Decontamination strategy puts Rocky Flats on 2006 closure path

(October 30, 2002) The Rocky Flats Closure Project has adopted a strategy for decontaminating, certifying, and disposing as low-level waste as many as 900 gloveboxes and other large equipment formerly used in plutonium processing and fabrication. Reclassification of the waste as low level as opposed to transuranic translates into significant cost savings because costly and hazardous size reduction of transuranic waste headed for the Waste Isolation Pilot Plant has been minimized. This Accelerated Site Technology Deployment (ASTD) project to deploy advanced radiological instrumentation and techniques for the decontamination of large quantities of transuranic-contaminated gloveboxes and equipment is yielding valuable data and experience to support a safer, more efficient, and cost-effective approach at Rocky Flats and other DOE sites.

While Rocky Flats has previously tried baseline decontamination technologies, the site's efforts have been foiled by labor-intensiveness, excessive secondary waste, or decontamination factors not high enough to allow reclassification. The new technique overcomes these drawbacks while proving a safer alternative for workers, who—under the size-reduction scenario—must cut apart highly contaminated gloveboxes to prepare the waste for shipment to WIPP.

Getting the plutonium out

Gary Huffman, the DOE technology project officer at Rocky Flats, is keen on decontamination. "Use of decontamination technology at Building 771/774 and other buildings at Rocky Flats is one of our biggest success stories in terms of cost savings. We estimate that the use of decontamination throughout the site will allow us to avoid more than $100 million in size-reduction costs. We've cut six months off the D&D schedule for Building 771/774." In Building 776/777, decontamination has reaped $22 million in cost avoidance, based on a rate of $10,000 saved per cubic meter of glovebox surface area.

Huffman says, "We knew that we had to increase efficiency to achieve our accelerated closure of 2006. Human efficiency in performing work isn't the answer; we knew we needed technologies to revolutionize work."

Back in 1996 when the site started studying alternatives for dismantling and disposing of gloveboxes and other large processing equipment like tanks, the assumption was that decontamination was too labor-intensive, would generate too much combustible waste, and be too injurious as far as personal exposure was concerned. The site investigated the use of laser cutters and concluded that they weren't fast enough and left crimped edges that were as dangerous as the cut edges left by mechanical cutters. And while the plasma arc was found to cut through metal faster (4–5 inches a minute), site cleanup managers realized that they'd have to be very vigilant in eliminating all combustibles before cutting.

Huffman says, "Considering all the accommodations we would have to make to size reduce large contaminated equipment, we came to the realization that it didn't really matter which size-reduction technology we used—any of them would take at least a week to size reduce a glovebox."

Rocky Flats began to reconsider decontamination. The ASTD project, sponsored by the former D&D Focus Area and managed by DOE's National Energy Technology Laboratory, has made it possible for the site to work with private industry in developing decontamination processes that are effective, efficient, and safe.

Three-phased decon process

One particularly successful decontamination application was developed by Environmental Alternatives, Inc. This proprietary chemical extraction process employs as many as 25 different components in four separate chemical formulations, which are used in a three-step process to extract contaminants.

1. During the surface preparation phase, a complex blend of acids and other chemical agents is applied to clean dirt, oil, grease, and other interferences from the surface.

These blends also solubilize inorganics and organics and prepare the substrate by establishing proper conditions for the extraction step.

2. The extraction blend uses advanced chemistry in the fields of microemulsification and chemical ion exchange, a critical step in the decontamination process. The extraction solution penetrates below the surface and binds itself to the contaminants, then pulls horizontally and vertically through microscopic pores to the surface. Additional components of the formula encapsulate the contaminants to prevent them from recontacting and thereby recontaminating the surface by keeping them in suspension until they can be removed in the rinse step. A final formula is used in situations where extra solvency is desirable.
3. The third step is workers' rinsing and wiping down surfaces to remove chemicals.

The application and removal of the four formulas constitutes one cycle of the process, which typically requires one day (24 hours). Samples can be taken and/or surveys can be performed at the end of any cycle and often show 90% or more contaminant reduction per cycle.

Safety first and other considerations

These methods for decontaminating gloveboxes are safe. Gloveboxes, which were built to protect workers performing a variety of plutonium processing jobs, are now being used to protect workers during their decontamination of the gloveboxes. Glovebox ports are sleeved to shield workers' hands as they reach into contaminated areas and spray chemical solutions onto contaminated surfaces.

For extremely large tanks up to 2,000-gallon capacity, workers have to decontaminate only the outer surfaces. In Building 771/774, workers removed about 100 gallons of transuranic sludges that remained in a 2,000-gallon tank, decontaminated the exterior surfaces, applied fixative to interior surfaces, and sealed off entries into the interior. After wrapping the exterior with plastic, workers loaded the entire tank into a large cargo container for shipment off site.

TPO Huffman endorses these decontamination techniques as ways to avoid secondary waste. "We decided early on that we weren't going to be in the hazardous waste treatment business, so we're super hesitant about producing secondary waste." The processes produce little in the way of liquid waste. The cloths used by the workers are simply disposed through the glovebox ports into a garbage bag that the workers can tie off through the ports. The tied-off bag is routed to the outside of the building through a chute.

Huffman says, "Nine times out of 10 after treatment with one of these processes, we've been able to certify this material as low-level waste and put it in a cargo container to the Nevada Test Site or some other disposal site."

Another piece of the puzzle

Pivotal to the use of decontamination as the primary means of treating transuranic-contaminated equipment is certifying that the waste meets U.S. Department of Transportation criteria for low-level, surface-contaminated objects eligible for disposal at low-level waste disposal sites. Reclassifying the waste from transuranic to low level enables the site to avoid the management costs for transuranic waste, which are about three times higher. This project included recalibrating the Ludlum radioactivity detector to extend its upper detection limits to effectively demonstrate radioactivity levels both before and after decontamination. Since the Rocky Flats modification of the instrument, the manufacturer has used the technology to create and calibrate new instruments extending the dynamic range of the detectors.

Putting Rocky Flats closer to closure

Successful decontamination operations have encouraged Rocky Flats managers to adopt the technology throughout the site. Gary Schuetz, who provides DOE oversight of the Building 776/777 Closure Project, is typical of Rocky Flats managers who credit decontamination with helping Rocky Flats meet an aggressive closure schedule. "The implementation of this decontamination technology and the SCO [surface-contaminated object] characterization process is one of the most significant

elements contributing to achieving the December 2005 completion date."

For more information about the ASTD project to deploy decontamination techniques at the Rocky Flats Closure Project, contact Cliff Carpenter, (304) 285-4041, ccarpe@netl.doe.gov. Technical questions should be directed to Dave Maloney, Technology Director at Kaiser-Hill, (303) 966-7566, david.maloney@rfets.gov or Jeanna Blatt in the Communication Department at Rocky Flats, jeanna.blatt@rfets.com.