

EnergySolutions' Implementation of HM-250 – 16641

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ABSTRACT

This presentation discusses the various changes at EnergySolutions' radioactive material disposal and processing facilities to implement the recent changes in Department of Transportation (DOT) [1] with respect to the receipt and return to service of conveyances and packages used to transport radioactive material.

Effective July 13, 2015, the DOT has revised 49 CFR 173.443(c) in an effort to prevent inadvertent diversion of conveyances and bulk packages into general commerce that had previously been used to transport radioactive material. Previous to this change, conveyances, such as, trailers, railcars, gondolas and bulk packages, such as, sealands and intermodals that were received at radioactive material management facilities could be released back to the customer as "Return to Service" (RTS) in accordance with the contamination and dose limits specified in 49 CFR 173.443(c).

At the point of release, these conveyances or packages were not required to be dedicated exclusively for subsequent radioactive material shipments. The DOT revised this regulation to implement additional controls that require any conveyance or package that was transported as Class 7 (radioactive) materials exclusive use shipment to be dedicated to subsequent radioactive material shipments. If these conveyances or packages are not use for Class 7 (radioactive) use, then they must be released for unrestricted use in accordance with the DOT and the respective radioactive material license or other regulatory authority.

INTRODUCTION

On August 12, 2011, the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) published a notice of proposed rulemaking (NPRM), Hazardous Material Regulations [2]; Compatibility With the Regulations of the International Atomic Energy Agency. PHMSA, in coordination with the U.S. Nuclear Regulatory Commission (NRC), proposed to amend requirements in the Hazardous Materials Regulations (HMR) governing the transportation of Class 7 (radioactive) materials based on recent changes in guidance by the International Atomic Energy Agency (IAEA) [3]. The purpose for these revisions was to harmonize HMR requirements with international standards and update, correct, clarify or provide relief from certain regulatory requirements for the transportation of Class 7 (radioactive) materials.

As part of this rulemaking, the DOT revised 49 CFR 173.443(c) in an effort to prevent inadvertent diversion of conveyances and bulk packages into general commerce that had previously been used to transport radioactive material. Previous to this change, conveyances such as trailers, railcars, gondolas and bulk packages, such as, sealands and intermodals that were received at radioactive material management facilities could be released back to general commerce as "Return to Service" (RTS) in accordance with the contamination and dose limits specified in 49 CFR 173.443(c).

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The DOT's reasons for the RTS changes, as stated in the final rule, III. Section-by-Section Review, were as follows:

1. If "returned to service" were to be considered a criterion for unrestricted release following exclusive use transport of Class 7 (radioactive) materials, it would be providing a radioactive material unrestricted transfer (free release) limit, which the U.S. DOT does not have the authority to do.
2. Given that non-hazardous material, or even foodstuffs, could be transported in contact with these items or conveyances, an unacceptable health physics practice would result if these limits were construed to be a criterion for free release (i.e., for unrestricted radioactive transfer).
3. Adhering to the removable contamination requirement (no greater than the § 173.443 (a) values) and the radiation level requirements (no greater than 0.005 mSv per hour or 0.5 mrem per hour, at the surface of the vehicle) of § 173.443 (c) would not provide sufficient protection for unrestricted transfer, considering that over time factors such as weathering could gradually convert any fixed contamination to non-fixed contamination.
4. Such a practice of providing a free release or unrestricted transfer of radioactive material at these levels would be incompatible with currently generally accepted radiation protection practices.

Although there were many proposed changes by DOT in this rule, the greatest impact to *EnergySolutions* was the restrictions to the RTS transportation category. *EnergySolutions* used RTS as an efficient and compliant method to release conveyances (gondola rail car, sealand containers, intermodal containers, and transportation vehicles) and return them back to customers or for general unrestricted use in commerce. These new changes restrict RTS for exclusive-use transport of Class 7 (radioactive) materials only. Therefore, all conveyances not released RTS must meet the Clive radioactive material license requirements for unrestricted release (UR), unless authorized as another type of DOT packaging, such as, empty packaging or sole use. The level of effort for an UR is significantly greater than a RTS release.

DISCUSSION

Overview of 49 CFR 173.443, Contamination Control Changes

§173.443 describes the non-fixed contamination control provisions for a package, a conveyance, a freight container and an overpack of Class 7 (radioactive) material. In order for these contamination control limits to apply the package, conveyance,

freight container or overpack must meet the definition of Class 7 (radioactive) material, which is,

Any material containing radionuclides where both the activity concentrations and the total activity exceed the values specified in §173.436 or the values derived according to §173.433.

In addition, any non-radioactive solid object with radioactive material on any surface exceeding the limits in §173.403, contamination, which is the sum of fixed and non-fixed contamination in units of Bq/cm², would also be considered Class 7 (radioactive) material and subject to these contamination control provisions.

Contamination means the presence of a radioactive substance on a surface in quantities in excess of 0.4 Bq/cm² for beta and gamma emitters and low toxicity alpha emitters or 0.04 Bq/cm² for all other alpha emitters. There are two categories of contamination:

- (1) Fixed contamination means contamination that cannot be removed from a surface during normal conditions of transport.
- (2) Non-fixed contamination means contamination that can be removed from a surface during normal conditions of transport.

The DOT added paragraph §173.401(b)(5) to clarify when non-radioactive solid objects are subject to the Class 7 (radioactive) material requirements of the HMR. In some cases, the DOT definition of contamination is more restrictive than a radioactive material license or equivalent limits (i.e. unrestricted release).

This subpart does not apply to:

Non-radioactive solid objects with radioactive substances present on any surfaces in quantities not exceeding the threshold limits set forth in the definition of contamination in §173.403.

§173.443(a)

Paragraph (a) of §173.443 provides guidance on the proper method for determining the non-fixed contamination levels on the external surfaces of a package, conveyance, freight container and overpack including the internal surfaces of a conveyance, freight container and overpack, in which, inners packages or receptacles of Class 7 (radioactive) material are offered for transport. This paragraph also defines the non-fixed maximum permissible contamination limits as set forth in TABLE I (Table 9 in §173.443(a)).

Contaminant	Maximum permissible limits		
	Bq/cm²	uCi/cm²	dpm/cm²
1. Beta and gamma emitters and low toxicity alpha emitters	4	10 ⁻⁴	240
2. All other alpha emitting radionuclides	0.4	10 ⁻⁵	24

TABLE I. NON-FIXED EXTERNAL RADIOACTIVE CONTAMINATION LIMITS FOR PACKAGES

A key component of these non-fixed contamination limits is the radiation safety philosophy called ALARA (As Low As Reasonably Achievable). Therefore, the non-fixed contamination levels on packages, conveyances, freight containers or overpacks of Class 7 (radioactive) material must also be ALARA, in addition to, compliant with the limits of Table I. The limits provided in paragraph (a) of §173.443 ensure that transportation equipment used for Class 7 (radioactive) material do not exhibit an excessive level of non-fixed radioactive contamination.

It should be noted that the DOT does not provide fixed contamination limits. A fixed contamination survey requires a direct survey with a portable contamination instrument (i.e. frisker) and the gamma radiation emanating through the package containing the radioactive material makes this impractical. The DOT stated that other hazard transportation controls and packaging requirements provide sufficient protection.

The DOT added a new section in paragraph (a) that describes the radiological survey requirements for a non-exclusive use shipment,

A conveyance used for non-exclusive use shipments is not required to be surveyed unless there is reason to suspect that it may exhibit contamination.

Exclusive Use

The remaining paragraphs (b), (c) and (d) of §173.443 address scenarios under which higher levels of non-fixed contamination are authorized with the requisite radiological survey requirements. In order to provide hazard communication for conveyances transporting Class 7 (radioactive) material under paragraphs (b), (c) and (d), exclusive use instructions must be provided by the consignor. These increased communication requirements are intended to compensate for the fact that packaging requirements are minimal. This is explained in greater detail in the forthcoming paragraphs.

Previous to HM-250, the DOT stipulated exclusive use provisions for certain transportation scenarios. In HM-250, the DOT expanded the use of exclusive use shipments to include the three scenarios listed above. The term “exclusive use” means,

Sole use by a single consignor of a conveyance for which all initial, intermediate, and final loading and unloading and shipment are carried out in accordance with the direction of the consignor or consignee where required by this subchapter. The consignor and the carrier must ensure that any loading or unloading is performed by personnel having radiological training and resources appropriate for safe handling of the consignment. The consignor must provide to the initial carrier specific written instructions for maintenance of exclusive use shipment controls, including the vehicle survey requirement of §173.443(c) as applicable, and include these instructions with the shipping paper information provided to the carrier by the consignor.

§173.443(b)

Paragraph (b) of §173.443 applies to exclusive use shipments, in which, the non-fixed contamination for the external surfaces of a package, as well as, the internal

surfaces of a conveyance, overpack or freight container may not exceed 10 times the levels in Table I. However, the non-fixed contamination may not exceed Table I at the beginning of transport.

§173.443(c)

Paragraph (c) of §173.443 replaced the phrase “return to service” (RTS) with “return to Class 7 (radioactive) materials exclusive use transport service” and then only for a subsequent exclusive use shipment utilizing one of the following transportation scenarios:

1. The shipment of packages that may develop increased contamination during transportation up to 10 times as authorized in §173.443(b); The use of the packaging exceptions for less than an A2 quantity as authorized in §173.427(b)(4) (LSA material and SCO in packaging that meets the general design requirements of §173.410); or
2. The shipment of unpackaged LSA-1 material and SCO-1 as authorized in §173.427(c).

The DOT is very clear, in that, “return to service” means “only that the conveyance and associated equipment may then be used for another exclusive use shipment of radioactive material using one of the above (but not for other exclusive use or non-exclusive use shipments, or for transporting non-hazardous material).”

Each conveyance, freight container, overpack, tank or intermediate bulk container utilizing the return to Class 7(radioactive) materials exclusive use transport service must be surveyed and exhibit radiation levels not exceeding:

- 0.005 mSv per hour (0.5 mrem per hour) on any accessible surface; and
- Non-fixed radioactive surface contamination no greater than Table I

The exclusive use provisions and radiological survey requirements are necessary to mitigate and control the build-up of contamination in undesired locations.

The DOT specifically stated that the procedure stated in paragraph (c) of §173.443 “would not be applicable, and would in fact generally be prohibited, for unrestricted return to general service of the item or conveyance.” This revision to paragraph (c) of §173.443 clarified a longstanding misinterpretation on the distinction between transport and transfer of radioactive material. Therefore, when a conveyance, a freight container, an overpack, a tank or an intermediate bulk container utilizing the return to Class 7(radioactive) materials exclusive use transport service is no longer needed, it must be surveyed to demonstrate radioactivity levels are below the contamination definition contained in §173.403 **and** as authorized by an U.S. NRC or Agreement State radioactive material license or appropriate regulatory agency (e.g. Department of Energy).

§173.443(d)

Paragraph (d) of §173.443 only had minor changes for “sole use” shipment of Class 7 (radioactive) material. The DOT added the requirements that these types of shipments must use exclusive use provisions and must be placarded.

§173.443(e)

Paragraph (e) of §173.443 is an entirely new section. This section prescribes required actions for a leaking or suspect leaking Class 7 (radioactive) material shipment. These actions include immediate actions and assessments, protective actions for persons, property and environment and prerequisites for continued transport. It is important to note that these actions pertain to all shipments of Class 7 (radioactive) material regardless if exclusive use or non-exclusive use.

Implementation

Examples of Transportation Scenarios

EnergySolutions' manage all types of equipment used in the transportation of Class 7 (radioactive) material. The following are some examples of different types of transportation scenarios that EnergySolutions could receive at one of its facilities for management of radioactive material.



Figure 1. Transportation Cask

An exclusive use shipment consisting of a loaded cask on a trailer is a package on a conveyance (Figure 1). Since the cask is the package, it is not shipped under §173.443(b) (i.e., weeping or seeping package in a conveyance), it is also not shipped as general design criteria, less than A2 quantity, domestic use package in/on a conveyance under 173.427(b)(4), (Note: if not shipped as a Type A or B package, it would still be considered an Industrial Package), and it is not used for unpackaged SCO-I or LSA-1 material per §173.427(c).

After removing the radioactive material from the cask, the cask is reassembled and surveyed as required by §173.443(a). Since the in-bound cask shipment was not transported under §173.443(b), §173.427(b)(4), or §173.427(c), there is no requirement for survey under 173.443(c) or continued exclusive use transport service. The empty cask is returned for reuse in accordance with §173.428 Empty Class 7 (radioactive) material packaging. The conveyance (trailer) is surveyed to

demonstrate radioactivity levels are below the contamination definition contained in §173.403.

Additional examples of exclusive use shipments may include a conveyance van (Figure 2), a freight container on a flatbed (Figure 3), a freight container on a flat railcar (Figure 4) or a railcar conveyance (Figure 5). If these conveyances/packages are transported as exclusive use shipments under §173.443(b) (e.g., containing packages that weep or seep), §173.427(b)(4) (less than A2, general design package, domestic use) or §173.427(c) (unpackaged LSA-1 or SCO-I) they must be surveyed:

In accordance with §173.443(c) to meet the limits of Table I (and ALARA) and 0.005 mSv/hr (0.5 mR/hr) criteria **and** used for subsequent exclusive use shipment under §§173.443(c), 173.427(b)(4) or 173.427(c),

or

Surveyed to demonstrate radioactivity levels are below the contamination definition contained in §173.403 **and** as authorized by an U.S. NRC or Agreement State radioactive material license or appropriate regulatory agency.



Figure 2. Conveyance van



Figure 3. Freight Container on Flatbed



Figure 4. Freight Container on Flat Railcar



Figure 5. Railcar Conveyance

CONCLUSIONS

EnergySolutions has implemented HM-250 at all of its operations within the United States, including our Walker facility in Toronto, Canada, which transports radioactive material into the United States for processing. All facets of our implementation strategy strived to ensure consistency throughout all operations within the constraints of different regulatory authorities (i.e. different Agreement State radioactive material licenses and regulatory administrations). The change in regulatory responsibility for releasing conveyances or packages used for transportation of Class 7 (radioactive) material shifted from the DOT to these individual Agreement States and their respective radioactive material licensees.

It is important that businesses involved with the transportation of radioactive material, including the carriers, work together to facilitate changes to processes that have been in place for many years. These changes may include an increase in decontamination and radiological survey capabilities and pre-receipt radiological surveys to notify facilities of the radiological status of packages and conveyances so the receipt and shipment of radioactive material can be completed efficiently. In addition, continued discussions with the DOT and other regulatory agencies to facilitate future changes to radioactive material transportation regulations.

REFERENCES

1. 49 CFR Part 100-185, Hazardous Materials Regulations
2. Federal Register/Vol.76, No. 156/Friday, August 12, 2011/Proposed Rules – U.S. Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA), Docket No. PHMSA-2009-0063 (HM-250)
3. *Regulations for the Safe Transport of Radioactive Material*, 2009 Edition, IAEA Safety Standard Series No. TS-R-1

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