Status Update: CLOSING ROCKY FLATS BY 2006

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ABSTRACT

Safely closing Rocky Flats by December 2006 is a goal shared by many: the State of Colorado, the communities surrounding the site, the U.S. Congress, the Department of Energy (DOE), Kaiser-Hill and its team of subcontractors, the site’s employees and taxpayers across the country. This paper will:

• Provide a status of the Closure Project to date
• Describe important accomplishments of the past year
• Describe some of the closure-enhancing technologies enabling acceleration
• Discuss the remaining challenges ahead

INTRODUCTION/CLOSURE PROJECT BACKGROUND

On January 24, 2000, the DOE and Kaiser-Hill signed a first-of-its-kind closure contract to complete the Rocky Flats Closure Project by a target date of December 15, 2006, at a target cost of $3.963 billion. This contract will result in the establishment of a federal wildlife refuge. Figure 1 illustrates the closure project’s end state.

The contract completion criteria are:

• All buildings are demolished, except continuing water treatment facilities or other structures with a DOE-declared continuing mission.
• All Individual Hazardous Substance Sites are remediated or dispositioned per the Rocky Flats Cleanup Agreement.
• All wastes are removed except for some materials that can be left in place, recycled or used as fill materials in accordance with regulatory requirements.
• Closure caps are used for the remediation of two old landfills, the 700-Area and the solar ponds or these areas are otherwise remediated in accordance with the Rocky Flats Cleanup Agreement.
• Building foundations, utilities, or other remaining structures paved roads and/or parking lots are covered by a minimum of 3 feet of fill after final grade.
• Surface water on site will meet health-based standards based on open space use.
• Water leaving the site in Woman and Walnut Creeks meets the water quality standards established by the Colorado Water Quality Control Commission.

To accomplish this undertaking, Kaiser-Hill developed an approach that achieves cleanup of the site on an accelerated schedule. Key elements of Kaiser-Hill’s approach include:

• emphasizing safety as the foundation of all work
• eliminating the highest health risks first
• reducing the site’s mortgage costs to make more funds available to accomplish more mission activities
• focusing the highest attention on the activities on the critical path (i.e., those activities which, if they slip, will significantly impact project completion)
• maximizing workforce efficiency
• employing proven, innovative technologies and approaches to increase efficiency and safety

CLOSURE PROJECT STATUS

Almost one half of the way through the Closure Project, Rocky Flats is currently under cost and ahead of schedule. Kaiser-Hill remains optimistic that the project will be delivered below the target contract cost of $3.9 billion and before December 2006. Through December 2002, the project cost and schedule performances are as follows:

• Cost variance is +$131 million (7.0%)
• Schedule variance is +$124 million (7.1%)
• Current projected closure date is August 2006

Chart 1 Project Cost and Schedule Variances
Kaiser-Hill also tracks several key closure project performance metrics in addition to traditional cost and schedule variance. Table I below shows the work completed on these metrics through December 2002, and how much work remains.

**Table I Closure Project Performance**

<table>
<thead>
<tr>
<th>Key Closure Activities</th>
<th>Completed</th>
<th>Work to be Completed</th>
<th>Percent Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Special Nuclear Material Stabilization and Packaging</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pu Stabilization and Processing</td>
<td>1,252 containers</td>
<td>508 containers</td>
<td>71%</td>
</tr>
<tr>
<td>Pu Residue Processing Packaging</td>
<td>106,000 kgs</td>
<td>COMPLETED</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Facility Deactivation and Decommissioning</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type 1 Facilities (free from contamination)</td>
<td>388,648 sq. ft.</td>
<td>976,051 sq. ft.*</td>
<td>35%</td>
</tr>
<tr>
<td>(June 2000)</td>
<td>(213 facilities)</td>
<td>(398 facilities)</td>
<td></td>
</tr>
<tr>
<td>Type 2 Facilities (without significant contamination or hazards)</td>
<td>66,834 sq. ft.</td>
<td>1,146,583 sq. ft.*</td>
<td>6%</td>
</tr>
<tr>
<td>(23 facilities)</td>
<td>(164 facilities)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type 3 Facilities (significant contamination/hazards)</td>
<td>64,790 sq. ft.</td>
<td>925,002 sq. ft.*</td>
<td>7%</td>
</tr>
<tr>
<td>(1 facility)</td>
<td>(6 facilities)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Offsite Shipment of Special Nuclear Material, Waste and Other Materials</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pit Shipment</td>
<td>100% of inventory</td>
<td>COMPLETED</td>
<td>100%</td>
</tr>
<tr>
<td>eU Parts destined for Oak Ridge</td>
<td>100% of inventory</td>
<td>COMPLETED</td>
<td>100%</td>
</tr>
<tr>
<td>Pu Parts destined for LANL</td>
<td>100% of inventory</td>
<td>COMPLETED</td>
<td>100%</td>
</tr>
<tr>
<td>Pu Parts destined for SRS</td>
<td>100% of inventory</td>
<td>COMPLETED</td>
<td>100%</td>
</tr>
<tr>
<td>LLW Shipment</td>
<td>67,200 m³</td>
<td>107,800 m³</td>
<td>38%</td>
</tr>
<tr>
<td>LLMW Shipment</td>
<td>22,690 m³</td>
<td>21,810 m³</td>
<td>51%</td>
</tr>
<tr>
<td>TRU/TRUM Shipment</td>
<td>5,163 m³</td>
<td>7,337 m³</td>
<td>41%</td>
</tr>
<tr>
<td>Environmental Restoration</td>
<td>34 sites</td>
<td>124 sites are projected to require remediation</td>
<td>27%</td>
</tr>
</tbody>
</table>

*Based on anticipated facility typing*
KEY ACCOMPLISHMENTS OF 2002
During 2002, a number of significant accomplishments were achieved that allowed Rocky Flats to not only stay on course for a 2006 closure, but to increase the chances of completing closure before the end of 2006. Following are just a few of the many examples of work that were completed in the past year.

Plutonium Residues
One major cleanup milestone achieved during 2002, was the completion of packaging and processing of 106 metric tons of nuclear materials that were byproducts of the plutonium production process. The successful packaging of this material was completed ahead of schedule and concludes a six-year effort to safely treat and package the material for off site disposal. Plutonium residues consist of a variety of materials like glass, firebrick, filters, rags and a variety of chemical compounds that were contaminated with approximately three tons of plutonium during weapons plutonium production activities. Historically, residue materials were processed (or stored for future processing) to recover plutonium. In the years since nuclear operations at Rocky Flats were halted in 1989, residues posed increasing risks because of inadequate packaging and potential chemical reactions.

In a 1994 study, the hazards posed by residues were highlighted as one of the most urgent vulnerabilities facing the DOE Complex. Much of the 106 metric tons of Rocky Flats residues have already been shipped to the Waste Isolation Pilot Plant near Carlsbad, NM, for disposal.

Waste Shipping
Another key accomplishment of 2002 was the large amount of radioactive waste shipped during the year. Workers once again set a new record for radioactive waste shipments, safely shipping off site more than 158,000 55-gallon drum equivalents during Fiscal Year 2002. For the third year in a row, Rocky Flats was the top shipper of transuranic waste to the Waste Isolation Pilot Plant and for the fourth consecutive year shipped more low-level waste to the Nevada Test Site than any other DOE site.

A total of 469 TRU shipments containing 2,906 cubic meters of waste from Rocky Flats were disposed of in FY02. Workers were able to triple the volume disposed of from last year due in part to the use of standard waste boxes, which hold 30 percent more waste than a load of 55-gallon drums.
A total of 502 shipments containing 26,015 cubic meters of low-level waste was sent to the Nevada Test Site for disposal in FY02. This year’s low-level waste disposal total is as much waste as the disposal totals for the previous three years combined. The majority of low-level waste is generated by deactivation, dismantlement and demolition activities as Rocky Flats moves towards closure.

Other significant waste shipments included 2,557 cubic meters of low-level mixed waste shipped to Utah, Washington, Texas and Tennessee for treatment and/or disposal; 256 containers of hazardous waste; 373 drums of chemicals; and 2,054 cubic meters of sanitary waste.

Building Demolition

The demolition of Building 886, the 10,000-square foot, former nuclear criticality laboratory was safely completed in 2002. Demolition of the nearly 40-year-old facility has been completed nearly three years ahead of the baseline schedule. Years of effort have gone into the decommissioning process including the removal of many tons of hazardous materials and equipment. Careful planning and safety-conscious workers ensured safe completion of the Building 886 demolition. Demolition was completed over a weekend using a technique called “Harmonic Delamination” to fracture the building’s thick concrete walls helping separate the concrete from the re-bar, allowing future reuse of the concrete.

Building 886 was constructed in 1964 and was one of five critical mass laboratories in the United States. The most unique feature of this building was the Critical Mass Laboratory where almost all criticality experiments were conducted. The lab’s concrete ceiling was 2-feet thick with walls 4- to 5-feet thick.

CLOSURE ENHANCING TECHNOLOGIES

A key ingredient in the strong cost and schedule performance and progress made during the last year, was the deployment of project enhancing technologies and innovations. Kaiser-Hill has fostered a climate that spawns innovation and deployment of technology. As a result, Kaiser-Hill has aggressively sought and then deployed proven technologies. Following are examples of recent technology deployments.
**Decontamination Solutions**

Several chemical processes are currently being deployed at Rocky Flats to decontaminate plutonium-contaminated gloveboxes and tanks. Decontaminating these items to meet low-level waste, Surface Contaminated Object (SCO) criteria allows for disposal as low-level waste rather than as TRU waste. This also allows for the packaging of larger items for disposal with little or no size reduction.

One process uses a mixture of tetravalent cerium (cerium IV), an oxidizing agent, in nitric acid to remove radioactive contamination from stainless steel surfaces. Decontamination is achieved by dissolving away some of the inner surface of the tank along with any surface contamination. The scouring action of the cerium nitrate removes 3 to 5 microns of stainless steel and eliminates most fixed contamination.

Another process involves a four-step procedure that includes three applications of a proprietary chemical to the inside of contaminated gloveboxes followed by subsequent wipedowns. Upon completion of a series of applications and wipedowns, the glovebox is surveyed for contamination levels and, if necessary, the process is repeated until the desired levels are met.

In addition to reducing or eliminating the need for size reduction, shipping and disposal costs are reduced. Another significant benefit is that worker safety is enhanced because the workers do not have to size reduce the gloveboxes and tanks, thus reducing their risk from radiation exposure and industrial hazards. Further, using these decontamination methods, it is estimated that 5,000 cubic meters less of TRU waste will be generated than originally estimated.

**Spray-on Shipping Container**

One of the major challenges in closing Rocky Flats is the disposal of extremely large pieces of production equipment contaminated with radioactive materials. Past practice has been to size reduce the equipment into pieces to fit into approved, standard waste containers. Size reducing this equipment is expensive, labor intensive and exposes workers to industrial and radiological hazards. Rocky Flats has deployed a packaging alternative to avoid the need for cutting up large equipment.

Under this process, a sprayable, polyurea plastic coating is applied to a thickness of ¼ inch. The final coated piece of equipment becomes the final shipping package. The coating resists punctures and tears and is impermeable to moisture and other environmental stresses. The Department of Transportation and the Nevada Test Site (NTS) have approved use of polyurea packaging for low-level waste shipments destined for NTS.
**Hydrolase**

Plutonium processing activities at Rocky Flats, dating back to the 1950s, resulted in radioactive contamination on floors, walls and other surfaces. Past practice was to fix the contamination with epoxy paint. Most of the time, these layers of paint and contamination must be removed before a building can be demolished. A system has been developed that blasts away paint and the initial layer of surface material, captures the resulting water and debris, and filters this mixture to separate the water from leftover sludge. The system consists of four basic components: a pump, the hydrolasing unit, a filter and water collection tanks.

The pump is a diesel-fired, stand alone unit fed by an ordinary hose bib at normal water pressures. The pump is operated remotely and water is transferred to the hydrolaser by high-pressure lines. The operator of the pump maintains contact with the operator of the hydrolaser in case of an emergency.

The hydrolaser itself is a compact, track-driven sled resembling a lawn mower base without wheels. Underneath the base is a round, rotating nine-inch head with six high pressure jets capable of spray pressures up to 36,000 pounds per square inch. Offset to one side of the spray head is a port that connects to a vacuum line to remove water and debris and pump it back to a filtering unit. The unit is capable of operating on floor surfaces or suspended from a boom for use on walls. All controls are pneumatic to eliminate the potential for electrical shock or a short that could result in equipment failure.

The system has proven to be tremendously effective in stripping paint and underlying contaminated material. The containment properties of the sled provide excellent protection for the workers from the high-pressure spray and in providing a vacuum seal for the water and materiel recovery. The work area remains surprisingly clean and dry considering the volume and pressure of the spray being used. In comparison to conventional scabbling or sandblasting techniques, the system has dramatically increased worker safety while decreasing waste.

**CLOSURE PROJECT CHALLENGES**

Achieving the completion criteria contained in the closure contract would be challenging under any time frame. Kaiser-Hill and the Rocky Flats employees are performing work the size and complexity of which has never been done anywhere in the world. Key challenges of the Rocky Flats Closure Project arise from:

- The sheer volume of work to be accomplished in a short period of time.
- The fact that nuclear D&D of this complexity has yet to be performed anywhere in the United States.
- The variety and quantity of special nuclear materials and radioactive wastes to be packaged and shipped during the project has never been attempted in the DOE complex.
- The need to maintain the highest safety standards while dramatically increasing work activity in the face of increased industrial hazards.

At this point in the project, the key challenges facing the project are as follows:

**Plutonium Stabilization and Packaging System (PuSPS) Operations**

The PuSPS was conceived as a system to package material into a long-term, safe configuration for storage. The PuSPS was originally designed and fabricated by British Nuclear Fuels Limited (BNFL) as an automated packaging system with additional capability incorporated for stabilization of material.
The PuSPS process involves packaging the plutonium into a convenience can which is then placed into an inner can that is filled with helium to prevent the plutonium from reacting with oxygen. This can is welded shut by an automated laser welder, leak-tested and visually inspected to ensure the integrity of the weld. The inner can is in turn placed in an outer can which is also welded shut, leak tested and visually inspected to create the final storage container configuration.

There have been ongoing problems with the laser welder, and various mechanical issues have arisen due in large part to the complexity of the equipment. Kaiser-Hill has dedicated a full-time maintenance crew to address these issues and keep the system functioning. In addition to these ongoing problems, some of the remaining materials needing to be stabilized and packaged to strict standards are proving to be technically challenging to process. Materials remaining to be processed are mostly comprised of plutonium and uranium oxides that contain impurities that, when heated, may be corrosive to certain components of the PuSPS or result in furnace excursions. To address these problems, Kaiser-Hill has (1) worked with the DNFSB and DOE to reduce the processing temperature of chloride materials which is expected to reduce corrosion problems and yet maintain the requirements for storage and (2) completed a Readiness Assessment and is now heating the oxides that may contain organics in a glovebox outside of the PuSPS, which eliminates the chance of a furnace excursion. Additionally, DOE recently decided to ship approximately 962 kg of impure plutonium oxides to WIPP, rather than process the material through PuSPS. This reduced the number of “cans” to be processed through PuSPS by approximately 400.

Despite these challenges, nearly 70 percent of the plutonium we expect to generate that require packaging to the 3013 standard has been packaged in PuSPS.

Orphan Wastes

Currently, there are no DOE or commercial facilities for treatment of some Rocky Flats low level and TRU wastes that are contaminated with hazardous chemicals. These wastes, called ‘mixed wastes’, must be treated to meet the requirements of the Resource Conservation and Recovery Act before they can be disposed. Some low-level mixed and TRU waste streams can be treated by DOE or commercial facilities, but others have no treatment option and, consequently, no disposal option. Treatment options for these wastes are being pursued which will use a combination of DOE and commercial facilities.

Additionally, for some types of mixed waste, particularly low-level mixed waste >10 nCi/gram, there is no commercial or DOE disposal site. Disposal of these wastes was originally planned for the Hanford or Nevada Test Sites. Efforts to open up these DOE sites to these types of wastes continue to be delayed. Kaiser-Hill and DOE continue to look at options for management of these wastes.

Workforce Transition

The closing of Rocky Flats will ultimately affect more than 4,100 skilled workers. Kaiser-Hill recognizes that an effective and comprehensive Workforce Transition Program is essential to meeting the goal of cleaning up and closing down the site by no later than December 15, 2006. To safely reach closure, Kaiser-Hill is committed to helping employees prepare for transition to their next position, career or personal goal.

The goals of the Workforce Transition Program are to retain workers long enough to complete the job but also to create opportunities for workers after project completion. Rocky Flats workers are committed to a safe work culture, commonly work in extreme conditions, and follow complex procedures all while working safely. These employees are highly trained and have many diverse, transferable skills and would be great assets to local businesses.
Kaiser-Hill’s Workforce Transition Program is creating networks and partnerships with outside companies, chambers of commerce and business associations. Abundant resources will be made available to assist workers such as job training sessions, career consulting services, tuition reimbursement, web-based career transition assistance and an extensive library of resources.

**THE OUTLOOK FOR SUCCESS IN 2006**

Despite the present and future challenges facing the project, Kaiser-Hill remains optimistic about the probability for achieving closure no later than December 2006 and for a cost no more than $3.963B.

For questions or additional information, contact Allen Schubert at 303-966-5251 or email Allen.Schubert@rfets.gov.