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RECORD #89

TITLE: Clarification of Conditions for Waste Shipments Subject to
Hydrogen Gas Generation

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D. C. 20555

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IE INFORMATION NOTICE NO. 84-72: CLARIFICATION OF CONDITIONS FOR WASTE
SHIPMENTS SUBJECT TO HYDROGEN GAS GENERATION

Addressees:

All nuclear power reactor facilities holding an operating license (OL) or construction permit (CP) and certain registered users of NRC Certificates of Compliance for transport packages.

Purpose:

The NRC's Office of Nuclear Materials Safety and Safeguards (NMSS) has identified a need to clarify conditions relating to the use of NRC-certified packages for shipment of wastes.

Discussion:

A potential exists for the generation of combustible quantities of hydrogen for certain waste forms containing radioactive material. This is pertinent to shipments of resins, binders, waste sludge, and wet filters. It is not pertinent to dry compacted or uncompacted waste and irradiated hardware.

In general, applications for waste package certificates of compliance have not addressed the potential for generation of combustible gas mixtures. Generic requirements have recently been included in certain NRC Certificates of Compliance to preclude the possibility of significantly reducing packaging effectiveness in use. These conditions are typically stated as follows:

- (1) For any package containing water and/or organic substances that could radiolytically generate combustible gases, it must be determined by tests and measurements of a representative package whether or not the following criteria are met over a period of time that is twice the expected shipment time:
 - (a) The hydrogen generated must be limited to a molar quantity that would be no more than 5% by volume (or equivalent limits for other inflammable gases) of the secondary container gas void, if present, at STP (i.e., no more than 0.063 g-moles/ft³ at 14.7 psia and 70°F) or
 - (b) The secondary container and cask cavity must be inerted with a diluent to ensure that oxygen must be limited to 5% by volume in those portions of the package that could have hydrogen greater than 5%.

For any package delivered to a carrier for transport, the secondary container must be prepared for shipment in the same manner in which determination for gas generation is made. The shipment period begins when the package is prepared (sealed) and must be completed within twice the expected shipment time.

- (2) For any package containing materials with radioactivity concentration not exceeding that for low specific activity (LSA) material, and shipped within 10 days of preparation, or within 10 days after venting of drums or other secondary containers, the determination in (1) above need not be made, and the time restriction in (1) above does not apply.

The generation of combustible gases is dependent on the waste form, radioactive concentration and isotope, free volume, total mass and accumulated dose in the waste. In addition, packaging limitations such as effective shielding provided may preclude the radioactive concentrations and hence the generation of combustible gases.

It is believed, in most cases, that the above combustible gas criteria for waste not exceeding LSA concentrations will be met by ensuring that waste packages are shipped within 10 days of preparation. However, in those cases where this is not feasible, licensees may request a specific approval for their proposed shipment. The application should address those factors that would preclude the generation of combustible gases over at least twice the expected shipment time. Such applications should be directed to NMSS.

In all other cases, a determination must be made in accordance with the provisions of the certificate that the requirements of (1) above are met. Any tests and measurements that are representative of the waste to be shipped and address the factors that affect gas generation may be used. The determination should be documented and retained as part of the records for the shipment.

Recipients of this notice should review the information discussed for possible applicability to their waste shipments. No written response to this information notice is required. If you have any questions regarding this matter, please contact NMSS.



Edward L. Jordan, Director
Division of Emergency Preparedness
and Engineering Response
Office of Inspection and Enforcement

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