



U.S. Department
of Transportation

**Pipeline and Hazardous
Materials Safety
Administration**

1200 New Jersey Avenue SE
Washington, DC 20590

OCT 05 2015

Mr. Rod Coleman
Lawrence Livermore National Laboratory
7000 East Avenue
Livermore, CA 94550

Ref. No. 15-0077

Dear Mr. Coleman:

This responds to your April 21, 2015 email requesting clarification of the Hazardous Materials Regulations (HMR; 49 CFR Parts 171-185). Specifically, you ask for clarification on the classification of the small capsules described in your request, which are each filled with .075 curies (Ci) of tritium gas and present a radioactive hazard as well as a flammable gas hazard (hydrogen). You also request guidance on how to obtain regulatory relief in order to transport this material by air in the non-Department of Transportation (DOT) specification packaging described in your request.

In your request, you indicate that the shipment of the tritium-filled capsules meets the requirements of the HMR for transport as "UN 2910, Radioactive material, excepted package, limited quantity of material, Class 7." However, per the requirements of § 173.2a, the flammable gas would be the primary hazard class. Furthermore, given that § 173.306 states that "only packages of hazardous materials authorized aboard passenger-carrying aircraft may be transported as a limited quantity" and "UN1049, Hydrogen, compressed" is forbidden aboard passenger-carrying aircraft, your shipment cannot qualify for limited quantity exceptions and as such, the non-DOT specification packaging you wish to use is not authorized for air transport.

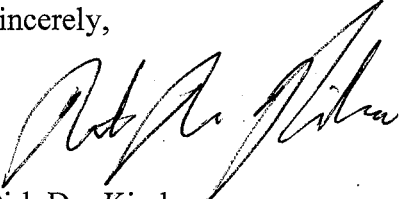
Nevertheless, you state that air transport is needed to make your organization's project successful, and you believe the small amount of tritium gas contained within the capsules would not sustain a flame if an ignition source was present, as the total combustion energy if all the capsules were burned is only 4 joules (J). Therefore, you believe the flammable gas would not pose a safety risk during transportation, even when transported in the non-DOT specification packaging exhibited in your request.

Based on the information you provided, it is the opinion of this Office that you should apply to PHMSA for permission to use the non-DOT specification packaging described in your request under the terms of a special permit. To apply, you must submit an application to the Associate Administrator for Hazardous Materials Safety in conformance with the requirements prescribed in 49 CFR Part 107, Subpart B. In your application, you must

provide justification that the packaging design you are considering achieves a level of safety that is equal to or greater than that required under the HMR. You may obtain information on the special permit application process from our website at <http://www.phmsa.dot.gov/hazmat/regs/sp-a>, or by calling PHMSA's Approvals and Permits Division at (202) 366-4511.

I hope this answers your inquiry. If you need additional assistance, please contact this Office at 202-366-8553.

Sincerely,

A handwritten signature in black ink, appearing to read "Dirk Der Kinderen". The signature is fluid and cursive, with the first name "Dirk" being the most prominent.

Dirk Der Kinderen
Acting Chief, Standards Development Branch
Standards and Rulemaking Division

Boothe
§ 173.22 Shippers Resp.
§ 173.115 Class 2 Division
2.1

Dodd, Alice (PHMSA)

15-0077

From: Geller, Shelby CTR (PHMSA)
Sent: Tuesday, April 21, 2015 3:44 PM
To: Hazmat Interps
Subject: FW: Request for interpretation or guidance on Tritium Shipment
Attachments: LLNL Tritium Shipment interpretation request.pdf

Dear Shante and Alice,

Attached is a formal request for a letter of interpretation. Mr. Coleman spoke with Jordan Rivera, with guidance from Victoria Lehman.

Thanks,
Shelby

From: Coleman, Rod [<mailto:coleman6@llnl.gov>]
Sent: Friday, April 17, 2015 1:52 PM
To: INFOCNTR (PHMSA)
Cc: Williams, James (PHMSA)
Subject: Request for interpretation or guidance on Tritium Shipment

Office of Hazardous Material Safety,
Attached is a description of a proposed shipment from Lawrence Livermore National Laboratory. I am asking for interpretation or guidance on the flammable gas classification on capsules filled with a small amount of tritium gas. Please let me know if you have any questions or concerns regarding this request.
Thank you,
Rod Coleman
925-424-4198

To: Office of Pipeline and Hazardous Materials Safety Administration
Office of Hazardous Material Safety

From: Lawrence Livermore National Laboratory
Rod Coleman
7000 East Ave
Livermore, CA 94550
coleman6@llnl.gov

Subject: Guidance and Interpretation on Flammable Gas Classification of Capsules filled with Tritium Gas

LLNL will fill small glass and plastic capsules with tritium gas according to parameters listed in Table 1 below. The capsules are filled with tritium gas at a pressure up to 15 atmospheres (220 PSIA) and are no larger than 1.6 mm OD (Figure 1). We need to ship up to 10 capsules in one package to Rochester, NY by air freight. Each capsule contains up to .075 Ci of tritium gas. Each capsule will be individually captured in a stainless steel fixture and the 10 fixtures will be packed in a transportation vessel which is a non-DOT specification cylinder (Figure 2). The transportation vessel will be backfilled with argon at one atmosphere and capped prior to shipment. To make this project successful the material needs to arrive at the destination within one week after filling and requires air transport.

Tritium gas is a radioactive material with a flammable gas subsidiary risk hazard (hydrogen). The shipment of these tritium filled capsules meet the requirements to ship as UN2910, Radioactive material, excepted package, limited quantity of material, class 7, however, the flammable gas would be the primary hazard class and is presenting a challenge for air transport in a non-DOT specification cylinder. Because of the small capsule volume, the pressure rise would be 2.2 psi if all 10 capsules were to break inside the 2 cc transportation vessel.

cubic centimeter

pounds/square inch

Based on the size of the capsules and the amount of tritium gas present, LLNL believes this small volume of tritium gas would not sustain a flame if ignition source was present and therefore the flammable gas does not pose a safety concern during transportation. The total combustion energy if all capsules burned is only 4 joules.

LLNL is requesting an interpretation on the flammable gas classification based on amount of gas present in the capsules or guidance on obtaining relief to transport this material by air in the configuration described above.

Capsule diameter, od	1.6	mm
Capsule radius, id	0.797	mm
Capsule thickness	3	microns
# of capsules in single shipment	10	capsules
Capsule gas volume	0.0021	cc
Composition	100%	tritium
Max pressure, atmospheres	15	atm
Max pressure, PSIA	220.5	PSIA
Capsule gas volume at Standard Temperature & Pressure (STP)	0.032	cc
Total volume of all gas capsules in single shipment at STP	0.318	cc
Activity of tritium	2.4	Ci/cc
Activity per capsule	75	mCi/capsule
Total activity of all capsules	753	mCi
Proposed shipping vessel volume	2	cc
% T gas volume/argon volume	15.9%	
Pressure if all capsules break	16.9	PSIA
Pressure rise	2.2	PSIG
Heat of enthalpy of hydrogen combustion	286	kJ/mole
Total moles of tritium gas in shipment	0.0000130	moles
Heat of combustion of capsules	3.72	joules

Table 1. Parameters used to evaluate shipment of 10 tritium filled capsules.

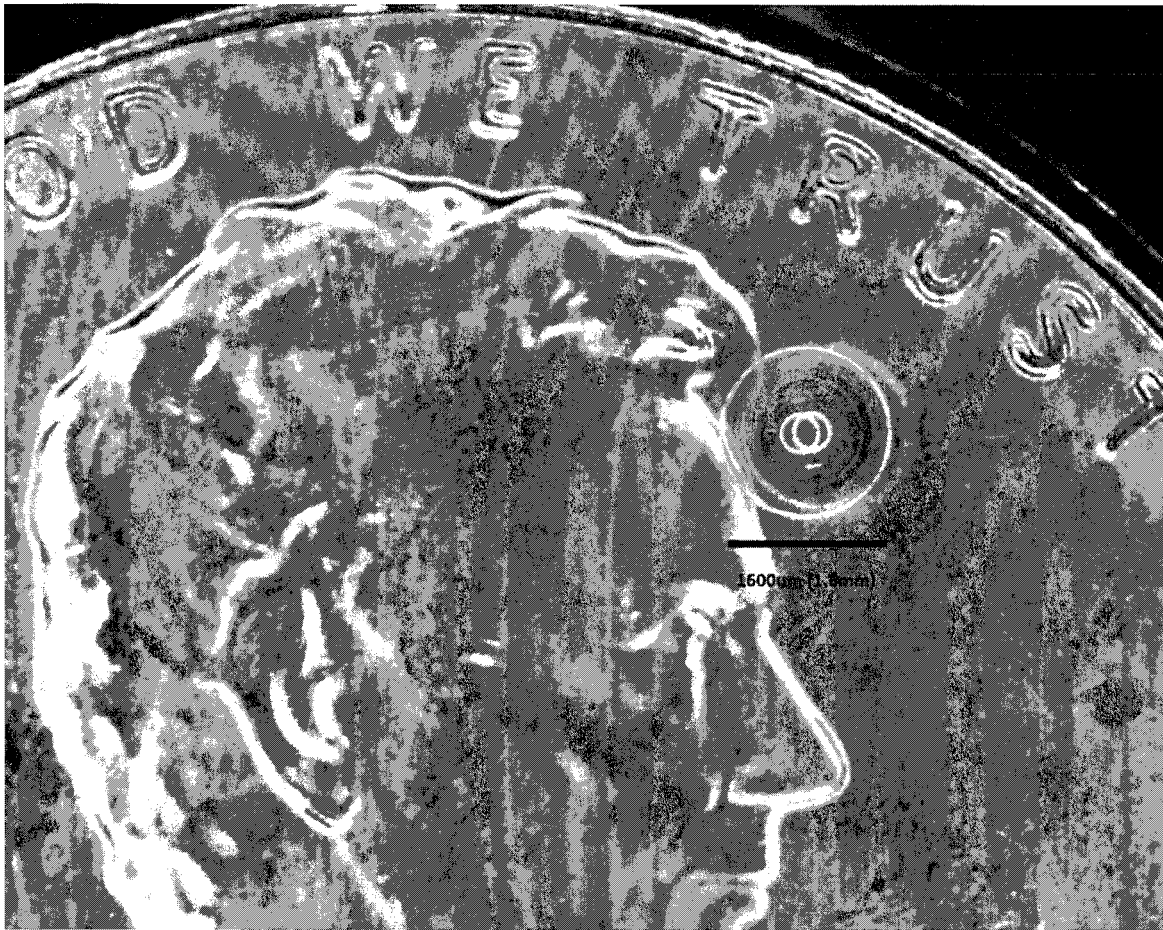


Figure 1: Photo of single 1.6 mm capsule on penny.

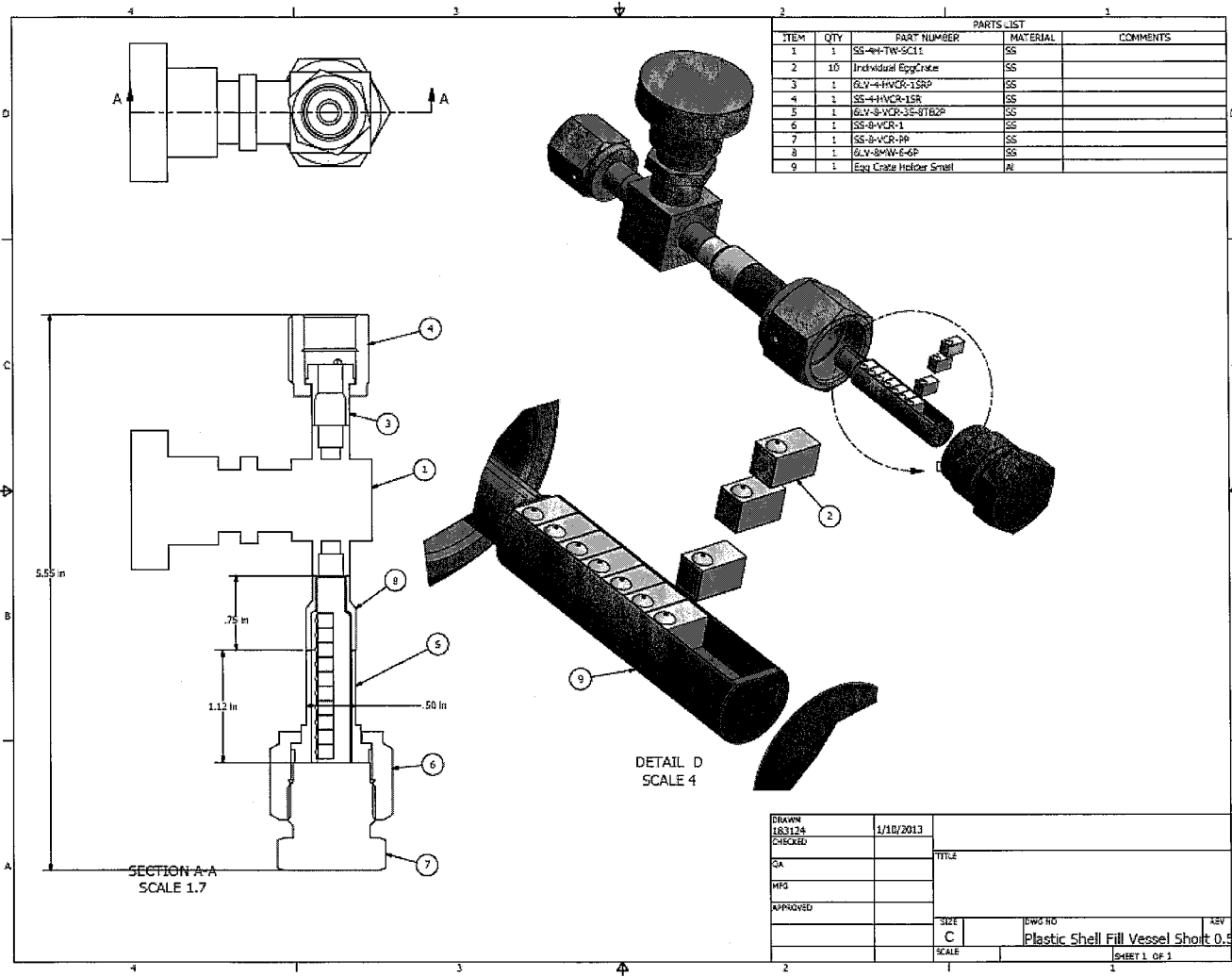


Figure 2. Drawing of proposed transportation vessel for ten, tritium-filled capsules. The vessel is based on Swagelok valve components.