Hazmat Rob's Blog

Do YOU Know Your Q Value?

Some things should never be together, like hot dogs and ketchup, fingernails and chalkboards and, of course, Sean Penn and Madonna. Well, the International Civil Aviation Organization (ICAO) and the Department of Transportation (DOT) feel the same way when you ship combination packaging of dangerous goods or hazardous materials by both air and ground. Regardless of whether you are shipping by ground or air, DOT states under Forbidden Materials in 173.21(e) that it is forbidden to offer or ship "a material in the same packaging, freight container, or overpack with another material, the mixing of which is likely to cause a dangerous evolution of heat, or flammable or poisonous gases or vapors, or to produce corrosive materials".

When incompatible materials are mixed in the same container or overpack in the ground mode, it can be a problem. However, when the same materials are shipped in the same container by air, it can be disaster. That's why in the air mode both DOT and ICAO have additional requirements when mixing different hazardous materials into the same outside packages. They not only restrict certain articles, they also restrict the amounts of hazardous materials in combination packaging. The trouble is they both have different ways of arriving at those restricted amounts.

Under the Department of Transportation, combination packaging means "a combination of packaging, for transport purposes, consisting of one or more inner packagings secured in a non-bulk outer packaging. It does not include a composite packaging." When required or when shipping by passenger aircraft, hazardous materials or dangerous goods must be packaged in the proper combination package, in at least two separate containers, inner and outer.

Most combination packaging only contains a single hazardous material. Very few shippers of hazardous material relish the prospect of placing different types of hazardous materials into the same outside packaging when shipping by air. That's right, even when shipping by air you can place more than one hazardous material into the same outer packaging. But how much? Well, that is based on whether you are shipping under the Department of Transportation (DOT) Hazardous Materials Regulations or under the International Civil Aviation Organization (ICAO) Technical Instructions.

Under ICAO in the air mode, shippers who decide to mix different hazardous materials in a combination packaging are required to employ a mathematical formula to derive the Q value. First you are required to divide the total amount authorized for that material in the Dangerous Goods List into the amount of material in each inner container, to ascertain a Q value for each substance. Then, the shipper is required to add up the individual Q values for each inner container to ensure the container's total Q-value does not exceed the number 1.

So if you have a .5 L bottle of Class 3 flammable liquid, .5 L bottle of Class 8 corrosive liquid and .5 L bottle of a Division 6.1 oral poison in one outer packaging, you would be required to ascertain the total maximum amount

allowed in each container for each of the chemicals in the IATA 4.2 Dangerous Goods Table (which contains the
ICAO Dangerous Goods List), so that you could divide the maximum outer container's amount into the amounts
in each of the inner containers. Let's say the Dangerous Goods List authorizes each of the above listed dangerous goods for maximum total amounts of up to 5 L in each inner container. Well, if you divide 5 L into .5 L, it equals .1. If the shipper were to add the .1+.1+.1, the Q value for the outer packaging would only be .3, well below the Q value of 1.

Q VALUE

	3		8		6.1		
Hazard Class →							
Amount in Each Container →	.5	+	.5	+	.5	=	Q
Amount Authorized in IATA 4.2 Dangerous Goods List →	5		5		5		
		+		+		=	.3

However, under IATA and ICAO, if the first of the individual bottles in the above mentioned combination packaging is 5 L, then that first bottle inside the combination package would already have a Q value of 1. That is because if
you divide the 5 L in that first bottle into the maximum allowed in the outer container, 5 L, you will arrive at the number 1. So the container could not be shipped
with those other hazardous material in the same outer container because the combination packaging with all its different dangerous goods inside the outer package would immediately exceed the Q value of 1.

Q VALUE

	3		8		6.1		
Hazard Class →							
Amount in Each Container →	5	+	0	+	0	=	1 (Q VALUE)
Amount Authorized in IATA 4.2 Dangerous Goods List →	5		0		0		

In addition, under IATA and ICAO the shipper would also be required to state the Q value of the combination container on the shipper's declaration (dangerous goods documentation). That's only by air under the ICAO Technical Instructions, the use of which DOT authorizes in 49 CFR 171.23 and .24 domestically under 49 CFR in the HMR. However, when you ship different hazardous materials in the same outside packaging by air domestically under the DOT regulations, there are no Q values. DOT, in place of the Q values, states in 173.27 only that when combination packagings are intended for transportation by aircraft, the total net quantity does not exceed the lowest permitted maximum net quantity per package as shown in Column 9a or 9b, as appropriate, of the §172.101 Table.

This means, under DOT domestically, if you have the same three different hazardous materials in an outer container, and the Class 3 flammable liquid's outer package was authorized for 5 L, the Class 8 corrosive's outer package was authorized for 5 L, but the Division 6.1 poison was authorized for 1 Liter in each outer packaging in the 172.101 Hazardous Materials Table, the total amount allowed in the outer packaging would only be 1 L (the lowest of the three material in the outer package). You're probably already aware that both the regulations require the complete package to meet the Packing Group indicating the highest order of hazard for the hazardous materials contained in the package. So if the flammable liquid was a Packing Group III, the corrosive liquid was a Packing Group III, but the poison was a Packing Group I, the combination packaging would have to be Packing Group I.

Regardless of whether you are shipping by air or ground, 173.24a also requires that all combination containers

of mixed contents must not be packed or mixed together in the same outer packaging with other hazardous or non-hazardous materials if the materials are capable of reacting dangerously with each other and causing combustion or dangerous evolution of heat, the evolution of flammable, poisonous, or asphyxiant gases, or the formation of unstable or corrosive materials. It should also be noted that in the air mode, corrosive materials when packed with other hazardous materials (except ORM-D) in bottles must be further packed in securely closed inner receptacles before packing in outer packagings.

Shipping hazardous materials can be hard enough separately, but when you place different hazardous materials together in the same outer container you might be required to produce some documentation to defend your choice of the "compatible materials" in your combination containers. There's no list or chart to tell you what can go together in the same package in the regulations, so the responsibility and liability falls on the shoulders of the shipper to document that different materials in combination packagings will not react if they co-mingle.

Packaging enforcement now takes place at the shipper's facility. Under the old specification container requirements, when the container failed in transportation, the DOT would look to the manufacturer to ensure the container was made to the proper specifications. Unfortunately, the Performance Oriented Packaging, or POPS, requirements that fully came into effect in 1996 switch all the liability for packaging onto the shippers. Now when a container fails in transportation, the Department of Transportation will look to the shipper to ensure the container was properly closed, not overfilled and compatible with its ladings.

There is a big difference between things that should not be together and things that can not be together. If you are unsure, err on the side of caution and ship them in separate containers. If you have a question on containers, whether single, combination, bulk or non-bulk, give us a call or send us an email and we will take you through it. Thanks for your readership and support.

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