (PCBs) (lighting ballasts), perchlorates (ductwork, 146 filters), and picric acid.

Because the data address waste management and safety concerns, exact readings were not as important as bounding readings. The data should identify thresholds for waste categories or PPE requirements.

IV. ENGINEERING CONTROLS

Unique engineering controls developed for the project were modifications to the process exhaust system and the compartmentalized support tent with its attached "body glove" glove bag. Other engineering controls used during the project included standard glove bags, HEPA filtration methodology (both portable HEPA filtration units and the reliance on the existing process exhaust system), and strippable coatings.

Before beginning any major decommissioning activities, modifications to the process exhaust were necessary primarily because of considerable system negative pressure. Before any modifications, the system negative pressure was approximately 3 in. of water, too much to allow its use during decommissioning. Dampening was possible by cutting a 36-in. hole in the process exhaust downstream from the two stages of system HEPA filters directly below where it entered the stack. A cylindrical 38-in. long by 36-in. diameter sheet metal piece was then welded to the hole with a circular plate attached to provide the dampening (Fig. 3). System negative pressure was adjustable from 0.2 to 3 in. of water with this modification. The negative pressure was adjusted to suit the task being performed.

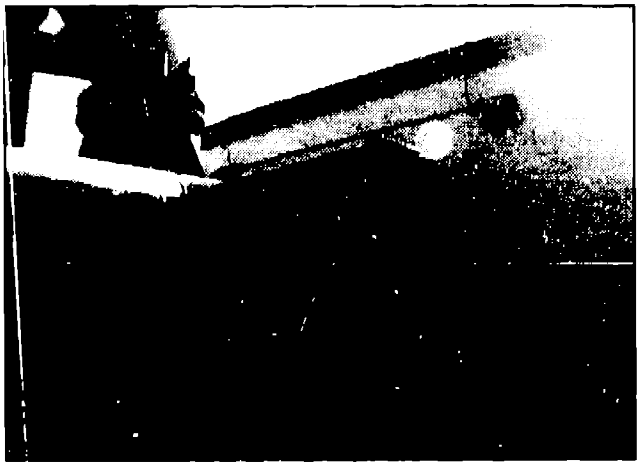

Fig. 3. Process exhaust system negative dampening modification.

Because of significant plutonium holdup in the entire process exhaust system, the reliance on engineering controls to reduce this hazard was a LANL Health Physics group requirement. Data made available during the initial characterization of the firescreen, verified through surveys and air sampling, indicated the average surface plutonium contamination at ~4.0E+06 dpm/100 cm^2 removable and airborne contamination levels up to 1500 derived air concentration (DAC)-hours. One significant engineering control developed specifically for the project and used with great success was the body glove. The body glove with its attached support tent (Fig. 4) provided maximum contamination control and worker protection. The support tent was compartmentalized for maximum contamination control in the event of a body glove failure. All negative ventilation was provided by the existing process exhaust with portable HEPA units attached to the support tent as backups. The body glove is essentially a glove bag that personnel enter to perform work; whereas, a normal glove bag surrounds a highly contaminated item within the bag, and personnel work from the outside. Before erecting the body glove, all necessary tools and equipment for a particular task were introduced into the firescreen. Then the body glove was inserted directly into the firescreen, unfolded, and supported by a rigid metal internal frame. Work was performed inside the bag using a series of gloves positioned on the sides and top of the body glove.

In highly contaminated areas, such as the firescreen and main filter plenum, the body glove isolated workers from both seriously high surface and airborne contamination (Fig. 4). Airborne contamination levels were reduced from the initial 1500 DAC-hours to <1 DAC-hour, which allowed most work to be performed using supplied-air respirators that were required in the event of a body glove failure.

Standard glove bags were used throughout the project. All demolition and size reduction of overhead process exhaust ductwork was done using glove bags, a skill developed during the demolition of Buildings 3 and 4 South. When the interior process exhaust system was removed, Buildings 3 and 4 North were active facilities, and extensive use of glove bags prevented release of radioactive contamination and avoided costly cleanup efforts.

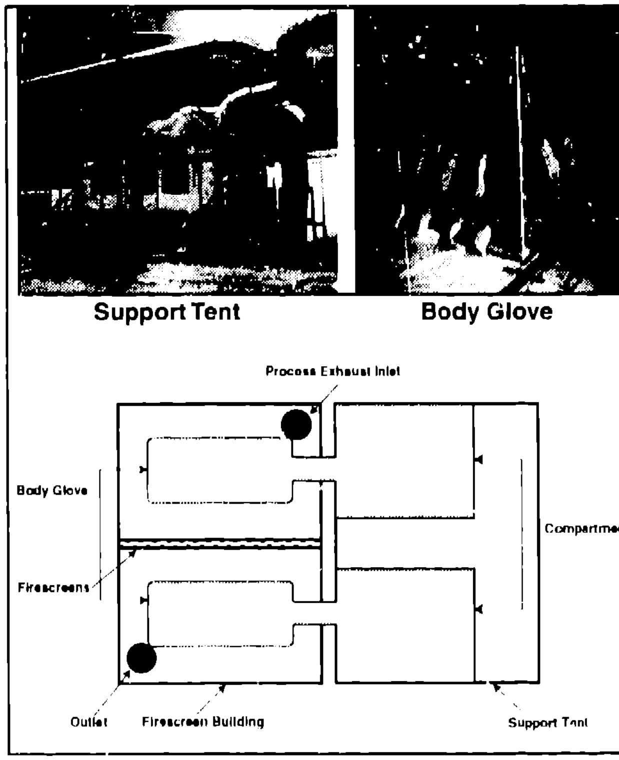

Fig. 4. Support tent, body glove, and containment system diagram.

V. DECONTAMINATION AND DEMOLITION METHODOLOGY

The objective of the TA-21 Filter Building Decommissioning Project was to reduce the plutonium contamination on surfaces below transuranic levels. If possible, metal surfaces were to be decontaminated further to meet Science and Ecology Group (SEG) waste classification guidelines to enable the metal to be recycled at their facility in Oak Ridge, Tennessee. SEG is a large recycler for radioactive-contaminated metal that deals mainly with the commercial sector. It has been used by LANL for less than one year. It was possible to recycle all plenum walls and ceilings, but floor surfaces were sent to LANL's LLRW landfill at TA-54. Project surface contamination acceptance criteria for LLRW and transuranic waste and SEG waste acceptance criteria are found in Table 1. Ninety percent of all radioactive waste for the project was characterized as LLRW. Twenty percent of this material was shipped to SEG. Equipment was either decontaminated *in situ* or brought to the project decontamination area, an old hot cell in Building 4 North. Sheet plastic was fastened to the floor, walls, and ceiling with duct tape, and two 1800 cfm HEPA-filtered negative air units were added to mitigate large amounts of surface and airborne plutonium contamination. Airborne contamination levels reached approximately 300 DAC-hours during certain decontamination operations.

Table 1. Project Waste Acceptance Criteria for Total Surface Contamination

	1/4" Steel ($dpm/200cm^2$)	16 Gauge Steel ($dpm/100cm^2$)	Heavy Plastic ($dpm/100xm^2$)
LLRW	<88,000,000	<26,800,000	<26,000,000
Transuranic	>88,000,000	>26,800,000	>26,000,000
SEG Recycle	<88,000	<268,000	N/A

The project relied on the following five proven methods of decontamination: vacuuming, wiping, scrubbing, using strippable coatings, and shot blasting. Vacuuming, wiping, scrubbing, and strippable coatings were primarily used to decontaminate the firescreen plenum, the main filter plenum, glove boxes, and ductwork. Shot blasting was used to decontaminate concrete surfaces especially the concrete slab in Building 146. Vacuuming, wiping, and scrubbing were used to remove radioactive dust and particles from plenum surfaces. Vacuuming was performed using HEPA-filtered vacuum cleaners. Surfaces were then wiped/scrubbed with a damp rag and an industrial all-purpose cleaner. Rags were discarded as radioactive waste.

After surfaces were vacuumed and wiped down, strippable coatings were applied. Decontamination factors ranged from 10 to 100 depending on the presence of grease or oily residue on surfaces. The use of strippable coatings involves the application of a polymer mixture, either by a paint roller or airless sprayer, to a contaminated surface. Both application methods were used in this project. As the polymer hardens, the contaminants are entrained into the material. The coating is then pealed off, containerized, and disposed of. This technique is best suited for floors, walls, and ceilings because of their easy accessibility. Strippable coatings were also used with limited success on internal glove box and ductwork surfaces.

Shot blasting was used on the concrete slab on Buildings 146 and 324 after all equipment was removed from the buildings and the ceilings and walls were removed. Most of both building structures were free released and sent to a local sanitary landfill for disposal. Shot blasting is an airless method that strips, cleans, and etches the surface simultaneously. The technique is virtually dust free, therefore, shot blasting of the concrete slabs was conducted without using respirators. Portable shot blasting units move along the surface as the abrasive is fed into the center of a completely enclosed centrifugal blast wheel. As the wheel spins, the abrasives are hurled from the blades, blasting the surface. The abrasive and removed debris are bounced back to a separation system that recycles the abrasives and sends the contaminates to a dust collector.

Demolition methodologies followed current, accepted industry practices. The general decommissioning sequence consisted of 1) HEPA filter removal from the main rotary plenum and from Building 324, 2) main filter plenum removal from Building 146, 3) hood and glove box removal, 4) exhaust system removal, 5) utility piping removal, 6) final system disconnects (that is, electrical and fire protection), and 7) a final status survey of both buildings to determine their suitability for free release. After additional spot decontamination of masonry block wall surfaces, the buildings were demolished using a trackhoe. Finally, both buildings' concrete slabs were decontaminated by shot blast, surveyed for free release, and then removed using a trackhoe.

VI. WASTE MINIMIZATION AND VOLUME REDUCTION

LANL and Department of Energy policy precludes the free release of any material with detectable activity above background levels, even when the surface contamination is below release guidelines. Although some materials have been released to a municipal landfill following demonstration of no detectable activity, waste minimization activities primarily emphasize volume reduction through on-site compaction and recycling of contaminated scrap metal. Concrete was cleaned using a shot vacuum system, and the remaining slabs will be crushed and used as on-site fill. Through recycling, steel decontamination, and concrete crushing, LLRW from decommissioning was reduced compared with previous decommissioning projects.

Soil remediation was coordinated with LANL's remedial action project. Sampling and other activities also were coordinated to ensure data applicability and cost effectiveness.

A significant amount of data currently exist for this project.[1] This information was obtained during a LANL-wide project to quantify special nuclear material holdup in ventilation systems. These data indicated that sizable portions of the process exhaust would be classified as transuranic waste. Ductwork was decontaminated during decommissioning to minimize the volume of transuranic waste. Accordingly, during decommissioning the removed ductwork and decontamination waste were characterized for waste disposal purposes. This approach also recognizes the difficulty and expense of sampling exhaust systems before removal. Likewise, HEPA filter sampling was best left until actual removal, at which time the filters were cored and samples were obtained more easily. Additional data were collected to measure radioactivity in systems not addressed during previous holdup measurement campaigns. Measurements were made using nondestructive assay methods with sodium iodide and germanium detectors. Items likely to be free of contamination were surveyed to verify that no unexpected radioactivity was present. Appropriate engineering controls were used during decommissioning to protect uncontaminated materials.

Except for one small spot of contamination on the floor of Building 146, no historical releases occurred within either Building 146 or 324. The walls and floors were surveyed before demolition and were decontaminated if contamination above detectable limits was indicated. The long-range alpha detector, an experimental system developed at LANL,[2] and conventional gas-proportional instruments were used to systematically survey the structures to verify that the material was uncontaminated.

Facility processes did not involve hazardous wastes listed under RCRA. The RCRA facility investigation work plan identified metals as a potential contaminant of concern, so the Building 146 filters were sampled for metals. Sampling for metals, like the surveys for radioactive constituents mentioned above, were performed when the filter was removed.

Building 146 was been sampled for perchlorates. This sampling was repeated after the drum had been turned. Historical records suggested that picric acid was used for some experiments. Building 146 was tested for picric acid before and after turning the drum, and the result was negative. During disassembly, duct systems were routinely tested for perchlorates and were all found to be negative.

The HEPA filters contained asbestos, and the roofs of both buildings were thought to contain nonfriable asbestos-contaminated material. All roofing material was tested for asbestos. Lighting systems were inspected for PCBs during disassembly, and fluorescent bulbs were handled as hazardous waste.

VII. LESSONS LEARNED

The main lesson learned to date involved the discovery of perchlorates in the Building 3 process exhaust system during system disassembly. Use of perchloric acid had not been identified during the assessment phase when many records were reviewed and former operators were interviewed. Perchlorates are shock and temperature sensitive, although they may be handled safely when wet. Experts from Oak Ridge National Laboratory were called in to assist in solving the problem. Considerable time and money was saved by using their proven techniques instead of developing solutions internally.[3] Perchlorate sampling and analysis were performed in the field using a portable ion-specific electrode system. Dismantlement required steaming two 3-ft × 3-ft × 20-ft sections of ductwork that joined to form a central upsweep that ran through the building attic and onto the roof. The system was disconnected in the attic and lowered to the floor, and the large section of ductwork was cut into smaller sections and rinsed in tanks of water.

Another important lesson learned is that the observational approach is very effective from both cost and schedule perspectives. By minimizing characterization activities, initial expenses and time to completion are reduced. Moreover, involving the people who will be doing the physical work during the planning stage simplifies the techniques used and guarantees the feasibility of the chosen techniques. Perchlorate and other unusual chemical contaminants (such as picrates) may be hazards in old chemical processing facilities and should be sampled for.

Finally, an extremely important lesson learned is that a small, autonomous project team, capable of internaldecision-making, is essential for staying on track. The customer must be part of the team.

ACKNOWLEDGMENTS

This work is funded by the U.S. Department of Energy and is being carried out under the LANL Environmental Restoration Project.

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