U.S. Department of Transportation

Pipeline and Hazardous Materials Safety Administration

1200 New Jersey Ave, SE
Washington, D.C. 20590

MAR 1 2010

Mr. Jon Varner
Director of Engineering
Detector Electronics Corporation
6901 West 110th Street
Minneapolis, Minnesota 55438

Ref. No. 10-0012

Dear Mr. Varner:

This responds to your email dated January 12, 2010 requesting clarification of the Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180). Your company manufactures a gas detection device designed to detect hydrogen sulfide (H2S). The calibration method for the H2S gas detection device requires the use of glass ampoules containing H2S. Specifically, you ask PHMSA to confirm that based on the LC_{50} value, the method of packing, and shipment quantities, the H2S ampoules are transported in a form and quantity that does not pose an unreasonable risk to health and safety or property, and therefore are not subject to the HMR.

You provide the following supplemental information:

> Each ampoule has a volume of 7 ml and is filled with H2S, which based on your calculations is equivalent to a concentration of 0.49%. You have determined through calculations that the LC_{50} of the H2S mixture contained in each glass ampoule is 145,510 ml/m^3. The ampoules are packed in blocks of foam, 6 ampoules per block. Two foam blocks are packed per corrugated outer box. These boxes are then overpacked in a box with 300 lbs. burst strength with additional packing material, and/or other items. Shipments typically include 100 ampoules and are not anticipated to exceed 1,000 ampoules.

A Division 2.3 (gas poisonous by inhalation) material is defined as a gas that is known to be so toxic to humans as to pose a hazard to health during transportation; or, in the absence of data on human toxicity, is presumed to be toxic to humans because when tested in a laboratory it has an LC_{50} of 5,000 ml/m^3. Based upon the calculated LC_{50}, the material you describe in your letter

does not meet the definition of a Division 2.3 material. Therefore, provided the material does not meet the definition of any other hazard class, it is not subject to the requirements of the HMR.

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

Sincerely,

Charles E. Betts
Chief, Standards Development
Office of Hazardous Materials Standards

Detector Electronics Corporation
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Minneapolis, MN 55438 USA
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DET-TRONICS®
A UTC Fire & Security Company

Eichenlaub
§173.132
§172.101 §173.115
Classification
10-0012

January 12, 2010

Mr. Charles E. Betts
Chief, Standards Development
Office of Hazardous Materials Standards
Pipeline and Hazardous Materials Safety Administration
Attn: PHH-10
U.S. Department of Transportation
East Building
1200 New Jersey Avenue, SE
Washington, DC 20590-0001

Re: Request for Advisory Opinion on the Hazardous Classification of H2S Ampoules

Dear Mr. Betts:

Detector Electronics Corporation (DEC) manufactures safety solutions including flame detection, gas detection and safety systems for use in hazardous industrial applications. As part of our industrial gas detection product line, we manufacture a line of toxic gas detectors which require routine calibration to ensure detection accuracy. The method for calibration of our hydrogen sulfide (H2S) gas detectors involves the use of glass ampoules containing a small quantity of H2S., and the purpose of this letter is to confirm our view that transportation of the ampoules is not subject to DOT's Hazardous Materials Regulations ("HMR") for the reasons discussed below.

The ampoules are filled with a specified mixture of H2S and nitrogen and sealed under partial vacuum. The calibration is performed by inserting the sensor into a 700 mL chamber and breaking the ampoule in the closed cylinder. The released mixture from the ampoule diffuses into the closed chamber yielding a concentration of 50 ppm H2S. The detector's output is then adjusted accordingly to ensure accurate measurement of gas leaks in the field application. Pictures of the calibration set up are included as Exhibit 1 and 2.

For the following reasons, DEC does not believe that these ampoules pose a significant hazard during transportation. Each ampoule contains 2.5% H2S in a 7 mL ampoule filled under negative pressure of one fifth normal atmospheric pressure. This is equivalent to a concentration of 0.49% as shown by the following equation:

$$2.5\%\ H_2S \ * \ \frac{150\ Torr}{760\ Torr} = 0.49\%\ H_2S$$

Subpart D §173.115(c)(2) describes a gas mixture as *gas poisonous by inhalation* (Division 2.3) when the LC_{50} value is not more than 5,000 mL/m^3. Using the formula defined in §173.133(b)(1)(i):

$$LC_{50}\ \text{of a DEC H2S ampoule} = \frac{(100\%)\ (713\ ppm)}{0.49\%} = 145{,}510\ mL/m^3$$

Where LC_{50} of H2S = 713 ppm (IDLH 7783064 NIOSH)

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Thus, the LC_{50} of each DEC H2S ampoule is 145,510 mL/m^3 which is significantly greater than the defined 5,000 mL/m^3 threshold in Section 173.115(c)(2) of the HMR.

The packaging for the ampoules is designed for maximum protection to limit breakage during transport. The ampoules are packed in blocks of foam (10 x 10 x 7.5 cm), six ampoules to a block (see Exhibit 3). Two foam blocks are packed per corrugated cardboard box (10 x 10 x 15 cm) or a maximum of 12 ampoules per box (see Exhibit 4 and 5). These boxes are then over packed in a box with 300 lbs. burst strength with additional packing material and/or other items. An MSDS describing the properties and exposure effects of H2S is included with each shipment. Shipments would typically include fewer than 100 ampoules and are not anticipated to exceed 1,000 ampoules. To put this information into context of an example shipment, if 3,000 ampoules (three times the expected maximum shipment) were broken in a 1m x 1m x 1m container with no ventilation, the concentration in the container would reach only 103 ppm. It would take 20,970 ampoules all broken at the same time in a 1m^3 container for the concentration to reach the LC_{50} of 713 ppm.

Based on the LC_{50} value of 145,510 mL/m^3 per ampoule, the method of packing, and shipment quantities, DEC believes that the ampoules are shipped in a form and quantity that does not pose an unreasonable risk to health and safety or property, and therefore are not classified as hazardous under 49 CFR Parts 170 – 199. The analysis and the classification of ampoules as non-hazardous is consistent with a 1994 letter to General Monitors, Inc. from Edward Mazzullo, Director of the Office of Hazardous Materials Standards. Copies of the General Monitors request, and the response, are attached as Exhibit 6. We are requesting that DOT confirm our assessment regarding the ampoules.

Questions regarding the information provided in this letter may be directed to the undersigned at 952 946-6464.

Sincerely,

Jon Varner
Director of Engineering
Detector Electronics Corporation
6901 West 110th Street
Minneapolis, MN 55438

Enclosures

Exhibit 1 Ampoule Calibration Set-Up

Exhibit 2 Calibration Chamber

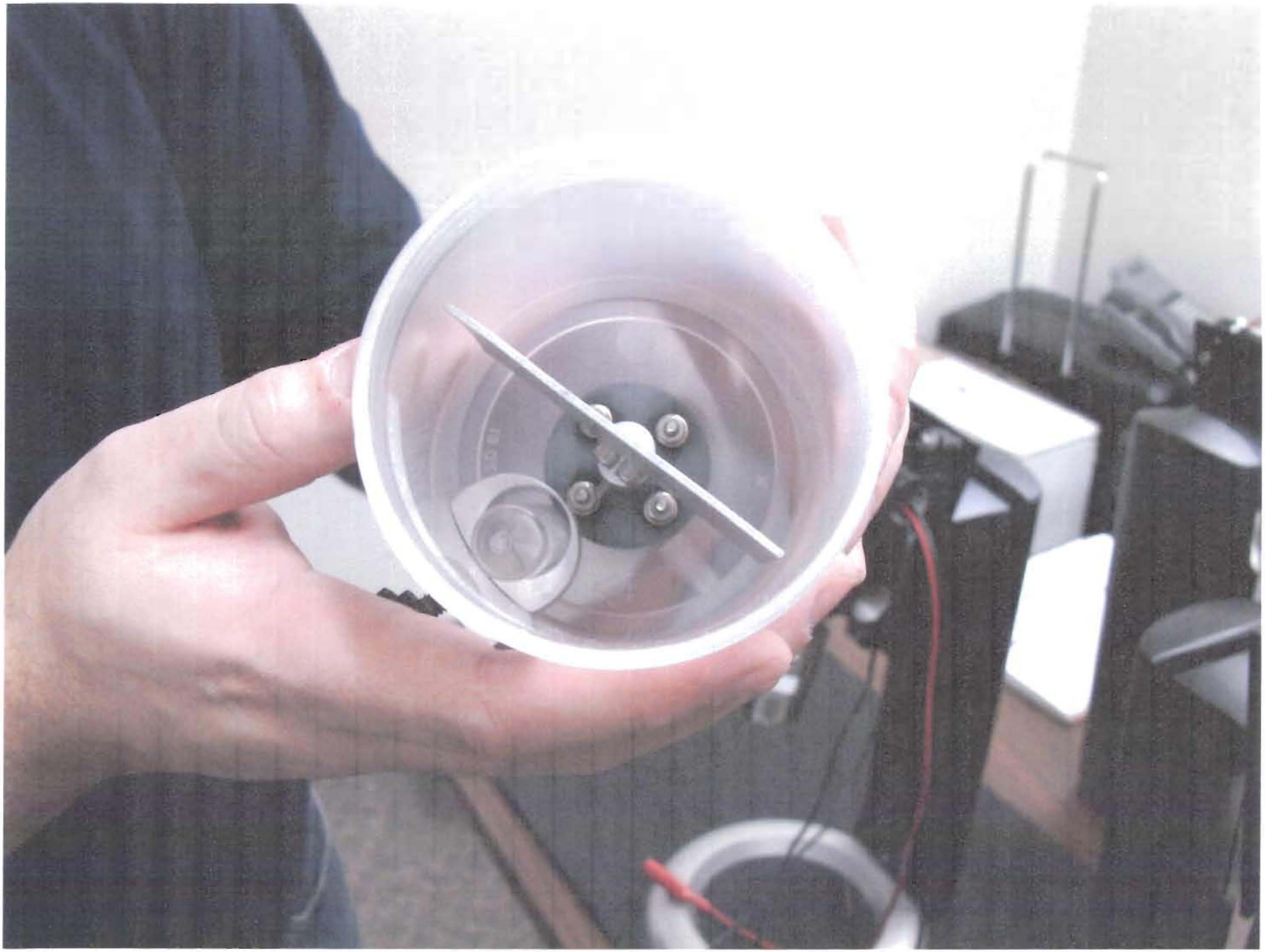

Exhibit 3 Ampoules in Foam

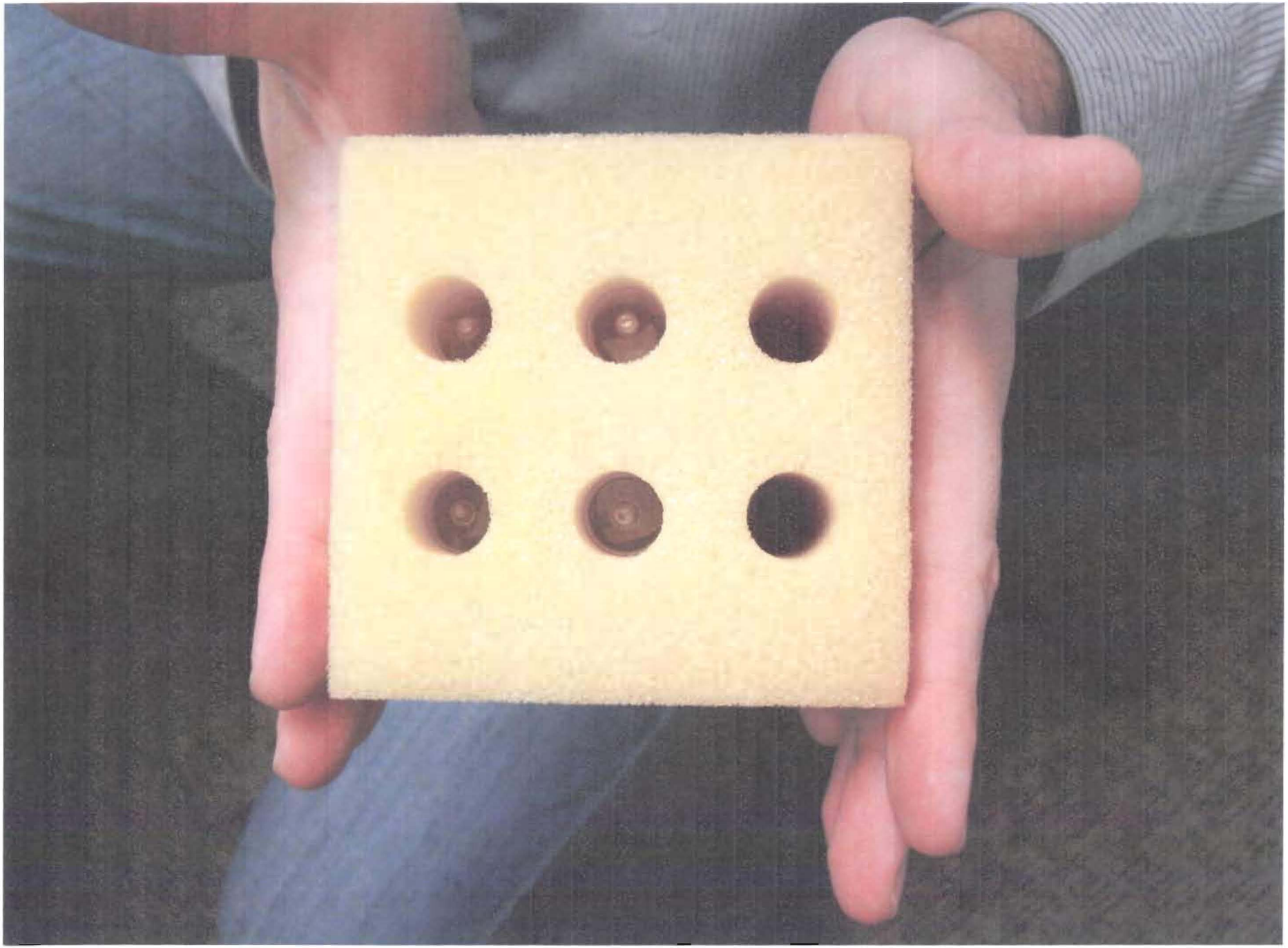

Exhibit 4 Foam Packing

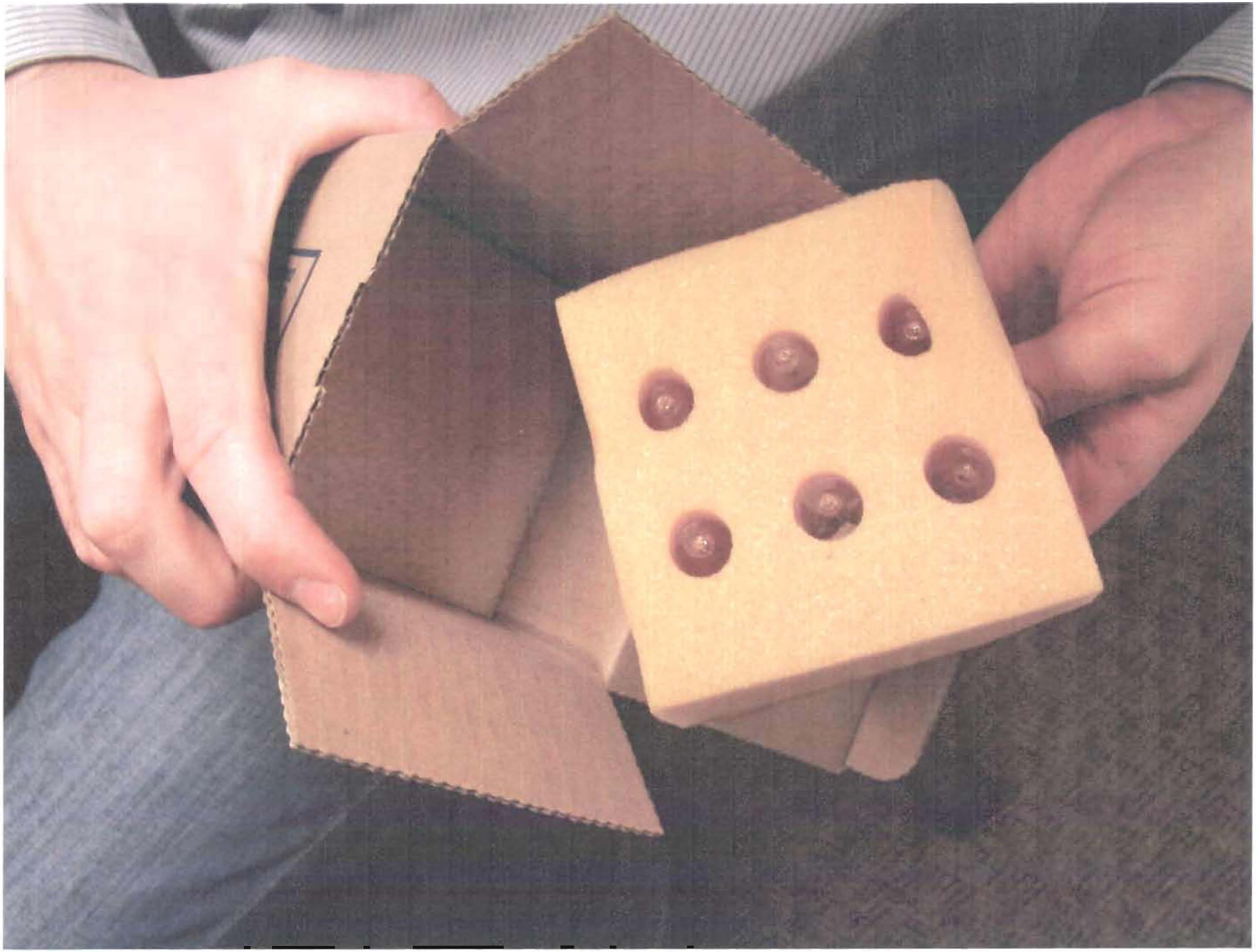

Exhibit 5 Packed Ampoule Box

Exhibit 6 GMI Letter and DOT Response

U.S. Department of Transportation
Research and Special Programs Administration

400 Seventh Street, S.W.
Washington, D.C. 20590

JUL 18 1994

Mr. Khanh Dang
Research Chemist
General Monitors, Inc.
26776 Simpatica Circle
El Toro, CA 92630

Dear Mr. Dang:

This is in response to your letter of May 5, 1994, requesting information on the classification of hydrogen sulfide (H_2S) ampoules.

You state that each ampoule contains a 1.78% concentration of H_2S mixed with nonpressurized nitrogen as a diluent. Each ampoule will simulate an exposure of a maximum amount of 500 parts per million of H_2S in a 250 ml container. Quantities of 12 or 100 ampoules are packed in a carton, with each ampoule packed in corrugated dividers. These cartons are then overpacked in another corrugated carton, filled with packing material.

It is the opinion of this Office that, based on the concentration of the H_2S, the fact the ampoules are not under pressure, and the manner the material is packaged, the ampoules of H_2S would not pose a significant hazard during transportation and, therefore, are not subject to the Hazardous Materials Regulations (49 CFR Parts 171-180).

Sincerely,

Edward T. Mazzullo
Director, Office of Hazardous Materials Standards

Exhibit 6 GMI Letter and DOT Response

HM | Label
FI#: 173 132
SC: 195,399

May 5, 1994
Edward Emazzullo
Director of H.M.S.
Office of Hazard Material Standard
400 7th St. South West, Room 8100
Washington D.C. 20590

MAY 18 1994
A.L.

Mr. Emazzullo:

I am writing this letter in regards to a more current release from DOT concurring with GMI's shipping policy that our H_2S ampoules are non-dangerous goods. We already have in our possession a letter from Thomas J. Charlton, Chief Standards Division of DOT, stating that the way we package our H_2S ampoules do not pose a significant hazard during transportation(see attached letter). However, this letter is about 12 years old and therefore, I would like to obtain a more current release from DOT.

I would like to take this opportunity to explain why we consider our H_2S ampoules as non-dangerous goods. First of all, the ampoules that GMI manufacture contain a very low concentration of H_2S mixed with nitrogen as a diluent. Each of these ampoules will simulate an exposure of a maximum amount of 500 parts per million(ppm) H_2S in a 250 mL container. According to the IATA 35 Edition, H_2S mixture less than 14.3% by volume may be classified as "compressed gas, toxic, n.o.s., UN1955" because the concentration of H_2S is low enough to have a LC_{50} value higher than 5,000 mL/m^3 as calculated below:

diluent

IATA Standard: Mixture of $LC_{50} = \frac{100\% \times LC_{50}}{\text{Mixture \%}} = 5000\ mL/m^3$

where LC_{50} = 713 ppm (pg. 280 of Toxic and Hazardous, 1985)

$$\text{Mixture \%} = \frac{(100)(713 ppm)}{5{,}000\ mL/m^3} = 14.3\%$$

GMI's ampoules: Concentration of each ampoules, 7 mL = $\frac{(500\ ppm)(250\ mL)}{7\ ml} = 17,857$ ppm

$$\text{\% Volume per ampoules} = \frac{17{,}857\ ppm}{10{,}000 ppm/\%} = 1.78\%$$

$$\text{Mixture of } LC_{50} = \frac{(100\%)(713\ ppm)}{1.78\%} = 40{,}056\ mL/m^3$$

Therefore, GMI's ampoules each contain only 1 78% of H2S with an LC_{50} value of 40,056 mL/m^3, which is significantly greater than 5,000 mL/m^3.

does not meet the definition of a Division 2.3 material. Therefore, provided the material does not meet the definition of any other hazard class, it is not subject to the requirements of the HMR.

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

Sincerely,

Charles E. Betts
Chief, Standards Development
Office of Hazardous Materials Standards