

Macroencapsulation as Manufactured Components for Disposal at the Nevada National Security Site (NNSS) - 16213

Max Saad, Dwight Stockham*
Lawrence Barela**
Jeanne Poling***

* Sandia National Laboratories
P.O. Box 5800, Mail Stop 0483
Albuquerque, NM 87185

mpsaad@sandia.gov, djstock@sandia.gov

**Department of Energy, National Nuclear Security Administration
NA122.1 Office of Stockpile Services and Business Process
P. O. Box 5300

Albuquerque, NM 87185

lawrence.barela@nnsa.doe.gov

*** National Security Technologies, LLC (NSTec)
P.O. Box 98521, Las Vegas, NV 89193-8521

polingej@nv.doe.gov

ABSTRACT:

Macroencapsulation as Manufactured is a relatively new terminology that supports the disposal of classified legacy weapon components at the Area 5 Disposal Cell at the Nevada National Security Site (NNSS). These components are composed of hundreds and sometimes thousands of parts. Examples of this type of item include firing sets, trainers, radar assemblies, neutron generators and other similar components (see photos below). Sometimes there are hazardous Resource Conservation and Recovery Act-regulated (RCRA) metals involved in the parts that make up the components. The typical regulated metals in the components can be lead and silver from circuit boards and wiring, cadmium or chromium from plating operations of the parts. To perform the Toxicity Characteristic Leaching Procedure (TCLP) components have to be completely disassembled and sanitized¹ prior to being sent to laboratories for analysis. The results vary but the majority of times there are regulated metals present in these samples. The levels are relatively low and since analysis has been performed then a disposal process needs to be followed. A process needed to be developed and approved by governing boards to allow disposal of these items as long as this material meets the Waste Acceptance Criteria (WAC) (No liquids, compressed gases, explosives, SNM, etc.) before being sent to the Nevada desert for disposal.

¹ Sanitized is a process in which DOE high risk personal property is the irreversible modification or destruction of a component or part of a component of a nuclear weapon, device, trainer, handling equipment, or test assembly, as necessary, to prevent revealing classified or otherwise controlled information (e.g., unclassified information that is restricted from the standpoint of export control because of its significance for nuclear explosives research, development, fabrication, or testing).

INTRODUCTION:

Classified legacy weapon components are composed of hundreds of thousands of parts. Per regulatory guidance, each part has to be characterized individually unless a defined process can be established. Examples of this type of item include firing sets, trainers, radar assemblies, neutron generators and other similar components. In most cases, there are hazardous RCRA-regulated metals involved in the parts that make up the components. The typical regulated metals in the components would be lead and silver from circuit boards and wiring, cadmium or chromium plating operations. When the components are completely disassembled the regulated metals are relatively small amounts. However, these weapon components are designed and built to be very durable since these items are used in extreme mechanical and environmental conditions and disassembly of the components to determine analytical results is a labor intensive process.

With the permit modification to accept Mixed Waste in Nevada as well as the memorandum of understanding from the National Nuclear security administration (NNSA) within the Department of Energy (DOE) from the Office of Non-Proliferation (NA20) and the Office Nuclear Weapons (NA10) opened the door for the National Security Sites (NSE) (i.e., Pantex, Sandia National Labs, Los Alamos National Labs, etc. . .) which established a disposal path for Classified Mixed waste, Classified hazardous and Classified non-hazardous wastes. Nevada State Regulators also wanted to get a better understanding of these items and they had an opportunity to see these units as they were being manufactured. They had made a decision that these items NG's, firing sets, radars and other "self-contained" type items meet the definition of being "Macroencapsulated" i.e., no further treatment is required for the disposal of these items. An example was the management of neutron generators. They no longer had to be cut in half and one part sent to Nevada for disposal while the other side had to be treated to meet Land Disposal requirements. These units could be placed into a box, as long as this material meets the Waste Acceptance Criteria (WAC) (No liquids, compressed gases, explosives, SNM, etc.) before being sent to the Nevada desert for disposal. This reduced the costs to handle and treat these items prior to being disposed of in Nevada. This reduces the risk of a potential radiological expose to the workers trying to sanitize these items and allows items to be removed from long term storage in a more effective and efficient manner.

The majority of classified legacy weapon components will have more than one hazardous constituent but it is estimated that over 95% of the components will meet the definition of hazardous debris. The appropriate Land Disposal Restriction treatment for the classified hazardous debris is macro encapsulation. The Nevada Division of Environmental Protection Federal Bureau Chief toured operations within the NSE and observed that there were numerous components that appeared to meet the regulatory

macro encapsulation requirement as manufactured. These items are fully encased in stainless steel, resin potting material or other polymer coating and require no further treatment. See Photos of the types of components that qualify as "inherently macro encapsulated as manufactured".

Requirements/Regulations

40 CFR 268.2(g) defines "debris" as:

Debris means solid material exceeding a 60 mm particle size that is intended for disposal and that is: A manufactured object; or plant or animal matter; or natural geologic material. However, the following materials are not debris: Any material for which a specific treatment standard is provided in Subpart D, Part 268, namely lead acid batteries, cadmium batteries and radioactive lead solids; process residuals such as smelter slag and residues from the treatment of waste, wastewater, sludge or air emission residues; and intact containers of hazardous waste that are not ruptured and that retain at least 75% of the original volume.

40 CFR 268.45 Table 1 defines "macro encapsulation" as:

- Application of surface coating materials such as polymeric organics (e.g. resins and plastics) or use of a jacket of inert inorganic materials to substantially reduce surface exposure to potential leaching media.
- Encapsulating material must completely encapsulate debris and be resistant to degradation by the debris and its contaminants and material into which it may come into contact after placement (leachate, other waste, microbes).

The Nevada State regulators got this recommendation correct whether these items should be opened or placed into the appropriate containers for direct burial in the Nevada Desert.

CONCLUSION:

Numerous classified legacy components that contain hazardous metal constituents when declared excess already meet the regulatory requirement for macro encapsulation as manufactured. These items are fully encased in stainless steel, aluminum, resin potting material or other polymer coating during manufacturing and require no further treatment. The justification of equivalency for macro encapsulation must be documented in the waste profile along with the backup documentation. Qualified waste inspector and certification officials will need to inspect the items to ensure that no further treatment is required for these intact components during packaging operations.

There is no need to cut into these items and remove components that might contain small amounts of RCRA regulated metals. These items no longer have to be cut or sliced to meet Land Disposal requirements. These items can now be placed into a certified/approved disposal container and as long as

these items meet the Waste Acceptance Criteria (WAC) (No liquids, compressed gases, explosives, special nuclear materials, etc.) can now be disposed of in the Nevada desert.

There is also another aspect on sending these items to an approved/secure disposal facility and that is, these items no longer have to be continuously monitored. The cost associated with this aspect of component management requires a large amount of man-power and security needs. These items must be accounted and stored in approved locations, these costs continue for a large duration of time in many cases over 20 years. By placing these items into an approved disposal facility the costs to continue to monitor these items are no longer required.

These disposal options reduce the costs to handle and treat these items prior to being disposed of at a disposal facility. This also reduces the risk of a potential radiological exposure to the workers trying to sanitize these items as well as possible beryllium and other heavy metal contamination issues. This option also prevents the risk that these items might be misplaced and accountability issues are reduced. This allows items to be removed from long term storage in a more effective and efficient manner.

The intent of this document is to provide information, that even if a component contains a regulated hazardous waste, it may not require any further treatment. Other State regulatory agencies have had issues with the interpretation of these regulatory drivers but it is hopeful that this process will help pervade the guidance needed to make an informative decision with respect to these items.



Figure 1
Examples of Radar Assemblies

Small electronic and other components are located within these items, then an epoxy material is placed around the items to fill all void spaces and then the items are placed into a metal case and welded closed.

REFERENCES:

The following lists of references were used to prepare this abstract. Some of the references were not specifically referenced but were used to support the preparation of this document.

1. The National Nuclear Security Administration (NNSA), The Nevada National Security Site (NNSS) Waste Acceptance Criteria (WAC) – DOE/NV – 325-Rev 9 Feb. 2012
2. Title 40 Code of Federal Regulations (CFR) – Protection of Environment, Part 260-273 Hazardous Waste Management System, Resource Conservation and Recovery Act
3. Title 40 CFR Protection of Environment, Subpart 268.45 Table 1 Definition of "macro encapsulation"