

**Challenges Facing Low Specific Activity (LSA) and Surface Contaminated Objects (SCO)  
US D.O.T. Shipments for D&D Waste Streams and Retrieved/Prepackaged Waste  
Containers - 11589**

M. S. Waters, J. P. McGrogan\*

\*Cavanagh Services Group, Inc. Salt Lake City, UT 84111

**ABSTRACT**

The majority of waste shipments resulting from D&D or waste retrieval activities may be categorized and compliantly shipped as Low Specific Activity (LSA) or Surface Contaminated Objects (SCO) shipments. The information used to make the correct categorization is often that which is used to ensure the waste meets the waste acceptance criteria (WAC) of the receiving treatment, storage, and disposal facility (TSD). However, the information necessary to ensure compliance with the TSD WAC may not always be sufficient to make the appropriate LSA/SCO determination for meeting US Department of Transportation (DOT) requirements for a shipment. Therefore, early communication between the waste generator and the transportation organization is essential to ensure the appropriate data is assembled. There are also other considerations that must be taken into account when determining level of effort in LSA/SCO determinations.

**INTRODUCTION**

LSA (radioactive material distributed within) and SCO (radioactive material distributed on) categorization data needs are somewhat different. In some cases, existing data sets for certain types of waste simply do not contain enough information to make both a TSD WAC compliance and DOT LSA/SCO determination. Therefore a combination of characterization methods are required to meet both objectives for newly generated waste activities. One of the complicating factors in determining data requirements is the fact that more often than not, the waste is composed of a combination of LSA/SCO material.

Prepackaged waste containers often present a unique set of issues of their own. These containers are typically from retrieval operations and the waste packages can range from 5 to 30 years old. The containers can vary in configuration from 55 gallon drums to very large (>55m<sup>3</sup>) boxes. Since regulations and measuring techniques have changed over time, data on container contents is often limited to what was required for the period, but is not sufficient for current regulations. This can complicate the process for making LSA/SCO determinations.

*Categorizing and Transporting Low Specific Activity Materials and Surface Contaminated Objects*, NUREG-1608 dated July 1998, has been recognized by some as providing one or more acceptable method of demonstrating compliance with regulatory requirements for LSA and SCO material. This document is only established as a guidance document and is not incorporated into the DOT regulatory requirements. Other methods demonstrating compliance with regards to

LSA and SCO categorization can also be acceptable with justification and proper process documentation.

Consideration of other factors is necessary when determining methods demonstrating compliance with regards to LSA and SCO categorization such as;

## **WORKER SAFETY**

Protection of the worker must be integrated into all phases of the work planning process. Identifying data needs and methods of collecting that data should be incorporated into the work planning process to minimize worker exposure to hazardous work situations. If it can be determined early in the planning process whether a D&D waste stream would be identified as an LSA or SCO category candidate, then the proper data set and the method for collecting that data would need to be identified. Thorough preparation helps minimize cost, time, and unwanted consequences as well as personnel safety concerns associated with a well managed project. This is especially important for newly generated waste streams in order to minimize repeat work.

In dealing with retrieved or prepackaged waste, a thorough review of available data to make the LSA/SCO category determination must be conducted. Utilization of existing data will minimize worker exposure to increased risks from additional waste handling up to and/or including repackaging efforts. It must be recognized that a portion of retrieved waste was placed in retrievable storage prior to current DOT regulations in relations to LSA/SCO category determinations. At that, a best effort should be made and method documented in the use of available data to make the category determination without increasing risk to the worker.

## **As Low As Reasonably Achievable - ALARA**

Programs such as ALARA are incorporated to provide radiological protection to the low-level waste worker. Conducting radiological operations in a manner that ensures the health and safety of their employees, contractors, and the general public is a major goal that must be considered. In achieving this objective, companies ensure that radiation exposures to workers and the public, and releases of radioactivity into the environment, are maintained below regulatory limits. In addition, deliberate efforts are made to further reduce exposures and releases in accordance with a process that seeks to make any such exposures or releases as low as reasonably achievable. Projects should be fully committed to implementing a radiological control program of the highest quality that consistently reflects this goal.

Companies should consider the International Commission on Radiological Protection's philosophy of a system of dose limitation. No practice shall be adopted unless its introduction produces a positive net benefit. All exposures shall be kept as low as reasonably achievable, with economic and social factors being taken into account.

Companies should be committed to reducing exposure to radioactive materials and ionizing radiation levels that are as low as reasonably achievable (ALARA) to protect the health and safety of our employees, contractors, the general public, and the environment.

Reducing the amount of time that personnel handle waste packages will ultimately reduce radiation exposures. This can be accomplished by reducing or minimizing the number of radiation surveys, moving or location changes, and opening or repackaging containers.

Evaluating data needs for proper waste characterization and shipping categorization in the project planning phase can also aid in achieving ALARA goals. Reducing exposure of individuals to not only radiological hazards but also perhaps other chemical hazards also contributes to worker safety.

## **PACKAGING**

Understanding the definitions of LSA and SCO is necessary to select the proper packaging for transportation.

LSA material is radioactive material that has a low activity per unit mass (specific activity). LSA material is divided into three groups of increasing specific activities: LSA-I, LSA-II, and LSA-III. Most LSA materials have a characteristic of presenting limited radiation hazard, because of their relatively low concentration of radioactivity. When the specific activity of an LSA material is computed, the radioactivity is divided by the mass of material in which the radioactivity is distributed; the mass of the packaging that may surround the LSA is excluded from the calculation. Shielding material surrounding the LSA material may not be considered in determining the estimated average specific activity of the package contents. The quantity of LSA material in a single package must be restricted so that the external radiation level from the unshielded material does not exceed 10 mSv/h (1 rem/h) at 3 meters from the unshielded material.

Objects which are both activated or otherwise radioactive and contaminated may qualify as LSA material since an object having activity throughout and also contamination distributed on its surfaces may be regarded as complying with the requirement that the activity be distributed throughout. For such objects to qualify as LSA material it is necessary to ascertain that the applicable limits on estimated average specific activity are complied with. In assessing the average specific activity, all radioactive material attributed to the object, i.e. both the distributed activity and the activity of the surface contaminations, needs to be included.

SCO materials are by definition objects which are in themselves not radioactive but have radioactive materials distributed on their surfaces. The implication of this definition is that objects that are radioactive themselves (e.g. activated objects) and are also contaminated cannot be classified as SCOs. Such objects may, however, be regarded as LSA material insofar as the requirements specified in the LSA definition are complied with.

A differentiation is made between two categories of SCOs in terms of their contamination level, and this defines the type of packaging to be used to transport these objects. The regulations

provide adequate flexibility for the unpackaged shipment of SCO-I objects or their shipment in an Industrial package (Type IP-1).

LSA material and SCO can also be transported in excepted packages that meet the requirements of 49CFR 173.24, 173.24a and 173.410 but only for domestic transportation of an exclusive use shipment that is less than an A2 quantity.

Industrial Packages (IP) may also be used for LSA and SCO materials based on potential radiological hazard of the material to be transported.

The table below illustrates various categories of IP packaged required by 49 CFR 173.427.

Contents	Industrial Packaging Type	
	Exclusive Use Shipment	Non-Exclusive Use Shipment
LSA-I:		
Solid	IP-I	IP-I
Liquid	IP-I	IP-2
LSA-II		
Solid	IP-2	IP-2
Liquid	IP-2	IP-3
LSA-III	IP-2	IP-3
SCO-I	IP-I	IP-I
SCO-II	IP-2	IP-2

DOT 7A Type A packages can also be used for the transportation of LSA and SCO materials. However, it should be recognized that DOT 7A containers are more expensive to procure and should be used only when IP-1 containers cannot be used. For larger materials as well as rubble and debris from D&D operations DOT 7A Type containers can be hard to find and very expensive to procure.

Type B containers are not normally used LSA and SCO shipments. However, they could be used if the radioactivity and physical form of the materials to be shipped are authorized by the certificate of compliance (C of C) for the particular Type B package to be used.

If additional characterization or hazard classification is too problematic for a project, using a more conservative packaging route (e.g., Type A or Type B packaging) may be necessary. The project team may have to make a choice: incur a potential cost increase in packaging or obtain additional waste characterization data to satisfy DOT hazard classification requirements. It should be noted however, that obtaining large Type A and or Type B packaging to package and subsequently transport larger LSA-SCO materials can be problematic. These types of packages are not readily available and very costly to design, certify, build and procure.

## **COST AND SCHEDULE**

The rigor applied to obtain data to support determination of LSA/SCO categorization will directly affect project cost and schedule. Examples could include;

- 1) If detailed radiological surveys are deemed necessary, additional radiation control personnel may need to be hired and trained as well as procuring often times expensive measurement equipment. Depending on the depth of the survey this could also have a schedule impact.
- 2) If additional sampling is required, again additional personnel may need to be hired and trained. Laboratory analysis to obtain required sample results can be expensive.
- 3) A decision to open and repackage previously packaged waste would add considerable cost and would have adverse schedule impacts. Merely providing a location or facility to perform the repackaging activities could be cost prohibitive not to mention impacts on other project considerations, personnel radiation exposures especially.
- 4) Packaging decisions would affect both cost and schedule. As package requirements increase from IP-I to IP-II to Type A, container costs and availability will become an issue. For instance, to make a conservative decision and package in large Type A containers may require design, test/certify, and manufacture which can take months to complete and cost in the area of hundreds of thousands of dollars.

## **SUMMARY**

Meeting DOT Hazardous Materials Regulations is not option. Identification of LSA material and SCO is not a quick, easy process. The regulation my present complexities when applied to actual situations. Programs such as ALARA are also incorporated to provide radiological protection to the low-level waste worker. The technical, economic, practical, and safety aspects such as time, cost, radiological exposure, and chemical exposure must be considered when determining at which point additional measurements for detailed characterization will jeopardize ALARA or impose unacceptable costs and schedule impacts.