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Safeguarding Against Hazardous Cargo Presents a Variety of Challenges

Passengers and shippers may be unaware of the dangers presented by materials they bring aboard aircraft in baggage or offer for transport. For example, cigarette lighters containing flammable liquid reservoirs and lighter fluid are forbidden. And proper warning labels are of little value in preventing dangerous incidents if the labeled packages are hidden from view within mailbags and other containers.

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On February 1, 1991, a McDonnell Douglas DC-9-31 aircraft landed in Greensboro, North Carolina, U.S., and taxied to the gate. When cargo handlers opened the aircraft's compartment door to offload baggage, a fire was discovered in the cargo compartment.

The fire was extinguished, but the floor and wall of the aft cargo compartment had fire, heat and smoke damage. There were 28 pieces of passenger luggage and six pieces of company material in the compartment. While the cause of the fire was never determined, inspections of passenger luggage disclosed that two passengers had failed to declare hazardous materials. One passenger had packed a tear-gas device, forbidden aboard passenger aircraft. A second passenger had packed two bottles of dichloromethane, a volatile liquid that is toxic and narcotic. Other passengers had packed lamp oil, witch hazel and safety matches. If the fire had included these passengers' luggage, the fire could have been further fueled by their contents.

The U.S. Secretary of Transportation defines a hazardous material as one that is capable of posing an unreasonable risk to health, safety and property when transported in commerce. Such materials are identified in regulations (49 U.S. Code of

Federal Regulations [CFR] Parts 171–180). Hazardous materials are also identified in the International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by Air.

Hazardous materials are categorized by classes (Table 1, page 2). These materials, many of which are common household items, have physical or chemical properties that can pose dangers when transported. These items are forbidden in carry-on and checked luggage. In the United States, violators of federal regulations pertaining to hazardous materials may be subject to a civil penalty of up to US\$25,000 for each violation; in appropriate cases, violators also will be subject to a criminal penalty.

The U.S. Department of Transportation (DOT) requires that hazardous materials be properly identified and packaged before being offered or transported aboard an aircraft. Quantities of certain hazardous materials permitted aboard aircraft are restricted, and the pilot-in-command must be notified when hazardous materials are loaded onto the aircraft.

The International Air Transport Association (IATA) Dangerous Goods Regulations note that cargo declared under a general

**Table 1
Hazardous Materials Forbidden in Carry-on and Checked Baggage***

Hazard Class	Common Items
Explosives	Fireworks, loose ammunition, flares, gunpowder, loaded firearms
Gas or vapors under pressure	Aerosols containing flammable materials (e.g., some hair sprays and paints), carbon dioxide (CO ₂) cartridges, medical oxygen, butane fuel, chemical mace, tear gas, scuba tanks, propane tanks, self-inflating rafts
Flammable liquids or solids	Flammable paint and paint-related material, perfumes, gasoline, safety or "strike-anywhere" matches, some cleaning solvents
Oxidizers	Bleach, nitric acid, fertilizers, swimming-pool and spa chemicals
Poisons	Weed killers, pesticides, rat poison
Infectious materials	Bacterial cultures, viral organisms, medical laboratory specimens
Corrosives	Drain cleaners, wet-type batteries, acids, lye
Organic peroxides	Fiberglass resins
Radioactive materials	Smoke detectors, radioactive-labeled pharmaceuticals
Magnetized materials	Magnets, as in some loudspeakers and laboratory equipment
Other hazardous materials	Dry ice, mercury, any equipment containing fuel

* There are certain exceptions for personal care, medical needs, sporting equipment and items to support physically challenged travelers.

Sources: Hazardous Materials Advisory Council and the U.S. Federal Aviation Administration

description might contain hazardous articles that are not apparent and that such articles might be found in baggage. It further states that when shippers offer packages containing certain commodities, the shippers must be asked to check their consignments against the classification definitions in the regulations and to confirm, by endorsing the air waybill, that no part of the package contents is hazardous.

In the United States, there are specific exceptions of hazardous materials that are used for personal care, medical needs, sporting equipment and items to support physically challenged travelers. For example, the U.S. Federal Aviation Administration provides the following information:

- Toiletry and medicinal articles containing hazardous material (e.g., flammable perfume) totaling no more than 75 ounces (two liters) may be carried aboard. Contents of each container may not exceed 16 fluid ounces (0.5 liters).
- Matches and lighters may only be carried on your person. Nevertheless, lighters with flammable liquid reservoirs and lighter fluid are forbidden. (Smoking is prohibited on U.S. scheduled air carrier flights of six hours or less within the 48 contiguous states, and between certain other locations.)
- Carbon dioxide gas cylinders worn by passengers to operate mechanical limbs, and spare cylinders of a

similar size for the same purpose, are permitted in both carry-on and checked luggage.

- Carrying firearms aboard aircraft is forbidden. Unloaded firearms can be transported in checked luggage if the firearms are declared to the agent at check-in and packed in a suitable container. Handguns must be in a locked container. (Some airlines may have other restrictions.)
- Ammunition may not be carried aboard an aircraft. Nevertheless, small arms ammunition may be transported in checked luggage, but must be securely packaged in material designed for that purpose. (The quantity transported may vary among airlines.)
- Dry ice for packing perishables, in quantities not to exceed four pounds, may be carried aboard an aircraft if the package permits the release of carbon dioxide. (Some airlines may apply additional restrictions to dry ice in checked luggage.)
- Electric wheelchairs may only be transported as checked luggage. An airline may determine that the battery must be unmounted and packed in accordance with the airline's specific requirements.

Other hazardous-materials incidents illustrate the importance of preventing hazardous materials from being loaded or carried

aboard aircraft unless the materials are properly identified and packaged and in authorized quantities.

On February 3, 1988, an in-flight fire occurred aboard a McDonnell Douglas MD-80 carrying 120 passengers and six crew members near Nashville, Tennessee, U.S. The fire was caused by undeclared and improperly packaged hazardous materials that leaked during transportation.

The incident began in Austin, Texas, U.S., when a shipper improperly packaged materials to be used in a “stone-washing” demonstration for denim products. [Stone-washing is a process that softens a fabric and removes some color from it. One common process machine washes the fabric in an oxidative bleach such as sodium hypochlorite and potassium permanganate.] The shipment included five gallons (19 liters) of hydrogen peroxide solution (an oxidizer), 25 pounds (11 kilograms) of granular corrosive material (a sodium orthosilicate-based mixture), 25 pounds of a laundry booster and 24 ounces (680 grams) of a liquid brightener.

The hydrogen peroxide solution was 50-percent strength. This strength of hydrogen peroxide is forbidden aboard aircraft because the chemical can cause spontaneous combustion. The corrosive sodium orthosilicate-based mixture can react with aluminum and other sensitive metals to produce hydrogen, a highly flammable gas.

The materials were placed into a fiber drum, described as laundry equipment and offered to an air carrier for transportation. No markings or labels were affixed to the fiber drum to warn cargo handlers that it contained hazardous liquid materials and that the drum should be transported in an upright position. The fiber drum was accepted and flown from Austin to Dallas/Fort Worth, Texas by the carrier. The next day, the drum was loaded on its side into the mid-cargo compartment of the MD-80 destined for Nashville.

About one and a half hours into the flight and about five minutes before landing, several passengers seated near the center of the airplane saw smoke rising from the floor, smelled a burning odor and summoned a flight attendant. The flight crew was notified, and passengers seated nearest that section of the floor were moved to other locations. Nevertheless, the flight crew was skeptical initially about the report of smoke in the cabin because a malfunction of the auxiliary power unit (APU) had been reported on a previous flight, so the flight crew believed that the earlier malfunction of the APU was the source of the fumes. Furthermore, because the cargo compartments had no fire or smoke detection systems, there was no indicator to confirm smoke or fire in a cargo compartment. No in-flight

emergency was declared, but two minutes after landing the captain ordered an evacuation of the airplane.

The U.S. National Transportation Safety Board (NTSB) concluded that the hazardous characteristics of the hydrogen-peroxide solution and the sodium orthosilicate-based mixture, and the hazard warning information on their containers, should have caused the shipper to realize that they presented hazards. The NTSB said that the shipper should have taken precautions for shipping the materials by air, regardless of the shipper’s lack of knowledge about specific federal transportation regulations.

The NTSB also recommended that the air carrier revise its procedures for accepting general freight packages for transportation to include questions developed to help identify hazardous materials shipped in packages and not declared. Further, the NTSB recommended that the Air Transport Association of America (ATA) develop a program to more effectively inform and warn passengers and shippers about restrictions and safety requirements for hazardous materials and to improve methods of detecting undeclared hazardous materials offered for air transportation.

The NTSB said that while the DOT regulations require for-hire air carriers to inform passengers about hazardous materials restrictions by posting a notice at locations where tickets are issued, baggage is checked and aircraft are boarded, warnings were inadequate. Notices were often posted at the sides of passenger ticket counters or at other locations that would not readily be visible to the public. The NTSB also said that the notices did not use bright, multiple colors or illustrations to attract attention, and recommended that the air carrier improve the design, content and posted location of hazardous-materials restriction notices to increase the effectiveness of the warnings. The NTSB previously had noted, in a separate safety study on passenger safety education, that the visual attractiveness of information material is important if a message is to be noticed and read.

During its investigation, the NTSB found that ATA had documented problems involving undeclared shipments of hazardous materials by mail that resulted in subsequent air transportation incidents. Among other suggestions, ATA recommended that the U.S. Postal Service improve its hazardous-materials information program by providing posters and handout materials to attract the attention of customers and to prompt customers to ask for assistance.

Shippers and passengers have the responsibility to properly prepare and describe any hazardous materials intended for transport. But carriers also have a responsibility, and the

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final opportunity, to determine if cargo is safe to transport aboard an aircraft and to warn passengers about restricted materials that they may be carrying in their baggage. The NTSB found that most air carriers had effective procedures to determine if *declared* hazardous-materials shipments offered for transportation met safety requirements. Nevertheless, the NTSB found that procedures were inadequate to identify *undeclared* hazardous materials in packages, and recommended that carriers' freight acceptance procedures include questions to help clerks identify undeclared hazardous materials.

On October 19, 1993, cargo handlers for a passenger air carrier opened the forward cargo compartment of one of the carrier's aircraft and noticed an unusual odor. Searching through several mail sacks, they discovered that one sack had been partially destroyed. Examination of the sack's contents revealed a saturated fiberboard box that contained four one-quart (0.95-liter) plastic bottles of a toilet-bowl cleaner. The cleaner contained 23 percent hydrochloric acid, and one of the bottles had emptied about half of its contents. Although the box was marked to indicate that the contents included hydrochloric acid and a corrosive label was affixed, the box had been placed into a mail sack, which was offered to the air carrier without being identified as containing a hazardous material.

In an incident on April 6, 1994, mercury, a corrosive liquid, was discovered leaking from a mail bag during loading of the rear cargo compartment of a McDonnell Douglas DC-9 Super 80 in Houston, Texas. The leaking package did not identify its contents or warn of any hazard. The shipper said that he had been shipping mercury in the same manner

for 20 years and that he was not aware that he had been doing so incorrectly.

On August 20, 1993, in Santa Rosa, California, U.S., an employee of an air cargo carrier discovered a fluid leaking from a package while unloading the package from a truck. Several employees handled the leaking package before it was placed into a clear plastic bag. In a subsequent inspection, the package was found to contain toxicological samples of human tissue and fluids, including blood, which had leaked from the package. Laboratory tests determined that the blood was positive for human immunodeficiency virus (HIV). The package was not marked or labeled to indicate that it contained a hazardous material or infectious substance.

It is important that passengers aboard airlines or general aviation aircraft understand that many common items used in the home or workplace are hazardous and should not be transported aboard aircraft, and that other materials can only be transported if they are properly identified and packaged. Corporate aviation departments should review carefully the handling procedures for any hazardous materials that might be transported on their aircraft. ♦

About the Author

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