THE ROCKY FLATS DECONTAMINATION AND DECOMMISSIONING (D&D) CHALLENGE

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ABSTRACT

The end of the Cold War and the decision to reduce the size of the nuclear weapons production complex have created a need for the Department of Energy (DOE) to deactivate and decommission a large number of facilities. The magnitude of this undertaking is daunting; there are over 7,000 structures targeted for closure across the DOE complex. In accordance with DOE's plan, Accelerating Cleanup; Path to Closure, there are major facilities at Rocky Flats (Buildings 771, 707, 776/777 and 371), Hanford (the Plutonium Finishing Plant, the 222-S Laboratory, and the 308 Building), and Savannah River (F Canyon, FB Line, 235-F, H Canyon, and HB Line) that require deactivation and decommissioning.

At the Rocky Flats Environmental Technology Site (RFETS), the D&D task is enormous. Tons of plutonium has been processed over the years in approximately 1,000 gloveboxes. This represents nearly half of the gloveboxes in the DOE complex. In addition, more than a thousand tanks of various designs, with miles of associated piping, supported the processes. A wide variety of operations were performed at RFETS, including aqueous processing, pyrophoric processing, hydriding and dehydriding, metal casting, and machining of plutonium. Various materials have been handled at the facility, including plutonium, uranium, americium, tantalum, beryllium, chloride salts, and various acids and solvents. Significant amounts of plutonium residues remain in inaccessible equipment in the facilities, which create criticality safety issues. Some of the plutonium has been at RFETS for many years, and there is significant in-growth of americium, a decay product that emits gamma radiation, which potentially increases exposure to the workers.

The size reduction portion of the D&D will be difficult and costly. The gloveboxes and tanks are constructed of stainless steel, frequently with lead shielding or double walls that hold water for neutron shielding. Window mountings, glove port rings, site gages, bolted flanges, and various penetrations reinforce the walls. Tanks may be filled with borated glass rings for criticality control, or double walled to hold the process fluid in the space between walls. The gloveboxes and tanks are generally tall enough to require workers to stand on scaffolding or platforms to perform D&D. Gloveboxes and tanks were individually constructed over a span of many years with evolving design specifications; therefore, most gloveboxes are unique and few tank designs are duplicated in more than pairs.

The variable sized gloveboxes and tanks must be reduced in size to fit in waste containers for disposal, mostly the Waste Isolation Pilot Plant (WIPP) Standard Waste Box (SWB). This usually means cutting the items into slabs that can be stacked fairly efficiently in the small (as compared to the standing size of the glovebox or tank) waste box. The pieces must be manageable by one or two workers, which also limits the maximum size and weight of each piece. Larger pieces can be safely placed in a waste box only with the aid of rigging and sacrifice of packing efficiency. Since the contaminated interior of

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the items is breached when they are cut open, protection of workers from inhalation of radioactive materials is a significant concern. Fire prevention requirements and other safety concerns limit the materials and techniques that can be used. The gloveboxes and tanks are frequently located in congested areas without full access on all sides, which also complicates size reduction activities.

Site infrastructure, or the cost to maintain RFETS in a status-quo condition, costs approximately $1.5 million per day. These are costs incurred by maintaining site operations and security and will continue until closure is completed. Significant cost savings from these landlord obligations are only possible after completion of glovebox and interior stripout. D&D schedule acceleration is critical to reducing infrastructure costs and achieving site closure by 2006. This represents the D&D challenge: D&D over 700 facilities including four major plutonium buildings each over one million square feet.

This paper describes the cultural transition and technical approaches taken for D&D at RFETS to achieve 2006 closure. Specific emphasis is placed on critical issues such as, workforce safety and retention, strategies for schedule acceleration, and technological breakthroughs for D&D of nuclear facilities.

I. INTRODUCTION

RFETS occupies an area of approximately 6,200 acres in northern Jefferson County, Colorado, about 15 miles northwest of Denver. In the 40 years since the Site was constructed, surrounding multi-use development has approached the Site, and the population of the Denver metropolitan area has increased to the point at which approximately 2.2 million people live within a 50 mile radius of the site. From its original construction in the early 1950's, Rocky Flats has developed an industrial complex consisting of more than 700 facilities and structures that were used as manufacturing, chemical processing, laboratory support, research and development, and administration. The main production and support facilities are located near the center of the Site and occupy approximately 385 acres.

From 1952 to 1989, the primary mission of the Site was the production of nuclear and non-nuclear components for nuclear weapons. During this time, activities generally consisted of radioactive (e.g., plutonium, uranium, etc.) and non-radioactive (e.g., stainless steel, beryllium, etc.) metal working, fabrication, and component assembly, and plutonium recovery and purification.

In 1989, almost all of the Site's radioactive material production activities were suspended due to safety and environmental concerns related to site operations. This suspension left much of the skilled workforce idle for seven years until Kaiser-Hill was awarded the prime management and integration contract for the site in 1996. This same workforce will be called upon to perform most of the D&D of Rocky Flats.

The site is now focused on accelerated risk reduction, cleanup, and closure by 2006. Current

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plans include completion of deactivation by 2002 with demolition of all structures and remediation planned by 2006.

II. TECHNICAL CHALLENGE AND APPROACH

The overall technical challenge for D&D of RFETS is extremely complex and becomes increasingly difficult in light of the site's history and background. The ability to perform extremely hazardous D&D with the quantities of Plutonium involved at RFETS entails detailed oversight from regulatory agencies and the Defense Nuclear Facility Safety Board (DNFSB), as well as obtaining the requisite buy in from the workers.

The timeframe for D&D presents a significant challenge to find technical approaches that safely optimize production within the cost and technical constraints of the Site. Essentially, no two buildings are alike, and the ability to standardize work practices and approaches are difficult. The operational mentality and infrastructure have been built around production of weapons and is not well suited to unique D&D type activities. The Plutonium buildings represent approximately 70% of the D&D effort with the Uranium buildings and other contaminated structures representing 20%. Non-radiologically contaminated buildings (e.g., administrative, warehouse, shops, etc.) represent the remaining 10% of the work scope.

The SNM removal and deactivation activities remain critical path and consume much of the Site's funding until 2002, preventing early start for D&D acceleration. This leaves the bulk of the D&D work to be driven to late start, requiring the four major buildings to be completed concurrently within a five year window. This requires a tremendous portion of the D&D work to be performed simultaneously, which will result in peak resource demands and create significant safety concerns. The end result is a D&D project that will be one of the most complex and challenging ever undertaken.

III. PILOT PROJECT

An implementation strategy was developed to establish the requisite processes, people, skills, and technologies to accomplish the RFETS D&D challenge. The first step in this strategy was to use a pilot project to gradually work through the site operations and cultural issues and develop lessons learned to structure a successful D&D project. Building 779 was initiated in 1998 as the pilot project to demonstrate the techniques and training necessary to implement full scale D&D of Plutonium buildings. The 779 Building was an experimental plutonium laboratory containing over 130 gloveboxes in a two story approximately 80,000 square foot concrete structure. The pilot project had numerous goals, which tied into the long-range strategy for closure. These goals included:

- Culture Change – The workers, management, support organizations, DOE staff, regulators, public, and DNFSB all had

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significant issues and a learning curve regarding D&D in Plutonium environments. Kaiser-Hill has been able to alleviate these issues by firmly embracing and implementing the Integrated Safety Management (ISM) process and philosophy. The conservative nuclear operations nature of the site requires a gradual shift in risk evaluation that can only be developed through the progressive experience gained in the pilot project. Management involvement, communications, and sharing of lessons learned with the workers, public and regulators have further helped gain acceptance that D&D can be performed in a safe and acceptable manner. A good example of this process, the D&D workers that have manually size reduced 133 gloveboxes are now involved in planning the more remote size reduction systems for follow-on projects.

- Technology Improvement – Significant progress has been made in development and evolution of size reduction technologies for gloveboxes, tanks, and vessels. Due to the conservative nature of the site, manual size reduction was initiated in soft side containment tents in Level A Personal Protective Equipment (PPE) using mechanical nibblers, sawsalls and shears. Further refinements have been made in selection and application of fixatives for glovebox and room containment, quick change tooling, access ports for external repair of tooling inside a size reduction containment, and improved ventilation point source control during cutting. These improvements and lessons learned have led to the evolution of next generation semi-remote size reduction systems (Building 771) with reduced levels of PPE up to a full scale production robotic size reduction facility (Building 776/777). Further technology improvements have been made in characterization planning and execution, decontamination techniques, and waste packaging. The best example of progress in gradual technology evolution is that after 18 months of D&D with 133 gloveboxes manually size reduced, the site is accepting thermal cutting technology as an acceptable risk.
- Process and Programmatic Improvement – Significant progress has been made in programmatic developments to improve Labor bargaining agreements, standardize and streamline regulatory documents, characterization protocols and procedures, D&D planning, and modification of authorization basis documents. As the focus shifts from an individual pilot project, significant cost and schedule savings can be seen and pursued. Centralized advance planning has enabled the site to develop standard approaches and templates for further acceleration. Advance characterization of facilities is being performed to enable D&D acceleration, so projects can be executed, as funding becomes available. Individual facility Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) decision documents are to be replaced by several generic D&D decision process descriptions (Rocky Flats Cleanup Agreement [RFCA] Standard Operating

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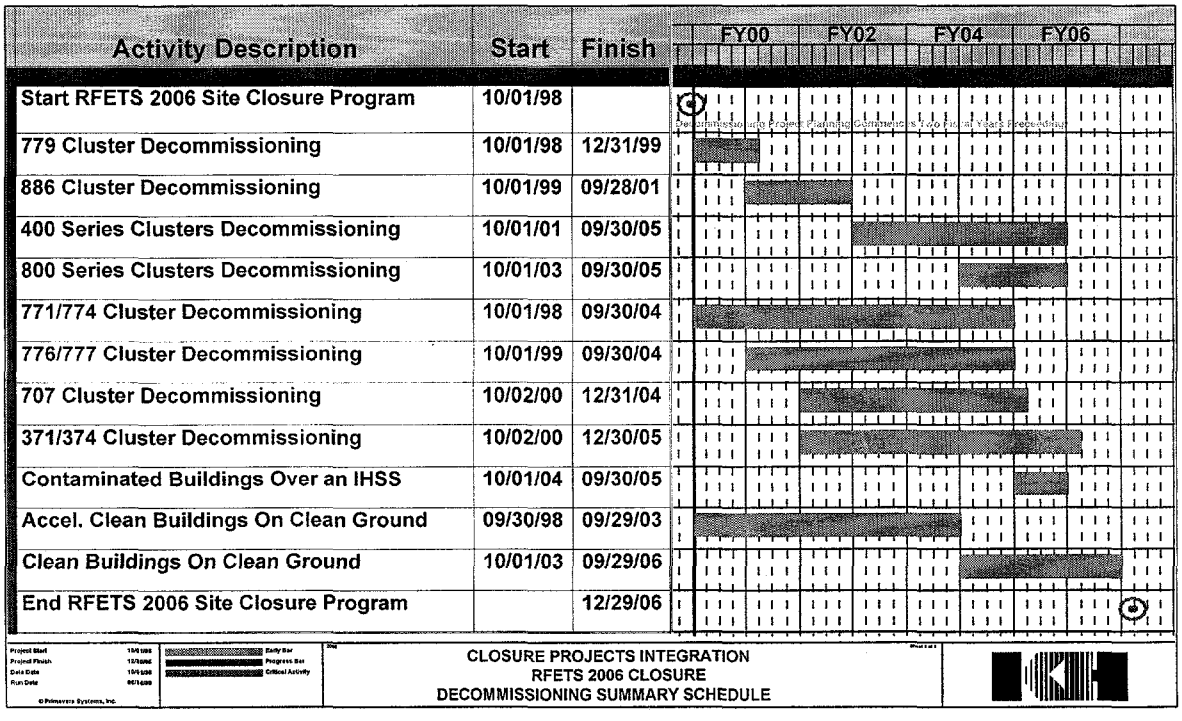
Protocol – RFCA Standard Operating Protocol [RSOP]). All of these improvements are targeted at accelerating schedule and reducing cost. The best example of success to date is an RSOP in public review for recycling free released concrete from building D&D and using it for backfill on the site. This single effort represents over $20 million savings to the project and significantly reduces traffic accident exposure in the Denver area.

IV. MEETING 2006

The D&D progress to date has been significant and highly successful. However, a quantum leap in performance is necessary to meet the 2006 schedule.



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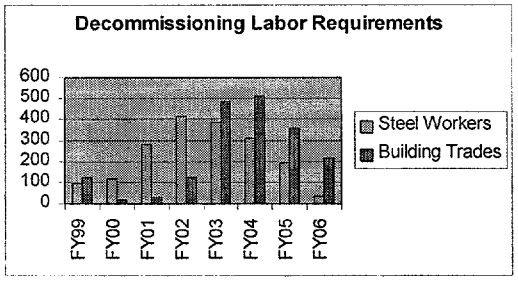
The strategy to achieve the next level of performance is in place and includes some of the following elements.

- Workforce Training and Retention – The availability of skilled workforce for this task is a significant concern. The 2006 schedule requires four major plutonium buildings to be in concurrent D&D. This represents a peak D&D workforce demand for the Site craft of approximately 1500 and for building trades during demolition of approximately 500. The Site craft can be obtained by transitioning existing process operations staff as deactivation and Special Nuclear Material (SNM) operations complete to D&D workers. A training center and curriculum, including mock up facilities for hands on qualification of critical skills for existing and new workers will be completed in early 2000. The overall implementation strategy requires the strategic re-deployment of D&D workers and supervisors from the pilot project to new projects as the leadership core. Similar training will be provided to the building trades, and a core site building trades group is being developed as the leadership team for eventual demolition. Worker incentives for both performance and retention are being evaluated to minimize worker turnover.



- Culture and Safety Enhancements – Further progress is necessary to turn the site into a safe construction environment to achieve 2006. Standard D&D work procedures are being developed and pushed through the site approval process to streamline the ability to plan and execute difficult D&D tasks. Using lessons learned and the Information Systems Management (ISM) philosophy, the current process of each work activity being reviewed and evaluated by site consensus will be minimized by a dedicated and experienced team that can explain the risk and consequences from a worker exposure point of view. This approach for some procedure standardization will further enhance job hazards evaluation and improve worker understanding and recognition of compliance and enforce conservative decision-making.
- Technology Improvements – Improvements are underway in both real technological improvements as well as obtaining site acceptance of existing technology that has not been used at RFETS. This effort is focused on proven or emerging technologies that can be successfully deployed within the 2006 closure window. Size reduction technology is being evaluated for production scale robotic systems. This will improve both speed and reduce worker exposure. These systems are being evaluated for a centralized approach for material that can be moved and portable systems that can be deployed on large immovable gloveboxes and equipment within a building. Alternate thermal cutting techniques for large equipment size reduction are also being

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evaluated. The most pressing developmental need is Beryllium monitoring and characterization equipment. Both the robotic size reduction and Beryllium monitoring efforts are being supported with EM-50 assistance.

- Process & Organization Improvements – The final step to achieving 2006 is the utilization of standardized processes through a disciplined project organizational structure. As the site mission shifts away from SNM operation in 2001 and 2002, a revised organizational structure can be deployed with clear lines of authority and responsibility. This focused organizational approach, combined with more standardized procedures and processes, will set the final stage for achieving 2006 closure. Transition to these standardized processes and organization structure will be made in 2000.

V. CONCLUSION

The Rocky Flats challenge to achieve closure by 2006 is achievable and on schedule. The necessary planning is in place, and the steps are identified for successful execution. The successful 779 Pilot Project has achieved the overall goal and set the stage for completing the most difficult and challenging D&D project ever undertaken.