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# LESSONS LEARNED FROM DECOMMISSIONING PROJECTS AT LOS ALAMOS NATIONAL LABORATORY

## Abstract

This paper describes lessons learned over the last 20 years from 12 decommissioning projects at Los Alamos National Laboratory. These lessons relate both to overall program management and to management of specific projects during the planning and operations phases. The issues include waste management; the National Environmental Policy Act (NEPA); the Resource Conservation and Recovery Act (RCRA); the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); contracting; public involvement; client/customer interface; and funding. Key elements of our approach are to be proactive; follow the observation method; perform field activities concurrently; develop strategies to keep reportable incidents from delaying work; seek and use programs, methods, etc., in existence to shorten learning curves; network to help develop solutions; and avoid overstudying and overcharacterizing. This approach results in preliminary plans that require very little revision before implementation, reasonable costs and schedules, early acquisition of permits and NEPA documents, preliminary characterization reports, and contracting documents. Our track record is good—the last four projects (uranium- and plutonium-processing facility and three research reactors) have been on budget and on schedule.

## Introduction

Over the last 20 years, 12 decommissioning projects have been performed at Los Alamos. An additional 3 have been started, and 3 more can start next year. This paper is an attempt to consolidate lessons learned from past decommissioning work. Although some of the earlier work was performed under regulations and programs different from those we operate under today, this paper attempts to present information that is relevant today and will be in the future. Programmatic and site-specific examples are given. All of the decommissioning work has been performed under the Department of Energy (DOE) or its predecessor, the Energy Research and Development Administration.

## Background

Early cleanup programs were performed as voluntary cleanups under DOE'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 DOE's EM-40 Environmental Management Program.

Past projects include removal of contaminated waste lines, septic tanks, and filter buildings. Additional work includes 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.

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## Reactors

Enrico Fermi advocated construction at Los Alamos of what was to become the world's third reactor, the first homogeneous liquid-fuel reactor and the first reactor to be fueled by uranium enriched in uranium-235. Three versions were built—all given the code name "water boilers." The water boiler version named "SUPO" (for super-power) was removed in 1988, and the area inside was made usable.

The Los Alamos Power Reactor Experiment No. II, LAPRE II, was a test of a compact homogeneous reactor that used a fuel solution composed of $UO_2$. The reactor began operating in 1956 and shut down in 1959, after which it was removed, Remediation was completed in 1992.

The Ultra-High-Temperature Reactor Experiment (UHTGREX) facility was constructed for the Atomic Energy Commission in the late 1960s to advance high-temperature and gas-cooled reactor technology. The 3-MW reactor, which was graphite-moderated and helium-cooled, used 93% enriched uranium as its fuel. The reactor operated for 1 year and was shut down in 1970. The removal of the reactor, decontamination of the main facilities, and removal of support systems and equipment, ancillary buildings, and contaminated waste lines was completed in 1990.

## Laboratories

The Defense Programs (DP) West Site at Technical Area 21 was developed in 1945 to replace the original plutonium facility at Technical Area 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 feed stock, 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 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 sump. Contaminants include tritium, asbestos, lead, mercury, and silver-based components. During the last 2 years, the glove boxes in Buildings 3 and 4 South have been removed, and the buildings have been dismantled. Characterization activities are ongoing, and remediation is expected to start next year, if funds are available.

## Process Buildings

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

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early Cold War weapons development programs. The Trinity bomb, the Hiroshima bomb (Little Boy), and the Nagasaki bomb (Fat Man) were the first projects conducted at this site. One building has some uranium contamination. All of 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 labs. Contaminants include mixed fission products, uranium, plutonium, and asbestos. Planning is complete and remediation is ongoing.

## Program Management

### Strategy

Our strategy is to perform work that effects long-term costs savings, reduces environmental liabilities, promotes quick success stories, enhances regulatory compliance schedules, and/or removes 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 a must 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 Decommissioning Project.

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

### Target Facilities

Preplanning allows us to have a target list of facilities with reasonable estimates for decommissioning. Preplanning is a graded planning effort that leads to final planning or to the start of remediation.

An inventory list of surplus facilities scheduled for decommissioning, which includes estimated waste volumes and contaminants, needs to be compiled. Lead documents, such as procurement contracts, NEPA documents, and regulatory permits, need to be started early. Structures and buildings should be grouped in single projects to allow easy project management and to expedite completion of work. Both the holistic approach and individual projects should be assessed. Even if the whole site is being decommissioned, we recommend discrete projects because they are easier to manage and funding requests are smaller and easier to justify.

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An additional criterion for selecting decommissioning projects is to select sites that can be quickly remediated to increase public trust that real cleanup is occurring; however, short-term projects to demonstrate rapid progress should not be undertaken if they would duplicate other efforts in the near future.

**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 Los Alamos has been proactive in trying to develop programs for recycling reinforced concrete, compacting waste, and disposing of wastes offsite.

**NEPA**

Efforts to obtain NEPA determinations should be initiated early. Categorical exclusion (preferred option), environmental assessments (second preference), and an environmental impact statement (last choice) should be sought in that order to expedite remedial efforts. Extra effort should be made to supply complete information at the beginning of the process. If a site is regulated under RCRA or CERCLA and if decommissioning operations do not fall under EPA's regulatory oversight, decommissioning may be performed, and the sampling data from the decommissioning operation can support RCRA/CERCLA activities.

**Land Transfer/Enhancement**

The best strategy is to avoid prolonged land use issues and determine concrete goals based on input from the facility landlord and DOE. The first consideration is to determine how the landlord might want to reuse the facility so that no additional decontamination is needed later and so that the facility can be released with no radiological restrictions per DOE criteria. A second consideration is to determine how the facility can be used with radiological restrictions (least favored). A third consideration is release of the facility in a condition that meets RCRA and CERCLA standards, if possible.

Decommissioning alternatives (decontamination, dismantlement, entombment, no action) should always be offered as options.

**Contracting**

At Los Alamos, using an onsite 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 quick response capability will be shifted to contractors.

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The decommissioning process should take into account the viewpoints and needs of the landlord, DOE, 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.

Up-front planning and preplanning (up-front documents) efforts should be should match the complexity of the project, and efforts should be made to eliminate or reduce the assessment phase. When possible, preplanning should assist in resolving transition issues and serve as a leap frog into remediation. Preplanning initiates NEPA documentation, regulatory permits (e.g., NESHAPS), project assessment, technical plans, health and safety plans, waste management plans, and cost and schedules.

**Stakeholders**

Our strategy is to solicit, integrate, and disseminate information and to coordinate decommissioning activities with Laboratory groups (engineering, facility landlords, ES&H groups, waste management, etc.), DOE, state, EPA, 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 CERCLA 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). This information emphasizes field cleanup actions to provide a concrete picture of cleanup accomplished.

**Client Interface**

DOE independently verifies decommissioning activities through the use of an independent verification contractor. Early interaction with this contractor eliminates misunderstandings and also strengthens survey planning and survey requirements. Adaptation of the independent verification contractor's procedures, methodology, and equipment saves time and money and aids in demonstrating compliance with cleanup criteria. The client is always right—he/she just needs to be convinced that there is a better way of doing things. We all have the same objective: to clean up faster, better, and cheaper.

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## Project Management

### Cost/Schedules Reporting

The earned-value system tracks costs and schedules and provides a measurement of work performance. The system's main purpose is to serve as a tool for the managers performing the work. Efforts to build one system for reporting purposes by others or to create a financial system for financial accounting by others require capabilities not available in current software. Managers should be aware that detailed tracking of actual costs and schedules and comparison with the planned costs and schedules require a big effort and take careful consideration of the level of reporting necessary. The objective is not to have a super tracking system with a huge support organization; the object is to perform the work and have a management tool that expedites work and saves time and money. The simpler the system, the better off you will be.

### Characterization

The amount of characterization information needed should be judged on a site-specific basis. Too much information leads to a lengthy and costly planning process; too little leads to added contractor costs or change orders in the operations or cleanup phase. Our approach has been to bound the planning information required, knowing that additional characterization information will be obtained during the actual work. This method allows us to incorporate procedures for analyzing hazards to operation workers by identifying hazards and working out procedures just before cleanup operations occur.

### Personnel

A single decommissioning project leader is assigned to oversee and manage projects from inception (planning) to completion (operation or remediation). A single point of contact is maintained through the project's life.

### Conclusion

The lesson learned is that it is important to determine which issues require lead time for resolution and which can be avoided by performing accelerated decommissioning activities. We take a proactive approach in eliminating barriers (unnecessary regulation and misinterpretation of regulations) and push to eliminate unnecessary requirements.