



The U.S. DOT Small Quantity Exceptions 49 CFR §173.4

A supplement to the ASU Shipment of Hazardous Materials Manual

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I. Introduction

49 CFR §173.4 excludes small quantities of certain hazardous materials from many of the requirements of the U.S. DOT Hazardous Materials Regulations. This document clarifies applicability of the small quantities exception and requirements that must be addressed under the provision.

II. Training

Anyone offering hazardous materials for transport must first receive training. Those wishing to ship hazardous materials according to the exceptions in 49 CFR §173.4 must receive the same personal training. Call EH&S at 965-1823 to locate shipper training.

III. Applicability

A. Shipping companies

The small quantity exceptions in 49 CFR may be utilized when shipping materials with UPS, FedEx Ground, or overland freight carriers. UPS is the only air-freight carrier that adheres exclusively to DOT regulations. Materials shipped by air typically conform to IATA regulations; IATA has its own small quantity exceptions, which are not discussed here. The small quantity exceptions also do not apply to materials sent through U.S. mail. The U.S. Postal Service will only ship hazardous materials packaged for retail sale.

B. Materials with exceptions

The materials covered by the small quantity exceptions include:

- Flammable liquids;
- Flammable solids;
- Spontaneously combustible materials;
- Dangerous when wet materials;
- Oxidizers;
- Organic peroxides;
- Poisonous materials; and
- Corrosives.

The complete list with references to hazard classes and divisions is in [Section V](#). Definitions of each of the hazard classes and divisions are in [Section VI](#).

C. Materials with no exceptions

Materials for which there are no exceptions to DOT regulations include:

- Explosives;
- Gases; and
- Infectious substances.

Shipment of the following materials requires assistance from EH&S:

- Chemical waste; and
- Radioactive materials.

IV. Requirements of 49 CFR §173.4

Materials covered by the small quantity exceptions are exempt from all other requirements of 49 CFR when they are shipped according to ten requirements outlined in paragraph (a) of the provision. For full text of these requirements, see [Section V](#). Briefly, these requirements are:

1. Inner receptacle contains not more than 30 ml or 30 g of hazardous material.
2. Inner receptacle is at least 0.2 mm thick and is not liquid full at 55 °C.
3. Closure of inner receptacle is positively secured.
4. Absorbent and/or cushioning requirements.
5. Inner receptacle is secured in outer packaging.
6. Prototype packaging must pass a drop test and compressive load test.
7. Package must not contain forbidden materials; see Appendix B.
8. Package does not exceed 29 kg.
9. Package is not opened or altered during transportation.
10. Package is labeled with the statement, "This package conforms to 49 CFR 173.4."

V. Full text of 49 CFR §173.4

Additions or comments to original text are included in brackets: [].

49 CFR §173.4 Small quantity exceptions.

(a) Small quantities of:

Class 3 [flammable liquids],

Division 4.1 [flammable solids],

Division 4.2 [spontaneously combustible materials in packing groups II and III],

Division 4.3 [dangerous when wet materials in packing groups II and III],

Division 5.1 [oxidizers],

Division 5.2 [organic peroxides],

Division 6.1 [poisonous materials],

Class 7 [radioactive],

Class 8 [corrosives], and

Class 9 materials (miscellaneous hazardous materials) that also meet the definition of one or more of these hazard classes, are not subject to any other requirements of this subchapter when-

(1) The maximum quantity of material per inner receptacle or article is limited to -

- (i) Thirty (30) mL (1 ounce) for authorized liquids, other than Division 6.1, Packing Group I, Hazard Zone A or B materials;
 - (ii) Thirty (30) g (1 ounce) for authorized solid materials;
 - (iii) One (1) g (0.04 ounce) for authorized materials meeting the definition of a Division 6.1, Packing Group I, Hazard Zone A or B material; and
 - (iv) An activity level not exceeding that specified in §§173.421, 173.424, 173.425 or 173.426, as appropriate, for a package containing a Class 7 (radioactive) material.
- (2) With the exception of temperature sensing devices, each inner receptacle:
- (i) Is not liquid-full at 55 °C (131 °F), and
 - (ii) Is constructed of plastic having a minimum thickness of no less than 0.2 mm (0.008 inch), or earthenware, glass, or metal;
- (3) Each inner receptacle with a removable closure has its closure held securely in place with wire, tape, or other positive means;
- (4) Unless equivalent cushioning and absorbent material surrounds the inside packaging, each inner receptacle is securely packed in an inside packaging with cushioning and absorbent material that:
- (i) Will not react chemically with the material, and
 - (ii) Is capable of absorbing the entire contents (if a liquid) of the receptacle;
- (5) The inside packaging is securely packed in a strong outside packaging;
- (6) The completed package, as demonstrated by prototype testing, is capable of sustaining-
- (i) Each of the following free drops made from a height of 1.8 m (5.9 feet) directly onto a solid unyielding surface without breakage or leakage from any inner receptacle and without a substantial reduction in the effectiveness of the package:
 - (A) One drop flat on bottom;
 - (B) One drop flat on top;
 - (C) One drop flat on the long side;
 - (D) One drop flat on the short side; and
 - (E) One drop on a corner at the junction of three intersecting edges; and
 - (ii) A compressive load as specified in §178.606(c) of this subchapter [See Appendix A].
- (7) Placement of the material in the package or packing different materials in the package does not result in a violation of §173.21 [See Appendix B];
- (8) The gross mass of the completed package does not exceed 29 kg (64 pounds);
- (9) The package is not opened or otherwise altered until it is no longer in commerce; and
- (10) The shipper certifies conformance with this section by marking the outside of the package with the statement "This package conforms to 49 CFR 173.4" or, alternatively,

until October 1, 2001, with the statement ''This package conforms to the conditions and limitations specified in 49 CFR 173.4.''

(b) A package containing a Class 7 (radioactive) material also must conform to the requirements of §173.421(a)(1) through (a)(5) or §173.424(a) through (g), as appropriate.

(c) Packages which contain a Class 2, Division 4.2 (PG I), or Division 4.3 (PG I) material conforming to paragraphs (a)(1) through (a)(10) of this section may be offered for transportation or transported if specifically approved by the Associate Administrator.

VI. Hazard class and division definitions

The following sections are the full-text definitions of hazard classes and divisions from 49 CFR. Additions or comments are included in brackets: [].

A. Flammable liquids, Class 3

§173.120 Class 3-Definitions.

(a) Flammable liquid. For the purpose of this subchapter, a flammable liquid (Class 3) means a liquid having a flash point of not more than 60.5°C (141°F), or any material in a liquid phase with a flash point at or above 37.8°C (100°F) that is intentionally heated and offered for transportation or transported at or above its flash point in a bulk packaging, with the following exceptions:

(1) Any liquid meeting one of the definitions specified in §173.115.

(2) Any mixture having one or more components with a flash point of 60.5°C (141°F) or higher, that make up at least 99 percent of the total volume of the mixture, if the mixture is not offered for transportation or transported at or above its flash point.

(3) Any liquid with a flash point greater than 35°C (95°F) which does not sustain combustion according to ASTM 4206 or the procedure in Appendix H of this part.

(4) Any liquid with a flash point greater than 35°C (95°F) and with a fire point greater than 100°C (212°F) according to ISO 2592.

(5) Any liquid with a flash point greater than 35°C (95°F) which is in a water-miscible solution with a water content of more than 90 percent by mass.

(b) Combustible liquid.

(1) For the purpose of this subchapter, a combustible liquid means any liquid that does not meet the definition of any other hazard class specified in this subchapter and has a flash point above 60.5°C (141°F) and below 93 °C (200 °F).

(2) A flammable liquid with a flash point at or above 38°C (100°F) that does not meet the definition of any other hazard class may be reclassified as a combustible liquid. This provision does not apply to transportation by vessel or aircraft, except where other means of transportation is impracticable. An elevated temperature material that meets the definition of a Class 3 material because it is intentionally heated and offered for transportation or transported at or above its flash point may not be reclassified as a combustible liquid.

(3) A combustible liquid which does not sustain combustion is not subject to the requirements of this subchapter as a combustible liquid. Either the test method specified in ASTM 4206 or the procedure in Appendix H of this part may be used to determine if a material sustains combustion when heated under test conditions and exposed to an external source of flame.

(c) Flash point.

(1) Flash point means the minimum temperature at which a liquid gives off vapor within a test vessel in sufficient concentration to form an ignitable mixture with air near the surface of the liquid. It shall be determined as follows:

(i) For a homogeneous, single-phase, liquid having a viscosity less than 45 S.U.S. at 38 °C (100 °F) that does not form a surface film while under test, one of the following test procedures shall be used:

(A) Standard Method of Test for Flash Point by Tag Closed Tester, (ASTM D 56);

(B) Standard Methods of Test for Flash Point of Liquids by Setaflash Closed Tester, (ASTM D 3278); or

(C) Standard Test Methods for Flash Point by Small Scale Closed Tester, (ASTM D 3828).

(ii) For a liquid other than one meeting all of the criteria of paragraph (c)(1)(i) of this section, one of the following test procedures shall be used:

(A) Standard Method of Test for Flash Point by Pensky-Martens Closed Tester, (ASTM D 93). For cutback asphalt, use Method B of ASTM D 93 or alternate tests authorized in this standard; or

(B) Standard Methods of Test for Flash Point of Liquids by Setaflash Closed Tester (ASTM D 3278).

(2) For a liquid that is a mixture of compounds that have different volatility and flash points, its flash point shall be determined as specified in paragraph (c)(1) of this section, on the material in the form in which it is to be shipped. If it is determined by this test that the flash point is higher than -7 °C (20 °F) a second test shall be made as follows: a portion of the mixture shall be placed in an open beaker (or similar container) of such dimensions that the height of the liquid can be adjusted so that the ratio of the volume of the liquid to the exposed surface area is 6 to one. The liquid shall be allowed to evaporate under ambient pressure and temperature (20 to 25 °C (68 to 77 °F)) for a period of 4 hours or until 10 percent by volume has evaporated, whichever comes first. A flash point is then run on a portion of the liquid remaining in the evaporation container and the lower of the two flash points shall be the flash point of the material.

(3) For flash point determinations by Setaflash closed tester, the glass syringe specified need not be used as the method of measurement of the test sample if a minimum quantity of 2 mL (0.1 ounce) is assured in the test cup.

(d) If experience or other data indicate that the hazard of a material is greater or less than indicated by the criteria specified in paragraphs (a) and (b) of this section, the Associate Administrator may revise the classification or make the material subject or not subject to the requirements of parts 170-189 of this subchapter.

B. Flammable solids, Division 4.1

§173.124 (a) Division 4.1 (Flammable Solid).

For the purposes of this subchapter, flammable solid (Division 4.1) means any of the following three types of materials:

(1) Desensitized explosives that-

(i) When dry are Explosives of Class 1 other than those of compatibility group A, which are wetted with sufficient water, alcohol, or plasticizer to suppress explosive properties; and

(ii) Are specifically authorized by name either in the §172.101 Table or have been assigned a shipping name and hazard class by the Associate Administrator under the provisions of-

(A) An exemption issued under subchapter A of this chapter; or

(B) An approval issued under §173.56(i) of this part.

(2) --

(i) Self-reactive materials are materials that are thermally unstable and that can undergo a strongly exothermic decomposition even without participation of oxygen (air). A material is excluded from this definition if any of the following applies:

(A) The material meets the definition of an explosive as prescribed in subpart C of this part, in which case it must be classed as an explosive;

(B) The material is forbidden from being offered for transportation according to §172.101 of this subchapter or §173.21;

(C) The material meets the definition of an oxidizer or organic peroxide as prescribed in subpart D of this part, in which case it must be so classed;

(D) The material meets one of the following conditions:

(1) Its heat of decomposition is less than 300 J/g; or

(2) Its self-accelerating decomposition temperature (SADT) is greater than 75°C (167°F) for a 50 kg package; or

(E) The Associate Administrator has determined that the material does not present a hazard which is associated with a Division 4.1 material.

(ii) Generic types. Division 4.1 self-reactive materials are assigned to a generic system consisting of seven types. A self-reactive substance identified by technical name in the Self-Reactive Materials Table in §173.224 is assigned to a generic type in accordance with that Table. Self-reactive materials not identified in the Self-Reactive Materials Table in §173.224 are assigned to generic types under the procedures of paragraph (a)(2)(iii) of this section.

(A) Type A. Self-reactive material type A is a self-reactive material which, as packaged for transportation, can detonate or deflagrate rapidly. Transportation of type A self-reactive material is forbidden.

(B) Type B. Self-reactive material type B is a self-reactive material which, as packaged for transportation, neither detonates nor deflagrates rapidly, but is liable to undergo a thermal explosion in a package.

(C) Type C. Self-reactive material type C is a self-reactive material which, as packaged for transportation, neither detonates nor deflagrates rapidly and cannot undergo a thermal explosion.

(D) Type D. Self-reactive material type D is a self-reactive material which-

(1) Detonates partially, does not deflagrate rapidly and shows no violent effect when heated under confinement;

(2) Does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement; or

(3) Does not detonate or deflagrate at all and shows a medium effect when heated under confinement.

(E) Type E. Self-reactive material type E is a self-reactive material which, in laboratory testing, neither detonates nor deflagrates at all and shows only a low or no effect when heated under confinement.

(F) Type F. Self-reactive material type F is a self-reactive material which, in laboratory testing, neither detonates in the cavitated state nor deflagrates at all and shows only a low or no effect when heated under confinement as well as low or no explosive power.

(G) Type G. Self-reactive material type G is a self-reactive material which, in laboratory testing, does not detonate in the cavitated state, will not deflagrate at all, shows no effect when heated under confinement, nor shows any explosive power. A type G self-reactive material is not subject to the requirements of this subchapter for self-reactive material of Division 4.1 provided that it is thermally stable (self-accelerating decomposition temperature is 50 °C (122 °F) or higher for a 50 kg (110 pounds) package). A self-reactive material meeting all characteristics of type G except thermal stability is classed as a type F self-reactive, temperature control material.

(iii) Procedures for assigning a self-reactive material to a generic type. A self-reactive material must be assigned to a generic type based on-

(A) Its physical state (i.e. liquid or solid), in accordance with the definition of liquid and solid in §171.8 of this subchapter;

(B) A determination as to its control temperature and emergency temperature, if any, under the provisions of §173.21(f);

(C) Performance of the self-reactive material under the test procedures specified in the UN Recommendations on the Transport of Dangerous Goods, Tests and Criteria (see § 171.7 of this subchapter) and the provisions of paragraph (a)(2)(iii) of this section; and

(D) Except for a self-reactive material which is identified by technical name in the Self-Reactive Materials Table in §173.224(b) or a self-reactive material which may be shipped as a sample under the provisions of §173.224, the self-reactive material is approved in writing by the Associate Administrator. The person requesting approval shall submit to the Associate Administrator the tentative shipping description and generic type and-

(1) All relevant data concerning physical state, temperature controls, and tests results; or

(2) An approval issued for the self-reactive material by the competent authority of a foreign government.

(iv) Tests. The generic type for a self-reactive material must be determined using the testing protocol from Figure 14.2 (Flow Chart for Assigning Self-Reactive Substances to Division 4.1) from the UN Recommendations on the Transport of Dangerous Goods, Tests and Criteria.

(3) Readily combustible solids are materials that-

- (i) Are solids which may cause a fire through friction, such as matches;
- (ii) Show a burning rate faster than 2.2 mm (0.087 inches) per second when tested in accordance with UN Manual of Tests and Criteria; or
- (iii) Any metal powders that can be ignited and react over the whole length of a sample in 10 minutes or less, when tested in accordance with UN Manual of Tests and Criteria.

C. Spontaneously Combustible Materials, Division 4.2

§173.124 (b) Division 4.2 (Spontaneously Combustible Material).

For the purposes of this subchapter, spontaneously combustible material (Division 4.2) means-

- (1) A pyrophoric material. A pyrophoric material is a liquid or solid that, even in small quantities and without an external ignition source, can ignite within five (5) minutes after coming in contact with air when tested according to the UN Manual of Tests and Criteria.
- (2) A self-heating material. A self-heating material is a material that, when in contact with air and without an energy supply, is liable to self-heat. A material of this type which exhibits spontaneous ignition or if the temperature of the sample exceeds 200 °C (392 °F) during the 24-hour test period when tested in accordance with UN Manual of Tests and Criteria, is classed as a Division 4.2 material.

D. Dangerous When Wet Materials, Division 4.3

§173.124 (c) Division 4.3 (Dangerous when wet material).

For the purposes of this chapter, dangerous when wet material (Division 4.3) means a material that, by contact with water, is liable to become spontaneously flammable or to give off flammable or toxic gas at a rate greater than 1 L per kilogram of the material, per hour, when tested in accordance with UN Manual of Tests and Criteria.

E. Oxidizers, Division 5.1

§173.127 Class 5, Division 5.1 - Definition and assignment of packing groups.

(a) Definition. For the purpose of this subchapter, oxidizer (Division 5.1) means a material that may, generally by yielding oxygen, cause or enhance the combustion of other materials.

- (1) A solid material is classed as a Division 5.1 material if, when tested in accordance with the UN Manual of Tests and Criteria, its mean burning time is less than or equal to the burning time of a 3:7 potassium bromate/cellulose mixture.
- (2) A liquid material is classed as a Division 5.1 material if, when tested in accordance with the UN Manual of Tests and Criteria, it spontaneously ignites or its mean time for a pressure rise from 690 kPa to 2070 kPa gauge is less than the time of a 1:1 nitric acid (65 percent)/cellulose mixture.

(b) Assignment of packing groups.

- (1) The packing group of a Division 5.1 material which is a solid shall be assigned using the following criteria:

(i) Packing Group I, for any material which, in either concentration tested, exhibits a mean burning time less than the mean burning time of a 3:2 potassium bromate/cellulose mixture.

(ii) Packing Group II, for any material which, in either concentration tested, exhibits a mean burning time less than or equal to the mean burning time of a 2:3 potassium bromate/cellulose mixture and the criteria for Packing Group I are not met.

(iii) Packing Group III for any material which, in either concentration tested, exhibits a mean burning time less than or equal to the mean burning time of a 3:7 potassium bromate/cellulose mixture and the criteria for Packing Group I and II are not met.

(2) The packing group of a Division 5.1 material which is a liquid shall be assigned using the following criteria:

(i) Packing Group I for:

(A) Any material which spontaneously ignites when mixed with cellulose in a 1:1 ratio; or

(B) Any material which exhibits a mean pressure rise time less than the pressure rise time of a 1:1 perchloric acid (50 percent)/cellulose mixture.

(ii) Packing Group II, any material which exhibits a mean pressure rise time less than or equal to the pressure rise time of a 1:1 aqueous sodium chlorate solution(40 percent)/cellulose mixture and the criteria for Packing Group I are not met.

(iii) Packing Group III, any material which exhibits a mean pressure rise time less than or equal to the pressure rise time of a 1:1 nitric acid (65 percent)/cellulose mixture and the criteria for Packing Group I and II are not met.

F. Organic peroxides, Division 5.2

§173.128 Class 5, Division 5.2-Definitions and types.

(a) Definitions. For the purposes of this subchapter, organic peroxide (Division 5.2) means any organic compound containing oxygen (O) in the bivalent -O-O- structure and which may be considered a derivative of hydrogen peroxide, where one or more of the hydrogen atoms have been replaced by organic radicals, unless any of the following paragraphs applies:

(1) The material meets the definition of an explosive as prescribed in subpart C of this part, in which case it must be classed as an explosive;

(2) The material is forbidden from being offered for transportation according to §172.101 of this subchapter or §173.21;

(3) The Associate Administrator has determined that the material does not present a hazard which is associated with a Division 5.2 material; or

(4) The material meets one of the following conditions:

(i) For materials containing no more than 1.0 percent hydrogen peroxide, the available oxygen, as calculated using the equation in paragraph (a)(4)(ii) of this section, is not more than 1.0 percent, or

(ii) For materials containing more than 1.0 percent but not more than 7.0 percent hydrogen peroxide, the available oxygen, content (O_a) is not more than 0.5 percent, when determined using the equation:

$$O_a = 16 \times \sum_{i=1}^k \frac{n_i C_i}{m_i}$$

where, for a material containing k species of organic peroxides:
 n_i =number of -O-O- groups per molecule of the i th species
 C_i =concentration (mass percent) of the i th species
 m_i =molecular mass of the i th species

(b) Generic types. Division 5.2 organic peroxides are assigned to a generic system which consists of seven types. An organic peroxide identified by technical name in the Organic Peroxides Table in §173.225 is assigned to a generic type in accordance with that Table. Organic peroxides not identified in the Organic Peroxides Table are assigned to generic types under the procedures of paragraph (c) of this section.

(1) Type A. Organic peroxide type A is an organic peroxide which can detonate or deflagrate rapidly as packaged for transport. Transportation of type A organic peroxides is forbidden.

(2) Type B. Organic peroxide type B is an organic peroxide which, as packaged for transport, neither detonates nor deflagrates rapidly, but can undergo a thermal explosion.

(3) Type C. Organic peroxide type C is an organic peroxide which, as packaged for transport, neither detonates nor deflagrates rapidly and cannot undergo a thermal explosion.

(4) Type D. Organic peroxide type D is an organic peroxide which-

(i) Detonates only partially, but does not deflagrate rapidly and is not affected by heat when confined;

(ii) Does not detonate, deflagrates slowly, and shows no violent effect if heated when confined; or

(iii) Does not detonate or deflagrate, and shows a medium effect when heated under confinement.

(5) Type E. Organic peroxide type E is an organic peroxide which neither detonates nor deflagrates and shows low, or no, effect when heated under confinement.

(6) Type F. Organic peroxide type F is an organic peroxide which will not detonate in a cavitated state, does not deflagrate, shows only a low, or no, effect if heated when confined, and has low, or no, explosive power.

(7) Type G. Organic peroxide type G is an organic peroxide which will not detonate in a cavitated state, will not deflagrate at all, shows no effect when heated under confinement, and shows no explosive power. A type G organic peroxide is not subject to the requirements of this subchapter for organic peroxides of Division 5.2 provided that it is thermally stable (self-accelerating decomposition temperature is 50 °C (122 °F) or higher for a 50 kg (110 pounds) package). An organic peroxide meeting all characteristics of type G except thermal stability and requiring temperature control is classed as a type F, temperature control organic peroxide.

(c) Procedure for assigning an organic peroxide to a generic type. An organic peroxide shall be assigned to a generic type based on-

(1) Its physical state (i.e., liquid or solid), in accordance with the definitions for liquid and solid in §171.8 of this subchapter;

(2) A determination as to its control temperature and emergency temperature, if any, under the provisions of §173.21(f); and

(3) Performance of the organic peroxide under the test procedures specified in the UN Manual of Tests and Criteria, and the provisions of paragraph (d) of this section.

(d) Approvals.

(1) An organic peroxide must be approved, in writing, by the Associate Administrator, before being offered for transportation or transported, including assignment of a generic type and shipping description, except for-

(i) An organic peroxide which is identified by technical name in the Organic Peroxides Table in §173.225(b);

(ii) A mixture of organic peroxides prepared according to §173.225(c); or

(iii) An organic peroxide which may be shipped as a sample under the provisions of §173.225(c).

(2) A person applying for an approval must submit all relevant data concerning physical state, temperature controls, and tests results or an approval issued for the organic peroxide by the competent authority of a foreign government.

(e) Tests. The generic type for an organic peroxide shall be determined using the testing protocol from Figure 20.1(a) (Classification and Flow Chart Scheme for Organic Peroxides) from the UN Manual of Tests and Criteria (see § 171.7 of this subchapter).

G. Poisonous materials, Division 6.1

§173.132 Class 6, Division 6.1-Definitions.

(a) For the purpose of this subchapter, poisonous material (Division 6.1) means a material, other than a gas, which is known to be so toxic to humans as to afford a hazard to health during transportation, or which, in the absence of adequate data on human toxicity:

(1) Is presumed to be toxic to humans because it falls within any one of the following categories when tested on laboratory animals (whenever possible, animal test data that has been reported in the chemical literature should be used):

(i) Oral Toxicity. A liquid with an LD₅₀ for acute oral toxicity of not more than 500 mg/kg or a solid with an LD₅₀ for acute oral toxicity of not more than 200 mg/kg.

(ii) Dermal Toxicity. A material with an LD₅₀ for acute dermal toxicity of not more than 1000 mg/kg.

(iii) Inhalation Toxicity.

(A) A dust or mist with an LC₅₀ for acute toxicity on inhalation of not more than 10 mg/L; or

(B) A material with a saturated vapor concentration in air at 20 °C (68 °F) greater than or equal to one-fifth of the LC₅₀ for acute toxicity on inhalation of vapors and with an LC₅₀ for acute toxicity on inhalation of vapors of not more than 5000 mL/m³ ; or

(2) Is an irritating material, with properties similar to tear gas, which causes extreme irritation, especially in confined spaces.

(b) For the purposes of this subchapter-

(1) LD₅₀ for acute oral toxicity means that dose of the material administered to both male and female young adult albino rats which causes death within 14 days in half the animals tested. The number of animals tested must be sufficient to give statistically valid results and be in conformity with good pharmacological practices. The result is expressed in mg/kg body mass.

(2) LD₅₀ for acute dermal toxicity means that dose of the material which, administered by continuous contact for 24 hours with the shaved intact skin (avoiding abrading) of an albino rabbit, causes death within 14 days in half of the animals tested. The number of animals tested must be sufficient to give statistically valid results and be in conformity with good pharmacological practices. The result is expressed in mg/kg body mass.

(3) LC50 for acute toxicity on inhalation means that concentration of vapor, mist, or dust which, administered by continuous inhalation for one hour to both male and female young adult albino rats, causes death within 14 days in half of the animals tested. If the material is administered to the animals as a dust or mist, more than 90 percent of the particles available for inhalation in the test must have a diameter of 10 microns or less if it is reasonably foreseeable that such concentrations could be encountered by a human during transport. The result is expressed in mg/L of air for dusts and mists or in mL/m³ of air (parts per million) for vapors. See §173.133(b) for LC50 determination for mixtures and for limit tests.

(i) When provisions of this subchapter require the use of the LC50 for acute toxicity on inhalation of dusts and mists based on a one-hour exposure and such data is not available, the LC50 for acute toxicity on inhalation based on a four-hour exposure may be multiplied by four and the product substituted for the one-hour LC50 for acute toxicity on inhalation.

(ii) When the provisions of this subchapter require the use of the LC50 for acute toxicity on inhalation of vapors based on a one-hour exposure and such data is not available, the LC50 for acute toxicity on inhalation based on a four-hour exposure may be multiplied by two and the product substituted for the one-hour LC50 for acute toxicity on inhalation.

(iii) A solid substance should be tested if at least 10 percent of its total mass is likely to be dust in a respirable range, e.g. the aerodynamic diameter of that particle-fraction is 10 microns or less. A liquid substance should be tested if a mist is likely to be generated in a leakage of the transport containment. In carrying out the test both for solid and liquid substances, more than 90% (by mass) of a specimen prepared for inhalation toxicity testing must be in the respirable range as defined in this paragraph (b)(3)(iii).

(c) For purposes of classifying and assigning packing groups to mixtures possessing oral or dermal toxicity hazards according to the criteria in § 173.133(a)(1), it is necessary to determine the acute LD₅₀ of the mixture. If a mixture contains more than one active constituent, one of the following methods may be used to determine the oral or dermal LD₅₀ of the mixture:

(1) Obtain reliable acute oral and dermal toxicity data on the actual mixture to be transported;

(2) If reliable, accurate data is not available, classify the formulation according to the most hazardous constituent of the mixture as if that constituent were present in the same concentration as the total concentration of all active constituents; or

(3) If reliable, accurate data is not available, apply the formula:
where:

$$\frac{C_A}{T_A} = \frac{C_B}{T_B} + \frac{C_Z}{T_Z} = \frac{100}{T_M}$$

C = the % concentration of constituent A, B ... Z in the mixture;

T = the oral LD₅₀ values of constituent A, B ... Z;

T_M = the oral LD₅₀ value of the mixture.

Note to formula in paragraph (c)(3): This formula also may be used for dermal toxicities provided that this information is available on the same species for all constituents. The use of this formula does not take into account any potentiation or protective phenomena.

(d) The foregoing categories shall not apply if the Associate Administrator has determined that the physical characteristics of the material or its probable hazards to humans as shown by documented experience indicate that the material will not cause serious sickness or death.

H. Corrosive materials, Class 8

§173.136 Class 8-Definitions.

(a) For the purpose of this subchapter, 'corrosive material' (Class 8) means a liquid or solid that causes full thickness destruction of human skin at the site of contact within a specified period of time. A liquid that has a severe corrosion rate on steel or aluminum based on the criteria in §173.137(c)(2) is also a corrosive material.

(b) If human experience or other data indicate that the hazard of a material is greater or less than indicated by the results of the tests specified in paragraph (a) of this section, RSPA may revise its classification or make the determination that the material is not subject to the requirements of this subchapter.

(c) Skin corrosion test data produced no later than September 30, 1995, using the procedures of Part 173, Appendix A, in effect on September 30, 1995 (see 49 CFR Part 173, Appendix A, revised as of October 1, 1994) for appropriate exposure times may be used for classification and assignment of packing group for Class 8 materials corrosive to skin.

I. Miscellaneous hazardous materials, Class 9

§173.140 Class 9-Definitions.

For the purposes of this subchapter, miscellaneous hazardous material (Class 9) means a material which presents a hazard during transportation but which does not meet the definition of any other hazard class. This class includes:

(a) Any material which has an anesthetic, noxious or other similar property which could cause extreme annoyance or discomfort to a flight crew member so as to prevent the correct performance of assigned duties; or

(b) Any material that meets the definition in §171.8 of this subchapter for an elevated temperature material, a hazardous substance, a hazardous waste, or a marine pollutant.

Appendix A. Compressive load test, 49 CFR §178.606 (c)

§178.606 (c) Test method

(1) Design qualification testing. The test sample must be subjected to a force applied to the top surface of the test sample equivalent to the total weight of identical packages which might be stacked on it during transport; where the contents of the test sample are non-hazardous liquids with specific gravities different from that of the liquid to be transported, the force must be calculated based on the specific gravity that will be marked on the packaging. The minimum height of the stack, including the test sample, must be 3.0 m (10 feet). The duration of the test must be 24 hours, except that plastic drums, jerricans, and composite packagings 6HH intended for liquids shall be subjected to the stacking test for a period of 28 days at a temperature of not less than 40°C (104°F). Alternative test methods which yield equivalent results may be used if approved by the Associate Administrator. In guided load tests, stacking stability must be assessed after completion of the test by placing two filled packagings of the same type on the test sample. The stacked packages must maintain their position for one hour. Plastic packagings must be cooled to ambient temperature before this stacking stability assessment.

(2) Periodic retesting. The test sample must be tested in accordance with:

(i) Section 178.606(c)(1) of this subpart; or

(ii) The packaging may be tested using a dynamic compression testing machine. The test must be conducted at room temperature on an empty, unsealed packaging. The test sample must be centered on the bottom platen of the testing machine. The top platen must be lowered until it comes in contact with the test sample. Compression must be applied end to end. The speed of the compression tester must be one-half inch plus or minus one-fourth inch per minute. An initial preload of 50 pounds must be applied to ensure a definite contact between the test sample and the platens. The distance between the platens at this time must be recorded as zero deformation. The force A to then be applied must be calculated using the formula:

Liquids: $A=(n-1) [w+ (s \times v \times 8.3 \times .98)] \times 1.5;$

Solids: $A= (n-1) [w+ (s \times v \times 8.3 \times .95)] \times 1.5$

Where:

A=applied load in pounds.

n=minimum number of containers that, when stacked, reach a height of 3 m.

s=specific gravity of lading.

w=maximum weight of one empty container in pounds.

v=actual capacity of container (rated capacity + outage) in gallons.

And:

8.3 corresponds to the weight in pounds of 1.0 gallon of water.

1.5 is a compensation factor that converts the static load of the stacking test into a load suitable for dynamic compression testing.

Appendix B. Materials and packages forbidden from transportation, 49 CFR §173.21

§173.21 Forbidden materials and packages.

Unless otherwise provided in this subchapter, the offering for transportation or transportation of the following is forbidden:

- (a) Materials that are designated 'Forbidden' in Column 3 of the §172.101 Table.
- (b) Forbidden explosives as defined in §173.54 of this part.
- (c) Electrical devices which are likely to create sparks or generate a dangerous quantity of heat, unless packaged in a manner which precludes such an occurrence.
- (d) For carriage by aircraft, any package which has a magnetic field of more than 0.00525 gauss measured at 4.5 m (15 feet) from any surface of the package.
- (e) 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.
- (f) A package containing a material which is likely to decompose with a self-accelerated decomposition temperature (SADT) of 50°C (122°F) or less, or polymerize at a temperature of 54°C (130°F) or less with an evolution of a dangerous quantity of heat or gas when decomposing or polymerizing, unless the material is stabilized or inhibited in a manner to preclude such evolution. The SADT may be determined by any of the test methods described in Part II of the UN Manual of Tests and Criteria (see § 171.7 of this subchapter).
- (g) Packages which give off a flammable gas or vapor, released from a material not otherwise subject to this subchapter, likely to create a flammable mixture with air in a transport vehicle.
- (h) Packages containing materials (other than those classed as explosive) which will detonate in a fire.
 - (1) For purposes of this paragraph, 'detonate' means an explosion in which the shock wave travels through the material at a speed greater than the speed of sound.
 - (2) When tests are required to evaluate the performance of a package under the provisions of this paragraph, the testing must be done or approved by one of the agencies specified in §173.56.
 - (i) A package containing a cigarette lighter, or other similar device, equipped with an ignition element and containing fuel; except that a cigarette lighter or similar device subject to this paragraph may be shipped if the design of the device and its inner packaging has been examined by the Bureau of Explosives and specifically approved by the Associate Administrator. The examination of cigarette lighters and similar devices containing gaseous fuel will include scrutiny for compliance with §173.308 of this part. For the status of approvals previously issued by the Bureau of Explosives, see §171.19 of this subchapter.
- (j) An organic peroxide of the 'ketone peroxide' category which contains more than 9 percent available oxygen as calculated using the equation in §173.128(a)(4)(ii). The category, ketone peroxide, includes, but is not limited to:

Acetyl acetone peroxide
Cyclohexanone peroxide(s)
Diacetone alcohol peroxides
Methylcyclohexanone peroxide(s)
Methyl ethyl ketone peroxide(s)
Methyl isobutyl ketone peroxide(s)

(k) Notwithstanding any other provision of this subchapter, including §§171.11 and 175.10(a)(2) of this subchapter, an oxygen generator (chemical) as cargo on a passenger-carrying aircraft until January 1, 1997. This prohibition does not apply to an oxygen generator for medical or personal use of a passenger that meets the requirements of §175.10(a)(7) of this subchapter.