A13.8.2. **Handling Instructions.** Do not use halon fire extinguishers to combat fires involving lithium-sulfur dioxide ($Li-SO_2$) batteries. Use water, CO_2, or approved Class-D (recommended) fire extinguisher.

A13.8.3. **Packaging Requirements.** Package lithium cells and batteries in performance oriented packaging that meets the PG II performance level as follows:

A13.8.3.1. In strong inner fiberboard containers limited to a maximum of 500 grams (17.6 ounces) of lithium per inner container. Pack inner containers in a removable head metal drum (1A2, 1B2) with a gas-tight gasket. Separate inner containers from each other and from the outer packaging by at least 25 mm (1 inch) of noncombustible cushioning material.

A13.8.3.2. Cells containing no more than 12 g (.42 ounces) of lithium metal which are hermetically sealed, and batteries constructed of such cells, are excepted from the tests in A13.8.1.5 and the outer metal drum requirement of A13.8.2.1. provided the tests as specified in 49 CFR 173.185(h)(3) have been successfully conducted. Army-procured lithium batteries are manufactured according to MIL-B-49430 and meet the test requirements of 49 CFR 173.185(h). These batteries are identified by the following battery numbers: BA-5093/U, BA-5112/U, BA-5372/U, BA-5513/U, BA-5557/U, BA-5567/U, BA-5588/U, BA-5590/U, BA-5598/U, BA-5599/U, BA-5600/U, BA-5800/U, BA-5847/U, BA-6598/U. Package batteries that meet this requirement in a strong outer wooden box (4C1, 4C2, 4D, or 4F), fiberboard box (4G), or fiber drum (1G.)

A13.8.4. Non-Regulated Lithium Batteries. Lithium batteries are not regulated by this manual if they meet the following requirements:

- Each cell with a liquid cathode may contain no more than .5 g (.02 ounces) of lithium or lithium alloy, and each cell of a solid cathode may contain no more than 1.0 g (.04 ounces) of lithium or lithium alloy.
- Each battery with a solid cathode must contain a total quantity of no more than 2 g (.07 ounces) of lithium or lithium alloy, and each battery with a liquid cathode must contain a total quantity of no more than 1.0 g (.04 ounces) of lithium or lithium alloy.
- Each cell or battery containing a liquid cathode must be hermetically sealed.
- Cells must be separated to prevent short circuit. Batteries must be separated to prevent short circuit and must be packed in strong outside containers, except when installed in electronic devices.
- If a liquid cathode battery contains more than .5 g (.02 ounces) of lithium or lithium alloy, or a solid cathode battery contains more than 1.0 g (.04 ounces) of lithium or lithium alloy, it may not contain a liquid or gas that is a hazardous material unless the liquid or gas, if free, would be completely absorbed or neutralized by other material in the battery.

A13.9. **Carbon Dioxide, Solid (Dry Ice):**

A13.9.1. **Handling Instructions.** Dry ice is cold and will damage human tissue on contact. Store in ventilated space. Never store in hermetically or tightly sealed containers. To minimize carbon dioxide concentration in an aircraft while on the ground, open the cargo and access doors for maximum ventilation.

A13.9.2. **Properties of Carbon Dioxide, Solid.** At temperatures above -78.5 degrees C (-109.3 degrees F) dry ice will sublime and release carbon dioxide fumes. If the carbon dioxide concentration in the aircraft is over 0.5 percent, crew personnel may suffer shortness of breath. Carbon dioxide concentrations of 3.0 percent are endurable from 1/2 to 1 hour. Concentrations of 5.0 percent are dangerous from 1/2 to 1 hour and concentrations of 9.0 percent are fatal from 5 to 10 minutes. Carbon dioxide is heavier than air; therefore, the highest concentration is at or near floor level. Crew personnel must be cautioned against lying on the cargo compartment floor or remaining in the cargo compartment for a prolonged period. If symptoms of overexposure are noted, the use of oxygen and increased ventilation should provide rapid relief.

A13.9.3. **Dry Ice Limitations:**

- Do not carry dry ice in any upper deck compartment.
- Do not carry dry ice when troops are carried in the cargo compartment.
- Dry ice should be carried in the aft end of the cargo compartment.

A13.9.3.1. **Pressurized Aircraft.** For pressurized aircraft, the amount of dry ice that can be safely shipped by air regardless of the type container used depends on the sublimation rate of the ice, the volume of the aircraft, and the number of air changes per hour. To minimize the sublimation rate, use insulated containers surrounded with insulating blankets and tarpaulin during shipment to the greatest extent possible. To determine the amount of dry ice that can be safely shipped by air, use the formula in figure A13.1.

- During cargo loading, the following procedures apply to minimize carbon dioxide concentration:
  - Ensure APU is running and "both" air conditioning packs are operating.
  - Open number 4 passenger service door for additional ventilation.
  - Open all air inlets in the aerial refueling operators station and close aerial refueling operators hatch.
  - Ensure environmental curtain is closed before flight.

A13.9.4. **Packaging Requirements.** Wrap in Kraft paper, secure with tape, and pack in fiberboard boxes. POP marked packaging is not required. Packagings must meet the general requirements of A3.1. — designed – construct polystyrene to prevent release of CO_2

A13.10. Magnetized Material:

A13.10.1. **Handling Instructions.** Do not store magnetic materials suitable for military airlift closer than 4.6 m (15 feet) to compass sensing devices or other devices unduly affected by magnetic fields.

A13.10.2. **Packaging Requirements.** Shield magnetic materials (MIL-S-4473) when required to reduce magnetic field strength to not greater than 5.25 milligauss or two degrees deviation of a magnetic compass at a distance of 15 feet (4.6 m). Provide blocking and bracing as required. Additional packaging details are included in TO 00-25-251. Package magnetic tubes individually in compliance with MIL-E-75. Package magnetically susceptible items to make sure that the distance between the magnetic surface and outside of the innermost container is no less than the protective distance required, and in no instance less than 102 mm (4 inches). Magnetized materials for air shipment are identified as a PG III material. However, specification POP packaging is not required if the magnetized material has a magnetic field strength of less than 0.00525 gauss at 4.6m (15 feet). Magnetic material that has a magnetic field strength greater than 0.00525 gauss at 4.6m (15 feet) is forbidden for air movement.

A13.11. **Life-Saving Appliances.** Life-saving appliances, self-inflating or nonself-inflating, include (but are not limited to) life raft kits, life vest kits, survival kit assemblies, ejection seats, non-ejection seats, and parachutes that contain small quantities of hazardous material that are required as part of the survival equipment. Kit contents may include, but are not limited to, flammable items (fire starter and matches), ammunition items (cartridges and shells), pyrotechnics (signal flares), and nonflammable compressed gas cylinders (carbon dioxide and breathing oxygen).

A13.11.1. **Handling Instructions.** Store in cool, well-ventilated areas away from fire hazards and sources of heat or ignition. Do not drop or rough handle.

A13.11.2. **Packaging Requirements:**

A13.11.2.1. Pack kits in weather-resistant fiberboard or other securely closed strong outer container. Pack hazardous materials contained in the kit in inner packaging that is adequate to prevent accidental activation. Suitably cushion the inner packagings to prevent movement. Packagings must meet the general requirements of A3.1. Specification POP packaging is not required.

A13.11.2.2. Accompanying crew members. Package life-saving appliances containing small quantities of Class 1 (not to exceed 2.2 pounds N.E.W.) and other hazards in a strong fiberboard box or A-3 bag. Individual assigned kits may be handcarried by crew members. The requirements of A13.11.2.1 for inner packing and cushioning apply. When prepared and handcarried according to this paragraph, the marking and labeling requirements of Attachments 14 and 15 do not apply. Crew members must inform the Air Terminal Operations Center, when transporting life-saving appliances in this manner.

A13.12. **Asbestos (Hydrated Mineral Silicates.)** Asbestos blue, brown, or white, includes any of the following hydrated mineral silicates: chrysotile, crocidolite, amosite, anthophyllite asbestos, tremolite asbestos, actinolite asbestos, and every product containing any of these materials. Asbestos that is immersed or fixed in a natural or artificial binder material (such as cement, plastic, asphalt, resins, or mineral ore) and manufactured products containing asbestos are not subject to this paragraph. Asbestos must be loaded, handled, unloaded, and any contamination of aircraft removed in such a manner that will minimize occupational exposure to airborne particles released incident to transportation.

A13.12.1. **Packaging Requirements.** Packaging must meet the general packaging requirements of A3.1. Specification POP packaging is not required. Package asbestos in:

A13.12.1.1. Rigid, leak tight packaging such as metal, plastic, or fiber drums.

A13.12.1.2. Bags or other nonrigid packaging that are dust and sift-proof. The packages must be palletized and unitized by methods such as shrink-wrapping in plastic or wrapping in fiberboard secured by strapping.

A13.12.1.3. Bags or other nonrigid packaging that are dust and sift-proof in strong outside fiberboard or wooden boxes.

$$X = \frac{VA(0.47)}{32.3}$$

Where:
V= Volume of aircraft
A= Air changes per hour
X= Maximum dry ice loading in pounds

Figure A13.1. Formula For Determining Dry Ice Limitations.

A13.9.3.2. **Aircraft on Minimum Air Changes.** When aircraft is on minimum air changes per hour, safe loads are drastically reduced. When the aircraft is on the ground longer than 45 minutes, recalculate the safe quantity using new numbers of air changes per hour. Maximum quantities are shown in figure A13.2.

Aircraft	Maximum Amount	
Type	in Pounds	Kilograms
C-130	600	272
C-135	200	91
C-141B	3430 (See Note)	1555.5

Figure A13.2. Dry Ice Limitations When Aircraft is on Minimum Air Changes.

NOTE: 1,255 pounds (569 kg) with passengers.

A13.9.3.3. **Non-pressurized Aircraft.** For non-pressurized aircraft, the amount of dry ice that can be safely shipped by air depends upon the sublimation rate and ventilation of the aircraft. To minimize the sublimation rate, use insulated containers surrounded with insulating blankets and tarpaulins. The aircraft must have maximum ventilation during the shipment. Under these conditions 3, 644 pounds (1652.6 kilograms) of dry ice can be shipped on a C-141 aircraft. With unpressurized cargo compartment, the quantity of dry ice that can be transported is unlimited if the fumes are vented overboard the aircraft.

A13.9.3.4. **C-5 Aircraft.** Dry ice may be carried in the C-3A cargo compartment under the following aircraft operating conditions:

- During cruise (mach 0.5 and up) and altitudes up to 9144 m (30,000 feet), a safe load of dry ice is 2131.5 kg (4700 pounds.) During cruise (mach 0.6 and up) and altitudes above 9144 m (30,000 feet), a safe load is 1415 kg (3120 pounds.) The Environmental Control System (ECS) must be operated with "both" air-conditioning units on, a "Normal" flow setting on the flow control valve, and the "Intermediate" setting on the alternative air valve.
- During non-pressurized flight up to 3048 m (10,000 feet), a safe load is 2948 kg (6500 pounds.) The auxiliary vent valve must be open for this condition.
- During ground operations with one auxiliary power unit (air turbine motor at idle), a safe operating load is 1338 kg (2950 pounds). The auxiliary vent valve must be open for this condition.

A13.9.3.5. **KC-10 Aircraft.** Dry ice may be carried in the KC-10 cargo compartment under the following aircraft operating conditions:

- No environmental curtain (27 pallet all-cargo configuration.) A safe load of dry ice is 2,295 pounds with "both" air conditioning packs operating. This weight is reduced to 1,251 pounds when "one" air conditioning pack is operating. If "one" air conditioning pack is lost in flight, then accomplish emergency procedures for cabin. Turn Cargo Smoke Light on per KC-10 flight manual T.O. 1C-10(K)A-1, Section II. Include "Smoke Source is not Accessible" portion of procedure except do not put cabin pressure control in manual and do not depressurize cabin.
- Environmental curtain at station 615: A safe load of dry ice is 1,782 pounds with "both" air conditioning packs operating. This weight is reduced to 969 pounds when "one" air conditioning pack is operating.
- Environmental curtain at station 879: a safe load of dry ice is 1,204 pounds with "both" air conditioning packs operating. This weight is reduced to 653 pounds when "one" air conditioning pack is operating.
- Environmental curtain at station 615 or 879: If "one" air conditioning pack is lost in flight, then accomplish