

Colorado and the Accelerated Cleanup at Rocky Flats

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ABSTRACT

When the Rocky Flats closure project was declared complete in October 2005, it was the largest environmental cleanup to date. Even more impressive, it was ahead of schedule and well under budget. Several factors combined to produce this success including a performance-based contract with financial incentives, development and application of innovative technologies, and a regulator-backed accelerated approach to the cleanup process. The factor in this success in which the State of Colorado had the largest role was in developing and enforcing the Rocky Flats Cleanup Agreement. In compliance with this agreement, cleanup was accomplished by means of multiple interim actions that led to a comprehensive final decision at the end. A key element that allowed the accelerated cleanup was constant consultation among DOE, its contractor, and the regulators plus collaboration with stakeholders.

INTRODUCTION

The former Rocky Flats Plant sat on about 6,300 acres at the foot of the Rocky Mountains about 16 miles northwest of Denver. The plant began manufacturing components of nuclear weapons for the United States arsenal in 1951. In 1989, Rocky Flats stopped nuclear weapons production and its mission changed to cleaning up almost 40 years of environmental damage.

The statistics behind the accelerated cleanup of the former Rocky Flats Plant are impressive. It is the largest environmental cleanup project completed to date and when it was declared finished in late 2005, it was ahead of an aggressive schedule and over \$500,000,000 under budget.

The beginning of the cleanup process was not as impressive, however. The original goal for closure was 2070. Under the 1991 Interagency Agreement, a rigid framework laden with milestones was established for each of the 16 operable units at the site. After several years, much time and money had been spent collecting data and disputing missed milestones and associate penalties, but no actual cleanup had been done. Of the site's annual budget of nearly \$700 million, about two-thirds was spent just to maintain the site in a safe and secure state. It became clear that a new approach was needed – and that huge cost savings could be realized if the schedule were accelerated.

In 1996, a new, very different 3-party Rocky Flats Cleanup Agreement (RFCA) was negotiated among the State of Colorado, DOE, and the Environmental Protection Agency (EPA). The next year, the new integrating management contractor, Kaiser-Hill, proposed moving up the closure date to 2010 in response to the Department of Energy's (DOE) effort to speed up the closure of its sites across the nuclear weapons complex.

OBSTACLES TO ACCELERATED CLEANUP

In a report on the status of the cleanup at Rocky Flats in 1999 [1], the General Accounting Office (GAO) identified several obstacles to accelerating the closure process. Major obstacles included:

- Plutonium residues – About 106 metric tons of plutonium residues needed to be processed and repackaged; various types and mixtures of residues required different methods of preparation for shipment.
- Special nuclear materials – An automated plutonium stabilization and packaging system proved to be unreliable and prone to breakdowns; this delayed shipping approximately 16.5 metric tons of plutonium and enriched uranium off-site to at least two different receiving sites.
- D & D – Decontaminating and decommissioning the first two radiologically contaminate buildings proved to be more costly and take more time than anticipated; decontaminating and decommissioning the majority of the remainder of the site's 691 buildings and facilities (3.5 million square feet), including the largest and most highly contaminated ones, was scheduled for the out years in the 2010 closure schedule.
- Closure caps – Constructing protective barriers to prevent exposure to residual contamination at two landfills, over the solar evaporation ponds, and over a contaminated portion of the industrial area had not been approved by the regulators and some stakeholders opposed the idea.

In addition to these four major obstacles, the list of tasks that had to be accomplished seemed overwhelming. The regulators and DOE had identified 367 individual environmental sites that had known or suspected hazardous or radioactive contamination. Of these, about 140 sites were expected to require soil remediation; the remainder required justification for taking no action.

The Waste Isolation Pilot Plant (WIPP) in New Mexico was not yet available and there were problems getting certification from DOE's Carlsbad Area Office so that as many as 80,000 drums of transuranic wastes could be shipped there. At the same time, other sites in the DOE complex were also competing to ship their wastes to WIPP. No storage or disposal sites had been identified to take various so-called "orphan" wastes, including some low-level radioactive and hazardous wastes and some uranium contaminated with plutonium or hazardous materials.

In 1999, the future use of the site was still uncertain. Colorado, EPA, and DOE had not yet agreed on the condition of the site at closure or on final cleanup levels. The action levels for radionuclides in the 1996 RFCA had been on future uses that no longer seemed appropriate.

These action levels were also being attacked by many stakeholders as much too lenient. Uncertain cleanup levels left environmental cleanup plans and budgets uncertain as well.

The GAO report also noted that DOE had moved up the target date for closing the Rocky Flats site to the end of 2006. The report stated, "DOE's decision to accelerate the closure of Rocky Flats is laudable. If the cleanup and closure can be accelerated, health and safety risks may be reduced and financial benefits may be achieved." However, the report goes on to express reservations about the site's ability to overcome the numerous obstacles, some of which were largely outside the site's ability to control.

FACTORS ALLOWING SUCCESSFUL ACCELERATED CLEANUP

What happened between 1999 and the fall of 2005 was remarkable. In October of 2005, Kaiser-Hill declared that the cleanup project had been completed – 14 months ahead of the accelerated deadline – and a year later the Project Management Institute, an advocacy association for the project management profession, awarded the company its 2006 Project Management of the Year Award. Several factors combined in fortunate ways to produce this success. A follow-up GAO report [2] recorded four key factors identified by DOE, Colorado, EPA and the contractor as contributing to the accelerated cleanup:

- Overcoming the specific obstacles listed in GAO's 1999 report;
- an accelerated cleanup process embraced by agreement;
- favorable site-specific characteristics;
- a performance-based incentive contract.

DOE and its contractor found ways to overcome the obstacles listed in GAO's earlier report. Many innovative decontamination and demolition techniques were developed, saving considerable time and cost – and often increasing safety. These included the use of a cerium nitrate solution to decontaminate large pieces of equipment like tanks and gloveboxes. By reducing the level of contamination, the nearly 1,500 gloveboxes at Rocky Flats could be shipped and disposed whole or in vary large sections rather than chopping them into pieces that could fit into standard waste boxes. Explosives were used in a variety of ways to bring down several structures much quicker and more safely than conventional methods. Receiving sites for orphan waste streams became accessible and a sufficient number of waste containers were usually available. WIPP shipments from Rocky Flats were given priority over shipments from other sites.

An accelerated cleanup process allowed remedial actions to proceed at a much quicker pace than would have been possible under a traditional process. DOE and the regulatory agencies agreed to implement an accelerated action process through RFCA as described in the section on the State's role below.

Site-specific characteristics limited the extent of contamination and the complexity of the cleanup. The site-specific setting was favorable; i.e., the physical setting and robust construction of the buildings generally prevented major releases and contaminant migration. Several contaminated groundwater plumes resulted from past activities, but the hydrogeology of the site is such that groundwater moves very slowly and all contaminated groundwater

“daylights” to surface water before exiting the site. The focus of the cleanup agreement, therefore, was on ensuring that surface water did not exceed state standards. The chemical attributes of the main radiological contaminants were also favorable. Plutonium and americium are essentially insoluble and tend to bind to soil particles [3]. No groundwater was contaminated with plutonium or americium.

The integrating contractor had financial incentives in its performance-based closure contract and shared the incentives and rewards with its workers. The company stood to earn more than \$500 million in total incentive fees if the project was completed under budget and ahead of schedule. In the opinion of the GAO report, “this financial incentive drove site workers to seek creative cleanup solutions.”

A flexible baseline and scheduling process was necessary as priorities shifted due to unforeseen factors that constantly affected key elements in the baseline. Many tasks had to occur in succession. The successful completion of one project affected the schedule of other successive projects. For example, removal of contamination under a building depended on the decontamination and decommissioning of that building, which may likewise have depended on removal of utilities and other buildings in the area. The DOE complex cooperated with this flexibility in several ways, including sending shipping containers to Rocky Flats if they were not immediately needed at another site. The milestone-setting provisions of RFCA, which annually set new enforceable outyear milestones, became moot and were eventually disregarded because of the flexibility required by the fast pace of the schedule.

A supportive congressional delegation was vital for consistent funding and for sponsoring important legislation (Rocky Flats National Wildlife Refuge Act) that established the future land use for the site. Showing progress on an accelerated schedule was an important justification for continued and sufficient funding. State government administrations from both parties were also supportive and engaged during crucial decisions. Local governments and stakeholder organizations generally agreed with the end-vision and cleanup goals for the site, but they mounted rigorous challenges to some key issues and provided lengthy comments during comment periods.

STATE ROLE

The factor in this success story in which the State had the largest role was in developing, modifying, and enforcing the 1996 RFCA. This agreement integrated EPA’s Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) authority and the State’s Resource Conservation and Recovery Act (RCRA) authority. The State is authorized to carry out RCRA through the Colorado Hazardous Waste Act. As the Lead Regulatory Authority in the Industrial Area, the State also implemented provisions of CERCLA.

The regulators endorsed an accelerated cleanup process, which allowed cleanup actions to proceed much more quickly and collaboratively than a traditional cleanup process would have. Previously, each operable unit was scheduled to go through separate remedial investigation and feasibility study phases, leading to a record of decision detailing the

prescribed remedies for the various individual hazardous substance sites within the operable unit. In contrast, accelerated cleanup is an inherent, underlying element of RFCA. It was accomplished by means of multiple interim actions – mostly soil removals - tied together through the RFCA vision and framework that eventually led to a final comprehensive decision at the end. By using risk-based action levels to trigger remedial actions and to verify that the remedy was sufficient, this process helped to ensure that the closure requirements of both CERCLA and RCRA would be met.

RFCA also prescribed the use of standardized procedures so that major remedial decisions only needed to be addressed once. A site-wide sampling and analysis plan proved to be much more efficient and comprehensive than requiring individual plans for every hazardous substance site. The site-wide plan was then simply amended as necessary to include pertinent data from individual sites. Having standardized procedures for building decommissioning and soil removal actions allowed for quicker project-specific decision making and helped DOE to better project budgets. Approval to apply the standardized procedures to individual hazardous substance sites or buildings was still required along with site-specific elements of the remedy. That meant regulators saw a constant flow of documents, and the pace of reviewing and approving documents was frenzied. There were always multiple major projects underway or in the approval process. During one year at the height of the cleanup, Colorado regulators approved 208 documents. Some of the documents were multi-volume, including the massive 23-volume Remedial Investigation/Feasibility Study. Including the regulators in the working groups that developed these studies, plans and decision documents made the approval process significantly more efficient.

It was very helpful to have personnel from both regulatory agencies nearby. The State maintained a constant presence at the site. Regulators from the EPA and the Colorado Department of Public Health and Environment worked together in the field with staff of the Department of Energy and its contractors, observing sampling procedures, soil removal actions, and decontamination, decommissioning and demolition projects. This allowed timely, often on-the-spot decisions to be made so that the work could usually continue seamlessly. The regulators also worked in consultation with the contractor as decision documents were being developed. Collaboration among the regulators and DOE and its contractors was written into RFCA and became the normal way of doing business. This also allowed the State to review and approve decision documents in considerably less time than RFCA prescribed.

This collaborative spirit also carried over to dealings with stakeholders and local governments. Major decisions, including the processes to set cleanup levels and establish the monitoring framework, involved participants from local governments and stakeholders. Setting new radionuclide action levels was one of the most controversial and laborious decision-making processes during cleanup. It featured numerous studies, panels of experts, regular presentations in various public forums, workshops, and working groups that included the contractor, regulators, stakeholders and stakeholder groups. Because there was so much focus on the plutonium action level, it was ultimately lowered to less than half the risk level of the other radionuclides.

Only two of the four anticipated closure caps needed to be built. The landfill requirements derived from the Colorado Hazardous Waste Act were applied to both landfills, either as directly applicable or as relevant and appropriate requirements. Both caps were of alternative designs. The planned cap at the Solar Evaporation Ponds was not constructed; a risk assessment performed to satisfy the alternative closure requirements in the Colorado regulations did not identify sufficient risk to warrant a cap. Likewise, residual contamination in the Industrial Area following cleanup did not require additional physical protection.

The regulators also endorsed the use of real-time measurement of radionuclides for characterization, delineation of remedial actions, and field verification. In some areas, surrogate methods allowed real-time estimates of alpha emitting radionuclides by measuring the gamma radiation of associated gamma emitters. Use of these measurement technologies resulted in considerable savings over baseline sampling methods, but the greatest advantage came from allowing decisions to be made in the field so that men and machines could continue working without delays for laboratory results. Final confirmation still required physical sampling and laboratory analysis.

During cleanup, Colorado regulators interacted with environmental departments in other states to ensure that Rocky Flats waste streams could be disposed in those states. At the end of cleanup, the State quickly settled what could have been a lengthy process to assess Natural Resource Damages by agreeing to settle for a set fee in lieu of an assessment. A supportive congressional delegation once again helped by attaching legislation to the 2005 Defense Appropriations Bill that provided the agreed upon \$10 million that will be used to buy up mineral rights that underlie the site.

POST-CLOSURE

Lessons learned during the cleanup period are now being applied to aspects of post-closure. Much of the new Legacy Management Agreement between DOE, the State and EPA is based on the collaborative consultation process that was an integral part of RFCA. The State is identified as the Lead Regulatory Agency for post-closure.

One of the layers of institutional controls that will be put in place at the site is an environmental covenant with the State of Colorado. For several years, an environmental covenant has been required in Colorado at sites that are not "clean-closed", i.e., anywhere use restrictions are necessary. The central area of the site, where DOE will retain management, will have some use restrictions to protect engineered elements of the remedy. No restrictions will be required for the vast majority of the site that will become the wildlife refuge.

The legacy of this \$10 billion accelerated cleanup (including some estimated long-term costs) is a significant reduction in risk to the surrounding population (2.5 million people within 50 miles), thousands of acres returned to productive use, and a substantial savings of tax dollars over the original budget projections.

REFERENCES

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