

Successful Waste Treatment Methods at Sandia National Laboratories

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During the remediation of the waste landfills at Sandia National Laboratory in Albuquerque, New Mexico nine drums of mock high explosives were generated. This mixed waste stream was proposed to several offsite vendors for treatment and prices ranged from \$2.50 to \$10 per gram a total cost estimated to be in excess of \$2 million dollars. This cost represents more than 30 percent of the annual budget for the Sandia Waste Management Operations.

Concentrated solutions of common oxidizers, such as nitrates, nitrites, and peroxides, will also act as oxidizers and will give positive results in the Hazard Categorization oxidizer test. These solutions carry an EPA Hazardous Waste Number D001, Ignitable Waste, and Oxidizer as defined in 49 CFR 173.151.

Sandia decided that given budget and time constraints to meet a Federal Facilities Compliance Act milestone, a process for onsite treatment should be evaluated. Clean samples of mock high explosive materials were obtained from Pantex excess inventory and treatability studies initiated to develop a treatment formula and process.

The following process was developed and implemented in the summer of 2006.

Size reduction to allow for dissolution of the barium nitrate in water. Mock HE 900-10 is 47% barium nitrate and the barium nitrate was responsible for the D001 (ignitable due to oxidizer) and D005 (barium) RCRA codes. Barium nitrate has limited solubility in water and the other 53% of the mock HE was binders and fillers. A mill was used to grind the mock HE into a fine powder. When pieces of mock HE were encountered that were too big for the feed tube of the mill, a press was also used to break up larger pieces.

Dissolution of the Mock HE in water. This was necessary to conduct the chemistry needed to eliminate the RCRA waste codes. Our final "recipe" was to dissolve 30 pounds of mock HE powder in 28 gallons of water in a lined-55-gallon drum.

Deactivation of the oxidizer. After bench-scale studies using ferrous chloride and ferrous sulfate, ferrous sulfate was selected as the best reagent. The final "recipe" was to add 30 pounds of ferrous-sulfate heptahydrate to the drum of mock HE dissolved in water from above. Stirring continued until the formation of precipitate appeared to stop

and then the drums were allowed to sit for at least overnight to allow the reaction to go to completion. This step allowed us to remove the D001 RCRA waste code.

Stabilization of the barium & the cadmium contamination present as an underlying hazardous constituent. Stabilization of the RCRA metals present was accomplished by thoroughly mixing 470 pounds of portland cement into each drum. This was done with hand-held mechanical mixers and had to be done quickly, as the iron added in the previous step accelerated the curing of the portland cement. Samples were taken immediately for to validate the barium concentration in the waste form via the Toxic Characteristic Leaching Procedure.

This project was completed and the treatment milestone achieved for less than \$300,000.

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The Disassembly Sanitization Operation (DSO) is a process that was implemented to support weapon disassembly and disposition using recycling and waste minimization while achieving the demilitarization mission. The Department of Energy is faced with disassembling and disposition of a huge inventory of retired weapons, components, training equipment, spare parts, and weapon maintenance equipment. Environmental regulations have caused a dramatic increase for information needed to support the disposal and handling of these parts and materials. Manufacturing information from past decades often does not meet the needs for regulatory decisions of today to assure proper management of weapons components.

Huge inventories of classified weapon components were required to have long-term storage at Sandia and many other locations throughout the complex. These materials are stored because they are classified, they may also contain radiological and/or hazardous components and disposal options may not have existed for this material. Long-term storage is costly and somewhat problematic. It requires a secured storage area, monitoring, auditing and it also has the potential for loss or theft of this material.

Overall recycling rates for materials sent through the DSO process have enabled 70 to 80% of these components to be recycled. These components are made to extreme standards and are made of high quality materials. Once the material has been sanitized, the demand for these metals is very high.

Description:

The Disassembly Sanitization Operation (DSO) process was developed and proven successful during the Environmental Restoration Project cleanup of the Classified Waste Landfill site at Sandia National Laboratories/New Mexico (SNL/NM). This site held legacy classified components that needed to be removed and the site needed to be remediated for closure. A detailed Work Control process as well as the Sandia National

Laboratories Integrated Safety Management System (ISMS) was utilized during this process.

The DSO capability was developed for this clean-up project but the process was recognized as having potential for many different applications. The process was identified to be transferable to current day inventories of classified weapon components that were being stored long-term at Sandia and many other locations throughout the complex. Although older and out-dated classified weapons components do not have a future use, they have to be stored securely on-site(s) because no disposal path exists for these types of materials. By disassembling and sanitizing classified materials, the metals could be recycled, the remaining materials could be disposed, and the need for storing this huge inventory of classified weapons components eliminated.

Prior to the DSO being pursued outside of its original application at the landfill, all regulatory requirements were evaluated and adequately satisfied to confirm that the DSO could be applied to excess classified weapons components.

In 2004, a proposal from the DSO Program Leader, to management of the Neutron Generator Production Facility (NGPF) to implement this process for classified weapons components being stored at the NGPF. The proposal focused on taking these classified materials and either removing the classified part or pieces or rendering the classified parts or pieces unclassified.

The disassembly process segregates each material type. The sanitization process prevents these materials from continuing to exist as classified material. The process employed the sanitization of these materials using a number of methods including but not limited to, shredding, destruction by a ring mill, cutting with band saws and/or basic hands-on disassembly of the components. After the materials are sanitized, they are no longer required to be stored as classified matter.

Initial process test runs for the new application of the DSO process were completed successfully in 2005. This process utilized on the classified weapons components parts/pieces allow the metal to be recovered for recycling. In the first year of operation, the DSO process recycled approximately 7,000 pounds of metal.

By building recycling into this process, the DSO program avoided substantial waste management costs and directed more funding to the DSO mission. Recycling avoided the disposal of hazardous metals in the environment and prevented the extraction of the raw product from the earth for the future need of these materials. Approximately 1,500 pounds of the recycled metal was lead or lead contaminated material.

After segregating the metals for recycle, the remaining materials can be managed independently of each other. These additional materials comprise only 20 to 30 percent of the components' materials and as segregated materials they can then be disposed of as low level or classified low level waste eliminated the need for further storage.

The DSO process for the NGPF classified components established the credibility of this technique as a viable process for addressing the long-term storage requirements of classified weapons component inventory. The success of this operation has generated interest from other Sandia Organization other locations throughout the complex. Other organizations are soliciting the help of the DSO team and the DSO is responding to these solicitations by expanding its scope to include work for other projects. For example, Pantex has asked the DSO team to assist with the destruction of their classified components. The operation is full scale and continues to grow and serve SNL/NM and DoE by providing a solution to this evolving issue.

On an ongoing basis, SNL has been incurring expenses for the management and storage of classified components. It is estimated that this project will save the DoE and Sandia several hundreds of thousands of dollars until the excess inventory is eliminated. This innovative approach eliminates the need for long-term storage of classified weapons components and the associated accounting.