U.S. Department
of Transportation

**Pipeline and Hazardous
Materials Safety
Administration**

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

MAY 01 2014

Mr. William B. Wojtas
Manager, Dangerous Goods
United Airlines, Inc.
233 South Wacker Drive
Chicago, IL 60606

Ref. No.: 13-0203

Dear Mr. Wojtas:

This is in response to your October 16, 2013 letter requesting clarification of the Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180) regarding the standard for converting liters to kilograms. In your letter, you ask if the specific gravity of a liquid must be used when converting from volume (liters) to net mass (kilograms) in situations when the net mass is required by the HMR such as determining compliance with the loading requirements of § 175.75 and verifying the maximum gross weight authorized as a limited quantity. You state this conversion is difficult for air cargo acceptance personnel because neither the HMR, nor the International Civil Aviation Organization Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO TI) mandate provision of the specific gravity or density as part of the information to be provided by shippers. You ask if a 1 liter to 1 kilogram (1:1 ratio) volume to mass conversion is acceptable for all liquid hazardous material.

In a previous letter of interpretation, 10-0145, dated December 3, 2010, applicable to this scenario, guidance was provided by stating that when the net quantity shown on shipping documents is expressed as a volume (e.g. liters) the net mass expressed in kilograms may be calculated from the net volume by multiplying the volume of the liquid expressed in liters by its specific gravity. However, in this case the HMR do not require the use of a specific method for converting units of measure. Therefore, as an alternative to the use of specific gravity data, a 1:1 conversion ratio where 1 liter is equal to 1 kilogram may be used for the purposes of interpreting the HMR cargo quantity limitations expressed in kilograms.

I hope this information is helpful. If you have further questions, please do not hesitate to contact this office.

Sincerely,

Duane A. Pfund

Duane A. Pfund
International Standards Coordinator
Standards and Rulemaking Division

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$175.75
Air
13-0203

16 October 2013

US Department of Transportation
PHMSA
Office of Hazardous Materials Standards
Attn: PHH-10
East Bldg.
1200 New Jersey Ave. SE
Washington DC 20590-001

Subject: Liters to Kilogram Conversion Standard

FAA regulators indicate that the specific gravity must be used in the conversion of liquid volume to mass when determining compliance with 49 CFR 175.33 (PNF) and 175.75/ICAO TI US-13 (25kg limitations).

Currently, there exists an industry conversion standard of 1 liter to 1 kilogram based on the specific gravity of water at 4 degrees Celsius at sea level. This was validated in an email from IATA dated 09 July 2013 where the Secretary of the Dangerous Goods Board indicated that using this 1:1 ratio is a viable option based on the information required by ICAO for shippers to provide.

There is a single reference to using this conversion factor in the ICAO TI in Part 5 Chapter 4.1.5.1(b) *"...the net mass of liquids within the kits* ***is to be calculated on a 1 to 1 basis of their volume, i.e. 1 litre equal to 1 kilogram.****"* for chemical kits. While 49CFR173.161 does not specifically state that this standard conversion is used, it alludes to it in 173.161(c)(3)

> *(3) No more than* ***10 L or 10 kg*** *of hazardous material may be contained in one outer package (excluding dry ice). For transportation by aircraft, no more than* ***1 L or 1 kg*** *of hazardous material may be contained in one kit*

Since 49CFR175.75 limits the amount of DG which can be carried onto an aircraft to 25Kgs, using this conversion factor of 1:1 would have minimal impact on safety. For Example: The specific gravity of Isopropyl Alcohol is .8 and the maximum net quantity allowed is 5L. This calculates to 4Kg in mass or a difference of 1Kg if the 1:1 ratio is used. This is a very small difference. Conversely, mercury, having a specific gravity of 13.6 is shipped in small quantities (average shipment size over 3 months was .25L) would have a slight difference of 3.1kg.

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There seems to be some tolerance in conversion difference, particularly with smaller quantities. ICAO TI Part 1 Chapter 3 Table 1-1 indicates that for 500kg or less, a conversion factor of 1kg = 2.0Lbs may be used instead of the 2.205Lb factor. This results in a 2.6Kg difference when converting a 55Lb shipment using the 2.0 factor vice the 2.205 factor. This indicates that an argument using the 1:1 ratio would create too much of a weight difference, is difficult to prove when the ICAO allows for a slight difference in shipments under 500Kg.

One factor which causes the use of the 1:1 ratio in converting volume to mass is the fact that neither ICAO regulations nor the US Regulations mandate provision of the specific gravity as part of the required information to be provided by the shippers. Because this information is not required, it is not available to our front line employees to accurately calculate the volume to mass conversion.

One of the most commonly converted items is UN3082 Environmentally Hazardous Substance, Liquid NOS, which requires that the volume be converted to mass for limited quantities to ensure that the 30KgG (173.156 and ICAO TI Table 3-1) is not exceeded. For the frontline employee accepting dangerous goods, finding the specific gravity for this particular UN number via the use of a Chemical Dictionary as suggested by some FAA regulators is not an easy task and may impede commerce by frustrating cargo. UN3082 is just one example used to illustrate the need for a 1:1 conversion standard. There may be others that require this method of conversion.

In light of the above, I conclude that all shippers are allowed to use a 1.1 conversion of volume to mass for all liquid hazardous materials since the necessary information is not required to be provided by the shippers. Please let me know if PHSMA agrees with this interpretation.

Regards,

William B. Wojtas
Manager, Dangerous Goods
United Airlines Inc.