



U.S. Department
of Transportation

**Pipeline and Hazardous
Materials Safety
Administration**

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

Mr. James McManus
ATMI, Inc.
7 Commerce Drive
Danbury, CT 06810

DEC 20 2012

Ref. No.: 12-0239

Dear Mr. McManus:

This responds to your October 23, 2012 letter requesting clarification of the Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180) applicable to the segregation of hazardous materials when transported by vessel. Your questions are paraphrased and answered below.

Q1: You ask if a Division 2.3 gas (with a subsidiary hazard of Division 2.1) and a Division 2.3 gas (with a subsidiary hazard of Class 8) require segregation?

A1: The answer is no, provided the Division 2.3 gases are shipped in accordance with the applicable provisions detailed in § 176.83. Multiple Division 2.3 gases may be stowed in the same container for vessel transportation without regard to the subsidiary hazards, provided the different poison gas materials are not capable of reacting dangerously with each other and causing any of the conditions listed below. Specifically, as provided in § 176.83(a)(8) and notwithstanding the requirements of paragraphs (a)(6) and (a)(7), hazardous materials of the same class may be stowed together without regard to segregation required by secondary hazards (subsidiary risk label(s)), provided the substances do not react dangerously with each other and cause: (1) a combustion and/or evolution of considerable heat; (2) an evolution of flammable, toxic or asphyxiant gases; (3) the formation of corrosive substances; or (4) the formation of unstable substances.

Q2: You ask if a Division 2.3 gas (with a subsidiary hazard of Division 2.1) and a Division 2.3 gas (with a subsidiary hazard of Class 8) can be stowed in the same transport unit when transported by vessel?

A2: The answer is yes, as provided in A1.

I trust this satisfies your inquiry. Please contact us if we can be of further assistance.

Sincerely,

T. Glenn Foster
Chief, Regulatory Review and Reinvention Branch
Standards and Rulemaking Division



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October 23, 2012

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Nickels
§ 176.83 (a)
§ 176.86 (a)
Vessel
12-0239

Re: Request for Interpretation

Dear Sir or Madame:

In accordance with 49 CFR § 105.20, this letter is being submitted to PHMSA to request an interpretation of the Hazard Materials Transportation Regulations.

ATMI requests PHMSA to review an interpretation we have made regarding the carriage by vessel of certain Division 2.3 (Gas poisonous by inhalation) gases with a subsidiary hazard of 2.1 (Flammable gas) and certain Division 2.3 gases with a subsidiary hazard of Class 8 (corrosive).

Specifically, ATMI requests PHMSA to review our interpretation that the gas combinations listed in Table 1 do not require segregation as is allowed by § 176.83 (a) (8) as these gases (substances) do not react dangerously with each other and lead to the conditions listed in § 176.83 (a) (8) i-iv.

Table 1-List of Gas Combinations

Div. 2.3/Div. 2.1 Gas 1 Name	Div. 2.3/Class 8 Gas 2 Name	Chemically Compatible	Segregation Required as Per § 176.83
UN 2188 Arsine	UN 1008 Boron Trifluoride	Yes	No
UN 2188 Arsine	UN 1859 Silicon Tetrafluoride	Yes	No
UN 2188 Arsine	UN 3308 Liquefied gas, toxic, corrosive, n.o.s. (Germanium Tetrafluoride)	Yes	No
UN2199 Phosphine	UN 1008 Boron Trifluoride	Yes	No
UN2199 Phosphine	UN 1859 Silicon Tetrafluoride	Yes	No
UN2199 Phosphine	UN 3308 Liquefied gas, toxic, corrosive, n.o.s. (Germanium Tetrafluoride)	Yes	No

Analysis of Current Segregation Regulations for Gases with Division 2.1 and Class 8 Subsidiary Risks

49 CFR § 176.83 specifies the segregation requirements for hazardous materials transported by vessel stowed in cargo spaces on deck and under deck and in cargo transport units.

Table 176.83 (B) sets forth the general segregation requirements between the various classes (& divisions) of hazardous materials.

49 CFR § 176.83 Table 176.83 (B)

Class	1.1	1.2	1.5	1.3	1.4	1.6	2.1	2.2	2.3	3	4.1	4.2	4.3	5.1	5.2	6.1	6.2	7	8	9	
Explosives, 1.1, 1.2, 1.5	(*)	(*)	(*)	(*)	(*)	(*)	4	2	2	4	4	4	4	4	4	2	4	2	4	X	
Explosives, 1.3	(*)	(*)	(*)	(*)	(*)	(*)	4	2	2	4	3	3	4	4	4	2	4	2	2	X	
Explosives, 1.4, 1.6	(*)	(*)	(*)	(*)	(*)	(*)	2	1	1	2	2	2	2	2	2	X	4	2	2	X	
Flammable gases 2.1	4	4	2	4	2	2	X	X	X	2	1	2	X	2	2	X	4	2	1	X	
Non-toxic, non-flammable gases 2.2	2	2	1	2	1	1	X	X	X	1	X	1	X	X	1	X	2	1	X	X	
Poisonous gases 2.3	2	2	1	2	1	1	X	X	X	2	X	2	X	X	2	X	2	1	X	X	
Flammable liquids 3	4	4	2	4	2	2	2	1	2	X	X	2	1	2	2	X	3	2	X	X	
Flammable solids 4.1	4	3	2	4	2	2	1	X	X	X	X	1	X	1	2	X	3	2	1	X	
Spontaneously combustible substances 4.2	4	3	2	4	2	2	2	1	2	2	1	X	1	2	2	1	3	2	1	X	
Substances which are dangerous when wet 4.3	4	4	2	4	2	2	X	X	X	1	X	1	X	2	2	X	2	2	1	X	
Oxidizing substances 5.1	4	4	2	4	2	2	2	X	X	2	1	2	2	X	2	1	3	1	2	X	
Organic peroxides 5.2	4	4	2	4	2	2	2	1	2	2	2	2	2	2	X	1	3	2	2	X	
Poisons 6.1	2	2	X	2	X	X	X	X	X	X	X	1	X	1	1	X	1	X	X	X	
Infectious substances 6.2	4	4	4	4	4	4	4	2	2	3	3	3	2	3	3	1	X	3	3	X	
Radioactive materials 7	2	2	2	2	2	2	2	1	1	2	2	2	2	1	2	X	3	X	2	X	
Corrosives 8	4	2	2	4	2	2	1	X	X	X	1	1	1	2	2	X	3	2	X	X	
Miscellaneous dangerous substances 9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Numbers and symbols relate to the following terms as defined in this section:

- 1—"Away from."
- 2—"Separated from."
- 3—"Separated by a complete compartment or hold from."
- 4—"Separated longitudinally by an intervening complete compartment or hold from."
- X—The segregation, if any, is shown in the § 172.101 table.

An example of using Table 176.83 (B) as it applies to one of the gas combinations listed in Table 1 is as follows:

In the case of UN 2188 (arsine), which has a subsidiary hazard of Division 2.1 (flammable gas) and UN 1008 (boron trifluoride), which has a subsidiary hazard of Class 8 (corrosive), Table 176.83 (B) lists the number "1" at the intersection of Division 2.1 with Class 8. In this example these two hazardous materials would require segregation "Away from" as defined by the numbers and symbols used in Table 176.83 (B).

This requirement is inferred from Table 176.83 (B) based on the requirement of § 176.83 (a) (6) which states:

"When the § 172.101 Table or § 172.402 requires packages to bear a subsidiary hazard label or labels, the segregation appropriate to the subsidiary hazards must be applied when that segregation is more restrictive than that required by the primary hazard."

Furthermore any two hazardous materials requiring segregation cannot be stowed in the same cargo transport unit based on the requirement of §176.83 (d) which states:

"Segregation in cargo transport units: Two hazardous materials for which any segregation is required may not be stowed in the same cargo transport unit."

At this stage of the interpretation it would appear that any Division 2.3 gas with a subsidiary hazard of 2.1 would need to be segregated from a Division 2.3 gas with a subsidiary hazard of Class 8 and they could not be stowed in the same cargo transport unit together.

However further analysis of the regulations reveals there are exceptions to the requirement of segregation for hazardous materials of the same class even though the subsidiary hazards appear to necessitate segregation.

ATMI believes that the statement in § 178.86 (a) (8) is included in the regulations to accommodate situations where substances of the same class which are chemically compatible can be stowed together irrespective of the subsidiary hazards which would otherwise mandate unnecessary segregation.

§ 178.86 (a) (8) *"Notwithstanding the requirements of paragraphs (a)(6) and (a)(7) of this section, hazardous materials of the same class may be stowed together without regard to segregation required by secondary hazards (subsidiary risk label(s)), provided the substances do not react dangerously with each other and cause:"*

- (i) Combustion and/or evolution of considerable heat;*
- (ii) Evolution of flammable, toxic or asphyxiant gases;*
- (iii) The formation of corrosive substances; or*

(iv) The formation of unstable substances.

Using arsine and boron trifluoride as an example, we believe that § 178.86 (a) (8) would allow these two gases to be stowed together in the same cargo transport unit without the need for segregation as these two gases do not react with one another. [Martin and Dial¹ report no reaction between arsine and boron trifluoride and postulate that the steric hindrance of the fluorine atoms in boron trifluoride prevents coordination of the arsenic atom in arsine from coordinating with the boron atom.]

For the other gas (substances) combinations listed Table 1, if simultaneously released from their packaging during transportation, would not dangerously react with one another to produce the conditions listed in § 176.83 (a) (8) (i)-(iv).

Arsine + Boron Trifluoride -----> No chemical reaction under transport conditions

Arsine + Germanium Tetrafluoride -----> No chemical reaction under transport conditions

Arsine + Silicon Tetrafluoride -----> No chemical reaction under transport conditions

Phosphine + Boron Trifluoride -----> No Dangerous Reaction under transport conditions

Phosphine + Germanium Tetrafluoride -----> No Dangerous Reaction under transport conditions

Phosphine + Silicon Tetrafluoride -----> No Dangerous Reaction under transport conditions

In summary ATMI requests PHMSA to provide an interpretation of the following as they pertain to our transport situation, specifically with regards to the gas combinations cited in Table 1.

1. If a Division 2.3 gas with a subsidiary hazard of 2.1 and a Division 2.3 gas with a subsidiary hazard of Class 8 do not react dangerously with each other under transportation conditions, then they do not require segregation per § 176.83 (a) (8).
2. If a Division 2.3 gas with a subsidiary hazard of 2.1 and a Division 2.3 gas with a subsidiary hazard of Class 8 do not require segregation as per § 176.83 (a) (8) then they can they be stowed in the same cargo transport unit when transported by cargo vessel.

It is our belief that based on our review of the chemical literature and our own experience and data that the gas combinations listed in Table 1 do not react dangerously with each other; then they would not require segregation and can stowed together in the same cargo transport unit when transported by cargo vessel.

Cited References

1. D.R. Martin and R.E. Dial, *J. Am. Chem. Soc.*, 1950, 72 (2), 852-856

If PHMSA has any questions related to this document please contact:

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