# Thinking Outside the (Glove) Box

## *The Evolution of Decommissioning at Rocky Flats*

Challenged with the task of dismantling hundreds of gloveboxes from former nuclear production buildings, Kaiser-Hill Co. LLC recognized an opportunity to reduce worker risks if the surface-contaminated object process could be expanded to include larger contaminated equipment.

**By Jeanna Blatt**

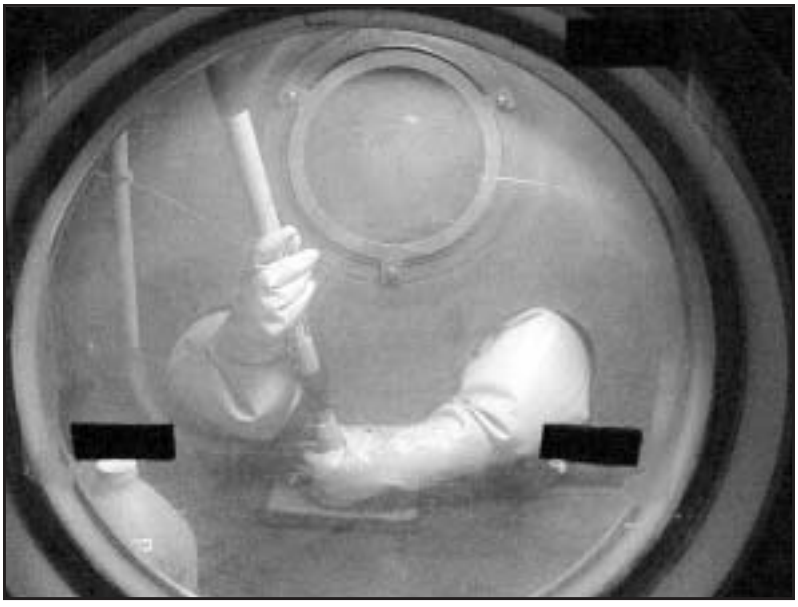
The U.S. Department of Energy's Environmental Management (EM) cleanup and closure mission involves management, regulatory, technical, and administrative challenges that differ from typical operating situations or other environmental cleanups. At the United States' first large government nuclear cleanup and closure site, Rocky Flats Environmental Technology Site (RFETS) managers are faced with first-of-a-kind issues that require bold and innovative approaches to undertake and accelerate the closure effort. This was the case nearly two years ago when Kaiser-Hill Co. LLC, the managing contractor in charge of cleanup, took on the dismantlement of hundreds of gloveboxes from former nuclear production buildings.

### *Rethinking an Old Method*

For at least 40 years, RFETS gloveboxes were used as the primary protective barrier for the workers' exposure to plutonium in the site's production facilities. From the inception of decommissioning the nuclear facilities, gloveboxes have been removed by means of hazardous size-reduction operations, a method continuing from the original planning efforts based on assumptions that gloveboxes, for the most part, would be transuranic (TRU) waste. The assumption was made in part because of an inability to adequately quantify the contamination levels inside gloveboxes, which usually exceeded the maximum instrumentation measurement range. Because TRU-waste containers are relatively small, it is necessary to size-reduce components to place them into the standard waste boxes for disposal. This effort requires a breach of the protective barrier by cutting through the gloveboxes and dismantling them in inner-tent chambers in which workers wear supplied breathing air suits for protection. This process is a cumbersome, slow, and potentially dangerous operation.

Rich in history, the cojoined Buildings 776 and 777 played a major role in the manufacturing of plutonium weapons components up to 1969. Since then, the buildings have housed major waste and residue handling processes, weapons component disassembly operations, pyrochemistry, coating operations, and test runs of organic wastes and combustibles in a fluidized bed incinerator. Because of the diversity of activities, compounded by a fire in the facility in 1969, all of the building equipment requires characterization prior to the beginning of any work done there. Buildings 776 and 777 are scheduled for demolition in the spring of 2005.

*A worker in Building 771 applies decontamination solution to the inside of a glovebox.*



*A worker uses a scrub brush after applying the proprietary decontamination solution during the second phase of the process.*

### *The Solution*

The Building 776/777 Closure Project team recognized an opportunity to reduce worker risks during the size reduction of gloveboxes if the surface-contaminated object (SCO) process was expanded to allow for larger contaminated equipment. If gloveboxes characterized with low surface contamination levels could be disposed of as low-level waste and packed as SCO using much larger cargo containers, they would need to be dismantled only sufficiently to allow for safe handling during the packaging of the pieces in the cargo containers. Size reduction of equipment and gloveboxes to fit into the containers would be minimal, in contrast to the significant effort needed to cut a large item into pieces that would fit into a standard waste box.

The EM-50 Office of Science and Technology provided funding—through the National Energy Technology Laboratory's Decontamination and Decommissioning Technology Program—to support two significant needs to improve the SCO process. The first was to develop improved instrumentation, which would measure surface contamination levels up to the SCO values. The second was to identify an effective method to decontaminate surfaces that exceeded the SCO limits. "The EM-50 funding allows the Building 776/777 Closure Project to have the flexibility to try innovative technologies to improve work practices without penalizing our baseline funding," said David Nichols, Building 776/777 Closure Project technology coordinator.

### *Getting Started*

So, with the shared risk funds, the Building 776/777 Closure Project began the initial investigation to have their instrumentation recalibrated to read the higher levels of contamination to determine if decontamination would be an option. The team contacted the Alpha Group & Associates LLC, responsible for maintaining and calibrating all radiological instruments for RFETS, to tackle the instrumentation improvements that would be required. Using the U.S. Department of Transportation regulations for SCO, they focused their efforts on the standard Ludlum instrument. They began looking into the appropriate way to recalibrate the 50-square-centimeter area of the detector. They measured and recalibrated the detector by reducing the sensitivity, thereby raising the upper detection limits. The new detection limits were certified with a known plutonium source in a controlled configuration located onsite. Since RFETS calibration and modification of the Ludlum instrument, the manufacturer has used the technology to create and calibrate new instruments to extend the dynamic range of the instruments.

Moving forward with the second objective to decontaminate the gloveboxes to low levels for shipment as SCO waste, the Building 776/777 Closure Project team solicited proposals from outside vendors to identify the method. A contract was awarded to Environmental Alternatives Inc., which offered a proprietary solution that through a three-part process would leach plutonium contamination from the steel gloveboxes.

### *A Three-Step Procedure*

During the chemical decontamination process, highly skilled workers spray a solution inside the glovebox, dissolving "caked-on" contamination. The procedure includes three applications of the proprietary chemical to

*Disassembly lines of gloveboxes fill the aisles of Building 776/777, the converse of the assembly line created by Ford Motor Co.*

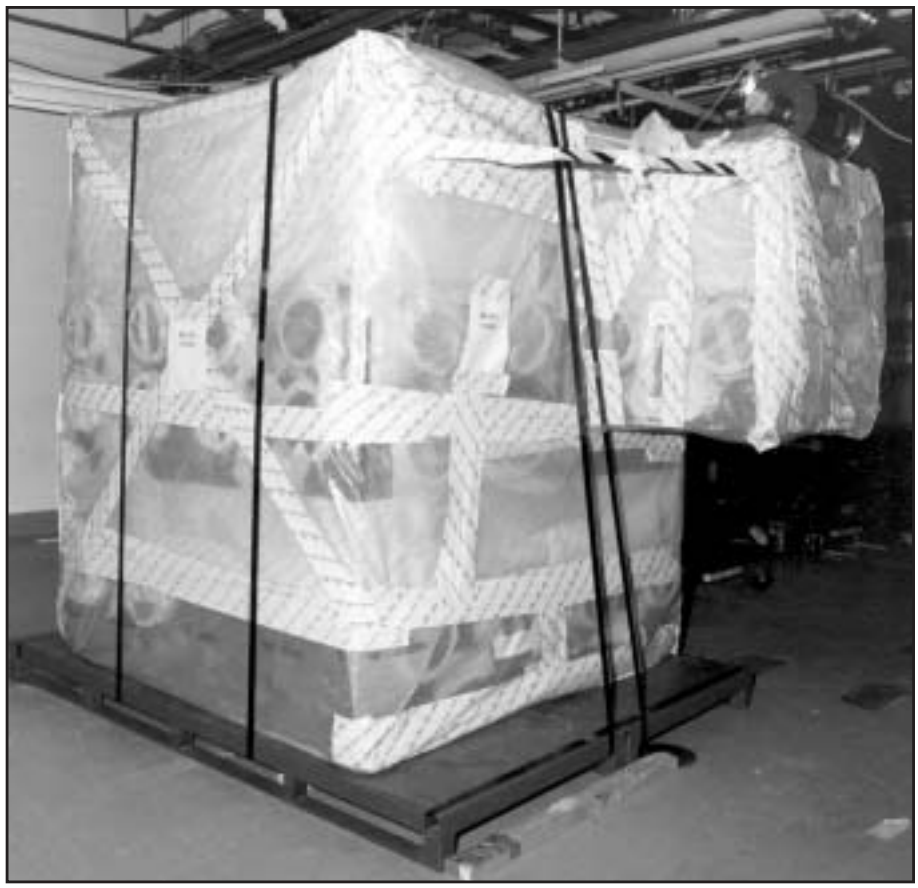
the inside of contaminated gloveboxes followed by subsequent wipe downs. Upon completion of each application and wipe down series, workers survey the interior of the glovebox for contamination levels and, if necessary, the process is repeated until the desired levels are met. After decontamination, the gloveboxes can be dispositioned as LLW rather than being size reduced as TRU waste. Because the gloveboxes do not require size reduction after decontamination to LLW levels, secondary waste normally created during size reduction is also reduced.

This innovative approach to disposing of contaminated gloveboxes and equipment as SCO waste produces another significant benefit. That is, using these methods ultimately reduces the volume of TRU waste that is generated by RFETS. TRU waste that is converted to low-level SCO waste saves the site approximately $10 000/m$^3$; however, some costs associated with characterization, decontamination, and packaging within the project will lessen the savings. The baseline budget estimates for the waste program were established at very challenging low values in an effort to encourage innovation and efficiencies. This process has been so successful that it has essentially eliminated the need for size reduction in the Building 776/777 Closure Project. In implementing innovations such as reducing TRU waste through this new, proven decontamination method, Kaiser-Hill is closing the gap between the original estimated cost for performing these functions and the contractual cost ceiling.

### *Looking Forward to Continued Benefits*

There are also other large contaminated items and equipment that appear to present potential opportunities for this process. The project expects to apply the decontamination technology and SCO process to all of the remaining glovebox systems. In so doing, the project expects the cost and schedule benefits to continue much as has been experienced to date.

The DOE's closure contract with Kaiser Hill to close Rocky Flats by 2006 was recognized as very aggressive. Consequently, original plans to meet this challenging goal identified the need to implement efficiencies. "The implementation of this decontamination technology and the SCO charac-



*The new decontamination process helps the Building 776/777 Closure Project reduce worker hazards during the removal of enormous gloveboxes reaching 8 feet in height.*

terization process is one of the most significant elements contributing to achieving the December 2006 completion date," said Gary Schuetz, in charge of DOE oversight of the Building 776/777 Closure Project. As a result of the successful decontamination operations, the new method has been adopted throughout Rocky Flats.

Unrelated to its positive effect on work/dose avoidance for the worker and cost/schedule of the closure project, the DOE realizes additional cost savings when the contractor decontaminates SCO levels. Low-level waste is much less costly to transport and dispose of at the Nevada Test Site than TRU wastes is to dispose of at the WIPP facility. These costs are borne directly by the DOE; as a result, the DOE directly benefits. Therefore, the deployment of the SCO process at other nuclear facilities in the DOE Complex has potentially large implications. ■

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*A Building 707 crew moves a decontaminated glovebox from the building.*

*Building 771 workers at the RFETS move a glovebox into a waste crate in preparation for transport to disposal at the Nevada Test Site.*