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# Ignorance of the Shipping Regulations May Be Hazardous to the Health of Your Business

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When most people think of "hazardous materials," they picture rusty 55-gallon drums oozing green chemicals that (a) eat away flesh or (b) change people into superheroes. Yet most homes carry a considerable inventory of hazardous materials such as alcoholic beverages, cleaning products, oils, paints, batteries, medicines and pesticides. In fact, the average household contains between 3 and 10 gallons of materials that the government classifies as hazardous materials.[1]

Clinical research sites and laboratories also contain numerous hazardous materials such as formalin, ethanol, acetone, dry ice and human bodily fluids. When these items are shipped in commerce by public road, air, sea or rail, the shipper must identify, classify and package them according to government regulations. These regulations have recently been in a state of flux, so staying current with them in an ongoing challenge.

## Regulations

In the United States, Occupational Safety and Health Administration (OSHA) regulations govern safe handling of hazardous materials in the workplace. This article discusses only the regulations that govern U.S. shipments of hazardous materials.

The International Civil Aviation Organization (ICAO), a multinational regulatory organization, publishes regulations ("Technical Instructions") for the air transport of dangerous goods (hazardous materials).[2] The International Air Transport Association (IATA), a trade association, uses the ICAO Technical Instructions as the basis for its Dangerous Goods Regulations.[3] IATA updates its regulations every two years.

Department of Transportation (DOT) hazardous materials regulations (HMR) apply to shipments that originate, terminate or pass through the United States. They set forth requirements for the safe transport of hazardous materials in commerce by rail car, aircraft, vessel and motor vehicle. The DOT's regulations authorize the use of the ICAO regulations for air transport. The regulations apply to each person who performs, or causes to be performed, functions related to the transportation of hazardous materials. These functions include determination of, and compliance with, basic conditions for shipping, filling packages, marking and labeling packages, preparing shipping papers, and handling, loading and transporting hazardous materials.

The regulations are enforced in the U.S. by the DOT modal administrations: Federal Aviation Administration (FAA), Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), and United States Coast Guard (USCG).[4] U.S. federal law provides for civil penalties of not more than $32,500 and not less than $275 for each violation. One shipping event can include multiple violations and result in aggregate fines well into six figures. An individual who willfully violates a provision of the regulations may be fined up to $250,000 and/or imprisoned for up to 5 years. A business entity may be fined up to $500,000.[5,6]

**Table 1: FAA Enforcement Examples**[7]

- **$220,000 civil penalty against Expert-Med.** The FAA alleges that on September 18, 2001, Expert-Med improperly offered a fiberboard box containing 24 50-millileter bottles of Etoposide Injection (flammable liquid) to United Parcel Service for transportation by air.
- **$97,500 civil penalty against PerkinElmer Instruments.** The FAA alleges that on February 22, 2002, PerkinElmer improperly offered a fiberboard box containing 83 100-milliliter plastic containers of "atomic absorption modifier solution" (oxidizer) to United Parcel Service for transportation by air.
- **$60,000 civil penalty against Revlon.** The FAA alleges that on December 12, 2000, Revlon improperly offered a fiberboard box containing three one-ounce glass containers of perfume (flammable liquids) to United Parcel Service for transportation by air.

**Hazmat in the Workplace**

A hazardous materials (hazmat) employee is anyone who directly affects hazardous materials transportation safety. That includes any individual that directly impacts the shipment, as well as supervisors, trainers and safety inspectors. Employers must ensure that all hazmat employees receive training in the performance of their hazmat function. After the initial training, retraining is required at least every three years under DOT regulations. Even the receptionist or medical assistant who holds hazmat packages for courier pick-up requires some minimal training. For example, putting a hazmat package outside the door after the office closes is not acceptable.

Training can be done in-house or outsourced, but the employer must ensure that the training requirements are met. Employers – not third-parties – "certify" employees who have completed the training. Employers may designate any appropriate employee to sign the certifications.

This article does not constitute hazmat training. A proper course takes about one-half day to cover shipping routine diagnostic specimens on dry ice and related topics. Before attending a class or purchasing a training product, ensure that it includes the most current regulations.

Hazardous materials must be shipped in packaging that, under normal conditions of transportation, will not release the contents. In other words, the packaging must function properly under rough handling, but not in an airplane crash. The regulations specify various performance levels for packaging based on the nature and level of hazards posed by the specific material they are intended to contain. In other words, a specific hazardous material must be matched with the appropriate hazmat packaging. The shipper is responsible for compliance with the regulations. If the study sponsor provides the packaging to the research sites, the clinical trial agreement should make the sponsor liable for any penalties that are assessed dues to improper packaging.

As with any government regulation, recently-hired employees and uninformed managers are still subject to the law. Company executives may be personally subject to penalties if they do not ensure compliance with proper hazmat training policies and procedures. In the enforcement example above, Expert-Med was also cited for failing to ensure that its employees were trained to properly package and handle hazardous materials.

 

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**Current International Regulations for Infectious Substances**

On January 1, 2005, the latest round of ICAO and IATA regulatory changes concerning infectious substances and diagnostic specimens took effect. Changes are normally published every two years, but there have already been several addendums to these regulations. A brief history of the regulations will help in understanding how they are evolving.

Prior to 2003, IATA classified biological materials using "Risk Groups" (Table 2):

- **Infectious substances**. Those known or reasonably expected to contain pathogens (Risk Groups 2, 3 or 4) and those where a relatively low probability exists that pathogens of Risk Group 4 are present. Specimens transported for the purposes of initial or confirmatory testing for the presence of pathogens fall within this group.
- **Diagnostic specimens.** Those where a relatively low probability exists that pathogens of Risk Group 2 or 3 are present. Specimens transported for the purpose of routine screening tests or initial diagnosis for other than the presence of pathogens fall within this group.
- **Not restricted**. Those known not to contain pathogens.

**Table 2. Risk Groups**[8]

| Risk Group | Pathogen | Risk to Individuals | Risk to the Community |
|---|---|---|---|
| 4 | A pathogen that usually causes serious human or animal disease and that can be readily transmitted from one individual to another, directly or indirectly, and for which effective treatments and preventive measures are not usually available | High | High |
| 3 | A pathogen that usually causes serious human or animal disease but does not ordinarily spread from one infected individual to another, and for which effective treatments and preventive measures are available. | High | Low |
| 2 | A pathogen that can cause human or animal disease but is unlikely to be a serious hazard, and, while capable of causing serious infection on exposure, for which there are effective treatments and preventive measures available and the risk of spread of infection is limited. | Moderate | Low |
| 1 | A micro-organism that is unlikely to cause human or animal disease. A material containing only such micro-organisms is not regulated. | None or Very Low | None or Very Low |

In 2003, IATA changed the criteria to reflect the fact that human bodily fluid and tissue samples containing Risk Group 2 and 3 pathogens are not as dangerous as cultures and Risk Group 4 pathogens. Therefore, this type of sample was no longer classified as an infectious substance, and needed only the minimal packaging and handling requirements required for Diagnostic Specimens as found in Packing Instruction 650 of the regulations. "Infectious substances" were limited to materials meeting one or more of the following criteria:

 

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- Biological products known to contain, or suspected of containing, a pathogen in Risk Group 2, 3, or 4
- Cultures and stocks containing a Risk Group 2, 3 or 4 infectious substance
- A diagnostic specimen that has or may have a serious human or animal disease from a Risk Group 4 pathogen
- Regulated medical waste containing an infectious substance in Risk Group 4
- A toxin containing an infectious substance or a toxin contained in an infectious substance

The 2005 regulations eliminate the Risk Groups for classification and divide infectious substances into Category A and Category B:[9]

- **Category A.** An infectious substance that is transported in a form that, when exposure to it occurs, is capable of causing permanent disability or life-threatening or fatal disease to humans or animals. Examples include Clostridium botulinum (cultures only), Ebola virus, Hepatitis B virus (cultures only), Human immunodeficiency virus (cultures only), Poliovirus (cultures only), Rabies virus, and Foot and mouth disease virus.
- **Category B.** An infectious substance that does not meet the criteria for inclusion in Category A.

Category A materials require packaging according to UN Packing Instruction 602.[10] Category B materials require packaging according to UN Packing Instruction 650.[10] Most clinical research specimens fall into the lower-risk Category B. For example, a blood sample from an HIV/AIDS patient now does not require Category A packaging, only Category B packaging. However, Category A packaging is required if the HIV in that blood sample is cultured in a lab.

**Patient Specimens**

In July 2005, IATA issued an exemption from its dangerous goods regulations for "Patient Specimens".[11] IATA considers a specimen from a clinical research subject to be a type of Patient Specimen. The definition of Patient Specimens is somewhat ambiguous, but may require that a medical professional determine on a case by case basis that there is minimal likelihood that pathogens are present.

The determination should be based on the known medical history, symptoms and individual circumstances of the subject as well as endemic local conditions. Examples of specimens that may be transported as Patient Specimens include blood samples to measure cholesterol levels, organ function, antibodies and drug levels. If an infectious disease is present, samples do not qualify. If an infectious disease may be present, professional judgment is required.

As a practical matter, most clinical research specimens do not strictly qualify as Patient Specimens because the specimens are collected and shipped in a routine manner without such a determination. However, the regulations are ambiguous and evolving, so they are worth understanding.

Patient Specimens must be transported in packaging that will prevent any leakage and that is marked with the words "Exempt Human Specimen".

The packaging must meet the following requirements:

a. The packaging must consist of three components:
    1. a leak-proof primary receptacle(s)
    2. a leak-proof secondary packaging

 

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3. an outer packaging of adequate strength for its capacity, mass and intended use, and with at least one surface having minimum dimensions of 100 mm × 100 mm

b. For liquids, absorbent material in sufficient quantity to absorb the entire contents must be placed between the primary receptacle(s) and the secondary packaging so that, during transport, any release or leak of a liquid substance will not reach the outer packaging and will not compromise the integrity of the cushioning material.

*c.* When multiple fragile primary receptacles are placed in a single secondary packaging, they must be either individually wrapped or separated to prevent contact between them.

**Recommendations**

With the 2005 regulations, few clinical research sites will be shipping bodily fluid and tissue samples that require Category A packaging for dangerous infectious substances. Instead, most the samples will be shipped as with less-stringent Diagnostic Specimen (Category B) packaging. The Patient Specimen exemption will also be used for many specimens under a liberal interpretation of the regulations.

Organizations that ship hazardous materials should create and implement standard operating procedures (SOPs) for hazmat shipping with the following elements:

- Identify hazardous materials that may be shipped.
- Identify hazmat personnel authorized to package or ship hazardous materials.
- Train and certify hazmat personnel and retrain every 3 years
- Train unqualified personnel to not participate in hazmat packaging and shipping
- Appoint Hazmat Officer to supervise training and inspections, as well as stay current on changes in the regulations.
- Educate unauthorized personnel to NOT package or ship hazardous materials.
- Develop internal procedures that minimize errors (e.g., labeling all blood tubes "HAZMAT? Just Ask") and manage any deviations that occur.

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