DEPARTMENT OF TRANSPORTATION

Research and Special Programs Administration

49 CFR Parts 172, 173, 179

[Docket No. HM-175A; Notice No. 93-19]

RIN 2137-AB89

Crashworthiness Protection Requirements for Tank Cars

AGENCY: Research and Special Programs Administration (RSPA), Department of Transportation (DOT).

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: RSPA is proposing revisions to the Hazardous Materials Regulations (HMR) that would improve the crashworthiness of tank cars and restrict the continued use in hazardous materials service of tank cars that no longer meet current safety requirements. Included are proposals to expand the use of thermal protection systems and head protection on tank cars used for transporting certain hazardous materials; add new requirements for bottom discontinuity protection; prohibit the use of self-energized manways located below the liquid level of the cargo; revise "grandfather" provisions that allow certain uses of tank cars; and require the use of pressure tank cars, that are more resistant to puncture, for all poisonous by inhalation (PIH) materials and certain other high hazard materials. The intended effect of these actions is to enhance the safe transportation of hazardous materials in tank cars.

DATES: *Written comments:* Comments must be received on or before February 7, 1994.

Public hearing. A public hearing will be held at 10 a.m., January 6, 1994.

ADDRESSES: *Written comments:* Address comments to the Dockets Unit, DHM-30, Research and Special Programs Administration, Department of Transportation, Washington, DC 20590-0001. Commenters should identify the docket and notice number, and, if possible, submit five copies in response to this notice. Commenters needing a confirmation of receipt of their comments should include a self-addressed stamped postcard that shows the docket number (i.e., Docket HM-175A). Interested persons may review the comments to this notice, and publications referenced in it, between the hours of 8:30 a.m., and 5 p.m., Monday through Friday, except holidays. The Dockets Unit is located in room 8417 of the Nassif Building, 400 Seventh Street SW., Washington, DC 20590-0001.

Public hearing: The public hearing noted above will be held in room 2230 of the Nassif Building at the same street address. Persons desiring to make oral statements at the hearing should notify the Federal Railroad Administration (FRA) Docket Clerk by telephone (202-366-0635) or in writing by December 22, 1993. Mail written requests to: Docket Clerk, Office of Chief Counsel, Federal Railroad Administration, 400 Seventh Street SW., room 8201, Washington DC, 20590-0001. Each request must identify the speaker; organization represented, if any; daytime telephone number; and the anticipated length of the presentation, not to exceed 10 minutes. Written text of the oral statement should be presented to the hearing officer prior to the oral presentation. The hearing may conclude before 5 p.m. if all persons wishing to testify have been heard.

FOR FURTHER INFORMATION CONTACT: Edward W. Pritchard (Telephone 202-366-9178) or James H. Rader (Telephone 202-366-0510), Hazardous Materials Division, or Thomas A. Phemister (Telephone 202-366-0635), Trial Attorney, Office of Chief Counsel, FRA, Washington DC, 20590-0001.

SUPPLEMENTARY INFORMATION:

I. Background

Based on research and on a continuing review of serious accidents involving the transportation of hazardous materials in tank cars in the United States and Canada, RSPA has issued a number of regulations to improve the survivability of tank cars in accidents. In these rulemakings, RSPA required the installation of a tank head puncture resistance system (head protection), a coupler vertical restraint system (shelf couplers), insulation, and a thermal protection system for certain high-risk cargoes.[1]

The record shows that these systems, working in combination, have reduced the potential harm to human health and the environment tremendously.[2]

On May 15, 1990, RSPA published an Advance Notice of Proposed Rulemaking (ANPRM) under Docket HM-175A (55 FR 20242). The notice solicited comments on the costs and safety benefits that would be derived should the HMR be amended to: (1) Require thermal protection or head protection, or both, on new and existing tank cars that are constructed of aluminum or nickel, or that are used to transport certain hazardous materials; (2) disallow the use of the half-head shield as an option to meet head protection requirements; (3) prohibit the use of tank cars that have a manway opening located below the liquid level of the material transported; (4) disallow the use of so-called "non-pressure" tank cars to transport materials toxic by inhalation; (5) increase the start to discharge pressure setting on certain tank car; (6) establish specifications for the securement and accident survivability of tank car tank closure fittings; and (7) phase out certain "grandfather" provisions. This ANPRM also solicited comments on what changes or design modification should be considered in place of the retrofitting of tank cars that do not conform to the safety requirements for new tank cars. RSPA published a Supplemental Advance Notice of Proposed Rulemaking (SANPRM) on August 29, 1990 (55 FR 35327), requesting information on four additional tank car related safety issues. Specifically, the SANPRM requested comments on the costs and safety benefits that would be derived should the HMR be amended to (1) prohibit bottom outlets on new and existing tank cars used to transport certain hazardous materials; (2) establish a maximum permissible safety relief valve capacity for materials that are toxic by inhalation; (3) require that, for new and existing tank cars, the exterior surface of a carbon steel tank and the inside surface of a carbon steel jacket be given a protective coating when foam-in-place insulation is applied; and (4) permit reductions in the safety vent size, or increases in the tank test pressure and vent bursting pressure, on new and existing tank cars used to transport certain hazardous materials.

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[1] The difference between a thermal protection system and insulation is that a thermal protection system protects the tank from a pool or torch fire environment; in contrast, insulation protects the contents of the tank from ambient temperature differentials, much like home insulation.

[2] The discussions in the following rulemakings provide greater detail about each of these safety system requirements: Interlocking Couplers and Restrictions of Capacity of Tank Cars, Docket HM-38, 35 FR 14215 (September 9, 1970); Tank Car Tank Head Protection, Docket HM-109, 41 FR 21475 (May 26, 1976); Shippers; Specifications for Pressure Tank Cars, Docket HM-144, 42 FR 46306 (September 15, 1977); Shippers, Specifications for Tank Cars, Docket HM-174, 49 FR 3473, (January 27, 1984); Specifications for Railroad Tank Cars Used to Transport Hazardous Materials, Docket HM-175, 49 FR 3468 (January 27, 1984); Transportation of Hazardous Materials, Miscellaneous Amendments, Docket HM-166W, 54 FR 38790 (September 20, 1989); and Performance-Oriented Packaging; Changes to Classification, Hazard Communication, Packaging and Handling Requirements Based on UN Standards and Agency Initiative, Docket HM-181, 55 FR 52402 (December 12, 1990).

RSPA received over 50 comments in response to the ANPRM and the SANPRM from members of private trade associations and the various industries that own, lease, transport or use tank cars. All comments were given full consideration and FRA and RSPA appreciate the information and opinions received. Based on those comments and on research conducted by the FRA, this notice proposes new regulations or revisions to the HMR in the following subject areas: (1) Tank head protection; (2) thermal protection; (3) self-energized manways below the tank liquid level; (4) the use of non-pressure tank cars for materials with a poison-inhalation hazard; (5) "grandfathering," that is, the permissive, continued use of tank cars conforming to former regulatory standards; (6) protection of bottom discontinuities on tank cars; (7) protective coatings on insulated tanks; and (8) the use of tank cars of limited and designated specifications with greater protection in accidents for transporting materials with health and environmental risks.

Based on comments made to some of the issues raised in the ANPRM and the SANPRM, and research done by the FRA, RSPA and FRA concluded that several topics raised in these earlier notices are either too technically complex or insufficiently developed to be resolved by regulatory proposals now. RSPA will consider action on safety relief devices, top fitting protection, and gasket specifications in a separate rulemaking action. Also, consideration will be given to making certain operational changes, for instance, restricting train placement, in lieu of tank car design or specification changes under a future rulemaking docket.

Tank cars built to the DOT 111 specification have received a great degree of interest since the ANPRM and SANPRM were published in this docket. With over 160,000 in use today, they constitute about two-thirds of the North American tank car fleet, and they remain a critical resource for movement of industrial chemicals and other materials in commerce. The issues surrounding this specification tank car are many and complex, but FRA and RSPA are committed to improving an already good safety record in the transportation by railroad of hazardous materials and to addressing forthrightly the hazards these cars may pose in certain situations.

Since the early 1970s, FRA and RSPA have been engaged in a program to improve the tank car fleet with respect to crashworthiness. The DOT program has proceeded from those cars used to transport the most hazardous commodities to those cars carrying commodities posing relatively less serious hazards. This NPRM is part of that process and addresses several key facets of low-pressure tank cars, including the DOT 111s. Among the proposals discussed in more detail below are those that would remove the DOT 111 tank car from the transportation of PIH materials, the transportation of Class 2 materials, and from the transportation of environmentally sensitive halogenated organic compounds (HOCs). Proposals in this notice also include the required installation of head and thermal protection on tank cars transporting thermally reactive materials. As will be developed more fully in the text that follows, comments are requested on the possibility of replacing DOT 111 tank cars constructed of aluminum or nickel plate with those made of stainless steel, or with lined or coated carbon steel tank cars. Additionally, current rulemaking actions and FRA mandated inspection and maintenance programs address other parts of the larger DOT program of progressive safety improvement.

II. Tank Head Protection

After a series of railroad accidents in the late 1960s and early 1970s involving head punctures of tank cars, FRA and RSPA began, in 1976, to require half-head protection for tank cars transporting flammable compressed gases (now Division 2.1 materials) and for tank cars transporting anhydrous ammonia and ethylene oxide (Docket HM-109). The design of, and criteria for, head protection were based on tests performed by the FRA, the Association of American Railroads (AAR), and the Railway Progress Institute (RPI) Tank Car Safety Research and Test Project in the early 1970s.

These tests showed that head punctures caused by over-speed impacts in railroad classification yards generally occurred at speeds above 12 mph, and often happened when a loaded tank car struck a standing empty car, causing the empty car to "jump" and ram its coupler into the head of the oncoming tank. Reviewing incidents on main-line trackage, a recent analysis of accident data showed that objects such as broken rails and couplers may penetrate the top half of the tank head indicating that head protection is essential, even though not 100 percent effective, in a train derailment.

In a recent FRA research effort on puncture resistance,[3] FRA conducted full- and 1/5-scale experimental studies to evaluate the relative puncture resistance of DOT 105A500W and 112J340W tank cars. The research results show that puncture resistance is strongly influenced by impact location, by head and jacket thickness and by insulation thickness. Based on the results of the studies, FRA expects that certain DOT 105A tank cars in chlorine service may meet the 18 mph threshold for puncture resistance prescribed in § 179.105(c)(4). The Coltman/Hazel report demonstrates that puncture resistance is an inter-related function of head thickness, insulation thickness, and jacket thickness, at least, and that the concept of "head protection" must include more than just traditional head shields. Some existing tank cars may in fact meet the performance standard through an increase in the thickness of the tank jacket, the tank head, or the insulation system.

Most commenters to the earlier notices in this docket expressed support for the application of full-head protection to new tank cars and to those existing tank cars without head protection used for PIH materials and Division 2.1 flammable gases regardless of tank car capacity. All commenters agreed that there is no need to require full-head protection on existing tank cars built to the current standard (49 CFR 179.100-23) allowing half-head protection. Most commenters did not support an across-the-board requirement for full-head protection on tank cars constructed from either aluminum or nickel plate. Both the National Transportation Safety Board (NTSB) and the Association of American Railroads expressed the need to require full-head protection on tank cars transporting thermally reactive materials (i.e., materials that decompose or polymerize when exposed to heat). These comments are discussed in more detail below.

Tank cars currently equipped with half-head protection: The AAR/RPI Tank Car Safety Research and Test Project analyzed the effectiveness of the requirements to install shelf couplers and half-head protection on Class DOT 112 and 114 tank cars. They reported that, based on accident data, these improvements were 95 percent effective in preventing head punctures.[4] While the RPI report combines shelf couplers with head protection and evaluates this protection *system*, the data is fully

[3] Coltman, M., & Hazel, M, Jr., Chlorine Tank Car Puncture Resistance Evaluation, (1992) Federal Railroad Administration, Washington, DC (NTIS DOT/FRA/ORD-92/11).

[4] Phillips, E. A., Analysis of Tank Cars Damaged in Accidents 1965 through 1986, (RA-02-6-55), 1989, AAR-RPI Railway Tank Car Safety Test and Research Project, AAR Technical Center, Chicago, IL.

applicable to this proceeding because all tank cars transporting hazardous materials are required to have shelf couplers.

Because tank cars currently equipped with a half-head protection system are already 95 percent effective against preventing head punctures, FRA and RSPA agree with commenters that there is neither a safety need nor an incremental cost justification to require a retrofit of full-head protection on those tank cars.

Head protection systems for existing tank cars with capacities less than 18,500 gallons: In 1984, the final rule published under Docket HM–175 did not require Class DOT 105 tank cars with a capacity of less than 18,500 gallons and transporting flammable gases, anhydrous ammonia, or ethylene oxide to be fitted with head protection. This provision is contained in Notes 23 and 24 to § 173.314(c) and § 173.323(c)(1). The preamble to HM–175 noted that RSPA would continue to evaluate the need for new or amended rules applicable to tank cars. These "smaller" cars were not covered earlier primarily because their predominant service is in chlorine transportation and, in that service, they are covered with thick cork or urethane foam insulation, believed by many at the time to offer sufficient protection against puncture.[5] In addition, these smaller capacity tank cars did not have the same history of tank head punctures that demanded the change and retrofit program mandated for the larger capacity DOT 112 and 114 tank cars. Summarized, the priorities in 1984 pointed to the need to provide head protection first to other segments of the tank car fleet.

In comments filed in response to the ANPRM in this docket, the NTSB said the accident data for the last 20 years clearly demonstrates the vulnerability of tank heads to puncture and urged RSPA to move expeditiously to issue and implement final rules that would require full-head protection for all DOT 105 tank cars, including those tank cars with a capacity less than 18,500 gallons. Several commenters to the May 5 and November 6, 1987 notices of proposed rulemaking (NPRMs) under Docket HM–181 agreed that the former grandfathering of tank cars based on capacity was no longer justified. The Chlorine Institute agreed that head protection systems are now warranted for on the cars they used. FRA and RSPA agree with these commenters and, for the stated reasons, RSPA proposes to remove the 18,500 gallon limitation.

Tank cars transporting materials in Division 2.2: RSPA is proposing to require full-head protection on all new tank cars and on those existing tank cars that currently do not have head protection, regardless of tank car capacity, when used to transport materials classed in Division 2.2 (non-flammable gas). Not only can these containers violently rupture if they are punctured, but the released cargo may kill or injure through asphyxiation or other impairment of the human cardiac, nervous, or pulmonary systems.

Existing tank cars without head protection: RSPA disagrees with those commenters who argue that there is no need to require full-head protection on existing tank cars equipped with no head protection. The benefits of head protection are real, are predictable, and are quantifiable. Where earlier rules required head protection on other cars, it was a matter of recognizing the highest priority needs first. The question is not one of demanding low-priority safety benefits, but the need to expand the safety base of hazardous materials transportation in tank cars.

Based on an accident history that highlighted the problem of coupler override in switch yard impacts, the first head shield requirements prescribed protection for the lower half of the tank head. It is now time to expand the head protection system priorities to include main line derailments. In these accidents, often involving higher speeds than yard derailments, tank cars may roll over while derailing or couplers may break because of high train-action forces; in either case, draft sill override may occur. However it happens, FRA is aware that the top half of the tank head is vulnerable to puncture. For example, on January 14, 1980, in Ridgefield, Washington, a Burlington Northern freight train struck a mud slide. The train action forces in that accident caused the coupler of a DOT 112S340W tank car transporting anhydrous ammonia to break. An adjacent box car over-rode the coupler and the half-head shield on the anhydrous ammonia tank car and punctured the top half of the tank head. Twenty thousand gallons of anhydrous ammonia were released and two train crew members died in the plume.

RSPA and FRA consider the small additional cost of installing full-head protection on cars that now have no head protection system, as compared with adding only half-head protection, is justified on the basis of increased safety. RSPA proposes that the installation of a tank head puncture resistance system on tank cars transporting Class 2 materials be phased-in over a 10-year period.

Tank cars constructed from aluminum and from nickel plate: Tank cars constructed from aluminum plate commonly transport fertilizer ammoniating solutions, hydrogen peroxide solutions, and nitric acids and tank cars constructed from nickel plate commonly transport acetyl chloride and bromine. After a 1983 release of nitric acid resulting from a puncture in an aluminum tank car head in Denver, Colorado, the NTSB urged the FRA to conduct a full scale testing and evaluation program to develop a head shield to protect aluminum tank car heads from puncture and, if needed, mandate installation of head shields at an early date.[6] FRA conducted the research and found that the threshold velocity needed to puncture a tank head constructed from aluminum is four mph.[7] Such low puncture resistance supports the need for full-head protection on new and existing tank cars constructed from aluminum plate in hazardous materials service. Because the properties of nickel plate are similar to those of aluminum plate, FRA and RSPA also believe that the use of full-head protection on tank cars constructed from nickel plate should be required as well.[8] These changes are proposed in this notice.

Several commenters stated that RSPA should consider the characteristics of the particular hazardous material to be transported before requiring steel head protection on tank cars constructed from either aluminum or nickel plate. Based on the low puncture resistance characteristics of aluminum and nickel plate, RSPA disagrees with these commenters.

With advances in alloy metallurgy and in the capabilities of tank car coatings, linings, and claddings, it may

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[5] Recent tests, see Coltman and Hazel, cited earlier, tend to confirm that view. These tests revealed that some stub sill to tank head configurations, with a modified reinforcing pad and bracket, may withstand the puncture resistance performance criteria, but some chlorine tank cars may not offer puncture resistance fully satisfying the performance criteria originally adopted for larger flammable gas tank cars.

[6] Denver and Rio Grande Western Railroad Company Yard Accident Involving Punctured Tank Car, Nitric Acid Vapor Cloud and Evacuation, Denver, Colorado, April 3, 1983, National Transportation Safety Board Report NTSB/RAR–85/10, National Transportation Safety Board, Washington, DC.

[7] Larson, W.G., Aluminum/Cold Temperature Tank Car Puncture Resistance Tests, (FRA/ORD 91/06), (1991), (NTIS DOT/FRA/ORD/91/06), Federal Railroad Administration, Washington, DC.

[8] "Constructed from nickel plate" means that the tank shell is built of steel with a high nickel content, conforming to specification ASTM B162, AAR TC133, or AAR TC134. A "nickel clad" tank car has a protective inner coating or lining of nickel applied to the parent steel.

now be more possible than it once was to transport in steel tank cars many of the products that today move in aluminum or nickel cars.[9] RSPA and FRA specifically request comments as to whether the use of other than steel tank cars should be disallowed with respect to all or to certain hazardous materials based on the low puncture resistance of aluminum and nickel shells; and, if so, what the effective date of such a requirement should be.

Tank cars transporting thermally reactive materials: RSPA agrees with those commenters who suggested the need for full-head protection on tank cars transporting thermally reactive materials.[10] Many of these materials, if released, react violently with other materials and may decompose with explosive force. As an example, in a 1989 investigation into the collision and derailment of a Montana Rail Link freight train, the NTSB found that the puncture of a tank car containing hydrogen peroxide resulted in a release of product. When the hydrogen peroxide combined with contaminants on the ground, a chemical reaction occurred causing a fire; the fire heated and ignited nearby polyethylene pellets and that fire led to an explosion of the hydrogen peroxide tank car releasing a force equivalent to 10 tons of TNT (tri-nitro-toluene). Fragments of the tank car penetrated homes within a fourth of a mile and one home, located one-half mile away, was penetrated by a section of the liquid eduction tube.[11]

In its comments, the Association of American Railroads supplied the following list[12] of thermally reactive materials that it believes should only be transported in tank cars with full-head protection:

acetaldehyde
acrolein
acrylic acid
acrylonitrile
butyl acrylate
chloroprene
crotonaldehyde
dimethylaminoethyl methacrylate
dimethylhydrazine, unsymmetrical
dinitrotoluene
ethyl acrylate
ethyl nitrite
ethyl methacrylate
ethylene imine
ethylene oxide
hydrazine, anhydrous
hydrogen cyanide
hydrogen peroxide solution
isobutylacrylate
isoprene
isopropyl nitrate
methacrylic acid
methacrylonitrile
methyl acrylate, inhibited
methyl isopropenyl ketone
methyl methacrylate monomer, inhibited
methyl vinyl ketone
methyl isopropenyl ketone
motor fuel anti-knock compound
nitroethane
proplyene imine
propylene oxide
styrene monomer
sulfur trioxide
vinyl acetate
vinyl ethyl ether
vinyl isobutyl ether
vinyl toluenes
vinylidene chloride
vinyl pyridene
vinyltrichlorosilane

FRA and RSPA agree with the AAR that this is an appropriate listing of the thermally reactive materials likely to move by railroad; however, the AAR list also contained other commodities that are not specifically named in the Hazardous Materials Table (HMT), and some of them move in substantial quantities. FRA and RSPA request comments on the identification of additional thermally reactive materials, on whether a generic description such as "thermally reactive materials, n.o.s." is proper for inclusion in the HMT, and on the best way to ensure that the proper packaging requirements (such as "B" codes in the Special provisions in § 172.102) are attached to appropriate commodities.

Based on the risks that these materials pose in the transportation system and based on the effectiveness of head protection systems, RSPA proposes to require full-head protection for new cars and for existing cars without head protection when transporting thermally reactive materials.

III. Thermal Protection Systems

At about the same time as action was being taken to provide head protection for tank cars, RSPA began to require the application of a thermal protection system on tank cars transporting Division 2.1 materials (flammable gases) or ethylene oxide after a series of major railroad accidents that involved fires and ruptures of non-insulated pressure tank cars.[13] The design and criteria of the thermal protection system were based on tests performed for the FRA at the U.S. Army Ballistics Research Laboratory in White Sands, New Mexico, and at the Transportation Test Center in Pueblo, Colorado.

These tests revealed that a 33,600-gallon non-protected tank car filled with propane will rupture within 24 minutes after exposure to a pool fire. Rupture occurs when the residual strength of the tank shell falls below the force generated by the vapor pressure of the cargo exerted on the inside surface of the tank shell.[14] Further testing by FRA demonstrated that a tank car filled with propane and equipped with a thermal protection system vented its cargo through the safety relief valve before the tank car shell ruptured when subjected to either a 100-minute pool fire or a 30-minute torch fire.[15] These periods were chosen because they provided emergency response personnel the needed time to assess the accident and to initiate remedial actions, such as evacuating an area.

The performance standard for thermal protection considers the tank and its cargo as a whole system. Many insulation materials also provide good thermal protection so these materials,

[9] In § 179.100–7 of the final rule for Docket HM–181F, Performance-Oriented Packaging Standards; Miscellaneous Amendments, 58 FR 50224 (September 24, 1993), RSPA has authorized certain stainless steel alloys for the construction of DOT 105, 109, 112, and 114 pressure tank cars.

[10] In 1974, the Department studied the self-reaction hazards of chemical substances that are thermally unstable. The thermal decomposition of 30 commercially available materials at 300 °C were reviewed. The report reviewed the thermal sensitivity of the 30 materials using thermal surge stimuli, differential scanning calorimetry, and a system designed to determine quantitatively the percent decomposition of the materials. The amount of gas resulting from the thermal decomposition was also reported. The report shows that the hazard potential of these materials is related to the percent of thermal decomposition, the amount of gas liberated in decomposition, the flammability of the material, and the reactivity of the material in air. For further information, see Kayser E.G., The Thermal Decomposition of Thirty Commercially Available Materials at 300 °C, DOT Report No. TES–20–74–1, (1974), Department of Transportation, Washington, D.C.; and Tsang, W. & Domalski, E.S., An Appraisal of Methods for Estimating Self-Reaction Hazards, DOT Report TES–20–74–6, (1974), Department of Transportation, Washington, DC.

[11] Collision and Derailment of Montana Rail Link Freight Train with Locomotive Units and Hazardous Materials Release, Helena, Montana, February 2, 1989, National Transportation Safety Board Report NTSB/RAR–89/05, National Transportation Safety Board, Washington D.C.

[12] The names of some commodities on this list have been edited to conform to the proper shipping names shown in the Hazardous Materials Table at 49 CFR 172.101.

[13] Shippers; Specifications for Pressure Tank Car Tanks, Docket HM–144, 42 FR 46306 (September 15, 1977).

[14] Some sources refer to this phenomenon as a tank car BLEVE. That term, the acronym for Boiling Liquid Expanding Vapor Explosion (BLEVE), is technically imprecise to describe a thermally induced tank car rupture although it has become useful in the emergency response training field. A more complete description of tank car thermal ruptures, together with a technical discussion of the BLEVE, can be found in Emergency Action Guides, ©1990, Association of American Railroads, Washington, DC, pp. V–VII.

[15] This is the current performance standard in 49 CFR 179.105–4.

when analyzed with the tank and the cargo, may show that nothing further needs to be installed on the car to achieve passage of the Federal pool and torch fire performance tests. Research sponsored by the FRA on urethane foam and glass fiber insulation systems show that urethane foam insulation will pass the pool and torch fire requirements and that glass fiber insulation will also pass both tests provided the insulation is held in place with a plastic or wire scrim. Owners of tank cars with either of these systems, or another comparable system, may find that their thermal analysis of the car shows the presence of sufficient thermal protection to meet the performance standard. In this case, the tank car owner would have to verify only that the insulation material installed on the tank car is capable of passing the pool and torch fire verification or "proof" tests in part 179. Owners may find that a car will pass the performance standard with only minor modifications, such as applying a thermal protection system to the manway nozzle.[16]

While this notice is not the place for a detailed discussion of thermodynamics as applied to tank cars or of the use of thermal modelling as an acceptable approach for performing thermal analysis, the results of FRA research support the modelling concept.[17] Research shows that the thermal analysis should consider as a minimum a 100-minute pool fire having a flame intensity of 815.6 °C ± 37.77 °C (1500 °F ± 100 °F) over the entire surface of the tank car (including discontinuities); a 30-minute torch fire having a flame intensity of 1,204 °C ± 37.77 °C (2200 °F ± 100 °F) and a torch velocity 64.37 km/h ± 16.09 km/h (40 mph ± 10 mph). Other vital factors include the following: the cargo in the tank car, the angle of rollover, the diameter of the tank car, shell thickness, the capacity of the tank, the safety relief valve flow capacity and flow rating pressure, the safety relief valve start-to-discharge pressure, net absorptivity and emissivity of the tank car shell surface, the bursting strength of the tank, the thermal conductance of the tank car jacket and tank car shell material, the conductivity of the thermal protection system, the pressure of any nitrogen padding, the initial temperature of the tank car and its cargo, and the gas compressibility factor.

In some cases, the use of a high capacity safety relief valve with a low start-to-discharge pressure setting, the use of certain insulating materials, and the use of thicker or higher strength steels may be sufficient to meet the thermal protection performance requirements. As an example, if a tank car is constructed from TC128 steel plate 9/16-inch thick and has an adequately sized safety relief valve, some low vapor pressure cargoes may vent completely through the safety relief valve before the tank ruptures in a 100-minute pool fire or 30-minute torch fire. Such a car would conform to the performance standard for thermal protection and could be marked accordingly for that particular cargo.

As an example of how thermal modelling works, in a research contract for Occidental Chemical Corporation, the IIT Research Institute found that the urethane foam insulation applied to the company's DOT 105A tank cars was adequate to prevent failure of the tank in a 100-minute pool fire, when loaded with sulfur monochloride or sulfuryl chloride.[18]

Most commenters responding to the ANPRM and the SANPRM supported the need for a thermal protection system on tank cars transporting Division 2.1 (flammable gas) or 2.3 (poisonous gas) materials, regardless of tank car capacity. In contrast, some commenters opposed the application of a thermal protection system to tank cars transporting Division 2.2 materials (nonflammable gases) and anhydrous ammonia. In discussing tank cars constructed from either aluminum or nickel plate, most commenters said that the cargo within the tank should determine the need for a thermal protection system.

Class 2 materials: Under the current rules, tank cars used to transport Division 2.1 materials must have a thermal protection system, unless the tank car is a Class DOT 105 tank car that is also less than 18,500 gallons. There are no requirements for thermal protection for Division 2.2 materials. For Division 2.3 materials, the regulations contain grandfather clauses and other limited provisions that, overall, present an inconsistent regulatory scheme. Many commenters suggested the use of a thermal protection system for all Division 2.1 and 2.3 materials and RSPA agrees that these materials should be transported only in tank cars that have appropriate safeguards against fire. A comprehensive approach for all Division 2.1 and 2.3 materials, as proposed here, will require the owner or the shipper to assure an equivalent level of thermal protection, as prescribed in current § 179.105–4. This would require performing an analysis of the characteristics of the material and of the thermal resistance capabilities of the tank car, taking into consideration the safety relief valve start-to-discharge pressure setting and relief capacity and all areas of the tank car that are not afforded protection from fire (such as stub sills, bolsters, and protective housings). Such a whole systems approach ensures that all tank cars transporting a Division 2.1 or 2.3 material will have sufficient thermal resistance in a fire; in FRA's experience, all such materials will require the full measure of safety that only a thermal protection system can provide. This approach, analyzing the loaded car and designing a system to meet the standard for protection in pool and torch fires, is compatible with the regulatory framework of performance standards for packagings that has grown out of Docket HM–181. Because tank cars may transport different cargoes, and because changing cargoes may affect the whole system, owners or shippers may choose to perform a "worst case" analysis based on all the commodities the car is likely to carry.[19]

In 1981, a joint effort between the Chlorine Institute and the RPI–AAR Tank Car Safety Research and Test Project resulted in the development of an insulation system to protect a chlorine tank car involved in a fire. The developed insulation system maintains back plate (inside surface of the tank car shell) temperatures below 250.56 °C (483 °F). Since 1985, chlorine tank cars have been required to be equipped with half-head protection and an insulation system that meets the above requirements. The system consists of 5.08 cm (2 inches) of ceramic fiber covered by 5.08 cm (2 inches) of glass fiber encased in an eleven gauge steel

[16] The following research report contains additional information on the effectiveness of urethane foam and fiberglass: Wright, W.P., Slack W.A., and Jackson W.F., Evaluation of the Thermal Effectiveness of Urethane Foam and Fiberglass as Insulation Systems for Tank Cars, NTIS DOT/FRA/ORD–87/11 (1987), Federal Railroad Administration, Washington, DC.

[17] For example, further information about the effects of a pool fire on a tank car are available in Johnson, M.R., Temperatures, Pressures and Liquid Levels of Tank Cares Engulfed in Fires, NTIS DOT/FRA/OR&D–84/08.11 (1984), Federal Railroad Administration, Washington, DC. The procedures outlined in the cited work are being updated by the AAR and should be available from that organization prior to publication of a final rule in this docket.

[18] Johnson, Milton R., Fire Effects on Tank Cars Containing Sulphur Monochloride and Sulfuryl Chloride, IITRI Project VO8230 (1993), Occidental Chemical Corporation, Pasadena, Texas.

[19] Owners are reminded that 49 CFR 173.31 (a)(4) limits the use of tank cars to those commodities for which they are authorized. Authorized (or approved) commodities are those listed on the certificate of construction or an AAR R–1 form. (See the AAR Specifications for Tank Cars Section 1.4.3.1 and Appendix R, Section R4.04.)

jacket. Prior to 1985, the chlorine insulation system consisted of 10.16 cm (4 inches) of polyurethane foam or cork. The insulation system used today was incorporated into the HMR in 1981 by RSPA.[20] After reviewing the Chlorine Institute's insulation system, FRA and RSPA consider the thermal resistance capabilities of the current insulation system acceptable for the transportation of chlorine. This notice does not propose any new thermal protection requirements for chlorine.

While commenters do not agree on the need for thermal protection for Division 2.2 (non-flammable gas) materials, in the notice today, RSPA is proposing to require such a system if, after an analysis of the effects of a 100-minute pool fire and a 30-minute torch fire, there will be a release of the cargo from the tank car other than through the safety relief valve. An AAR publication states that "[a]t a chemical accident, there are generally two reasons for an evacuation, one is to protect the public from any toxic, poisonous, or noxious vapors or fumes generated by the product itself. . . ., the second is to protect the public from thermal ruptures and the container debris that may be hurled from an incident site." [21] Many Division 2.2 materials have both of these characteristics. For example, in the same publication, the AAR states that containers of dichlorodifluoromethane may rupture violently in fire due to increasing pressure and that the decomposition of dichlorodifluoromethane evolves highly toxic phosgene, fluorides, halogen acids, hydrogen chloride and carbonyl halides. Of the 125 materials most frequently shipped by rail,[22] only 4 fall into the Division 2.2 category: anhydrous ammonia;[23] carbon dioxide, refrigerated liquid; argon, refrigerated liquid; and dichlorodifluoromethane.

Anhydrous ammonia is transported in DOT 105A300W, 105S300W, 105J300W, 112S340W, 114S340W, 112J340W, and 114J340W specification tank cars (including the same class tank car with a higher marked tank test pressure). All these cars, with the exception of the DOT 112S and 114S tanks, are either insulated or have a thermal protection system. The RPI commented that, for anhydrous ammonia, there were three fire-induced ruptures in the 22-year RPI database reporting history (1965–1986):

—Orleans Road, West Virginia (11–28–77);
—Crestview, Florida (4–8–79); and,
—Hutchinson, Kansas (9–10–81).

Commenters to the ANPRM stated that even if the Class DOT 112 and 114 tank cars in the above accidents had been equipped with thermal protection, it would not have prevented their ruptures. Not only is this argument an exercise in historical speculation, but RSPA and FRA point to the proven benefits of the head shield, shelf coupler, thermal protection combination and conclude that thermal protection, at the very least, could have delayed the thermal rupture of the tanks by keeping the internal temperature of the tank shell below that at which it begins to thin and lose strength. Delay of ruptures, and not their absolute prevention, was the goal of the thermal protection systems, and that goal has been met.

Carbon dioxide is transported in DOT 105A500W specification tank cars equipped with two regulator valves, a reclosing pressure relief device, a frangible disc, and an insulation system with good thermal performance (a thermal conductance of 0.03 B.t.u. per square foot per degree fahrenheit differential). Consequently, existing and new tank cars in carbon dioxide service have sufficient thermal resistance and this notice would impose no new thermal protection requirements for those tank cars.

Argon, refrigerated liquid is transported in DOT 107A seamless-steel high-pressure cylinders that are mounted on a freight car structure. This notice would impose no new requirements for these types of tank cars because the carrying capacity of each cylinder is small and, if released, there would be no imminent or substantial harm to human health or the environment.

Dichlorodifluoromethane is commonly transported in DOT 114A tank cars having no insulation or thermal protection. As discussed later under the heading of "Health and environmental risks," dichlorodifluoromethane is banned from land disposal and RSPA believes that these tank cars are not equipped with the protection needed to ensure the protection of human health and the environment.

In this notice, RSPA proposes to require the owner or shipper of a tank car used to transport a Class 2 material to perform an analysis that will predict the behavior of the tank car in a 100-minute pool fire and in a 30-minute torch fire. If the analyses show that there will be a release of the cargo from the tank car, other than through the safety relief valve, a thermal protection system will be required. To analyze the thermal effects on a tank car, RSPA will allow the use of computer assisted thermal modelling. A possible alternative to the proposed performance standard is for RSPA to analyze each specific tank car/safety relief valve/compressed gas combination. This alternative approach is reasonably certain to lead to a patchwork of regulatory requirements rather than a single logical and consistent standard. The proposals contained in this notice are designed to reduce the violent rupture of a tank car in a fire environment.

Thermally reactive materials: For some thermally reactive materials,[24] the critical temperature for the tank car and its contents may be the heat at which the material undergoes decomposition or polymerization rather than the temperature at which the steel of the tank becomes so plastic that it begins to lose tensile strength. RSPA and FRA agree with the commenters that tank cars transporting thermally reactive materials need a thermal protection system.

Accidents involving thermally reactive materials can be dramatic. On August 2, 1988, at 9 p.m., at Brazoria, Texas, 13 cars of a Union Pacific freight train derailed.[25] Seven of the derailed cars contained acetaldehyde and none of these cars had a thermal protection system (nor was it required). Two acetaldehyde cars sustained coupler punctures and released their contents, which ignited. The resulting fire engulfed 4 other acetaldehyde cars and each of them had a total failure, or rupture, of the tank shell within 5 to 10 minutes after the derailment. Witnesses reported "3–4 explosions between 9:05 and 9:10." It would be speculation to assume that a thermal protection system would have extended the time before rupture of these cars, but the effectiveness of the combination of head shields, shelf couplers, and thermal protection has been amply demonstrated.

As with Class 2 materials, RSPA believes that the best approach for applying thermal protection systems on

[20] Transportation of Hazardous Materials; Miscellaneous Amendments, Docket HM–166U, 52 FR 13034, (April 20, 1987).

[21] Emergency Action Guides, p. VII.

[22] Annual Report of Hazardous Materials Transported by Rail / Year 1992, Association of American Railroads, Bureau of Explosives, Washington, DC, p. 3ff.

[23] Anhydrous ammonia meets the criteria of poisonous by inhalation and for international transportation is classified in Division 2.3 Zone D.

[24] A listing of the thermally reactive materials affected by this proposal appears earlier, in the section discussing the need for head protection systems on cars.

[25] Union Pacific derailment at Brazoria, Texas, FRA Accident Investigation No. 137–88, Railroad Report No. 0888H0200, August 2, 1988.

tank cars transporting thermally reactive materials is to require the owner or the shipper to perform an analysis of the predictable performance of the loaded car in a fire environment and to apply a thermal protection system that will (1) prevent the release of any cargo, other than through the safety relief valves, in a 100-minute pool fire and a 30-minute torch fire and (2), for the same time periods, maintain the internal temperature of the chemical in the tank below a level that will accelerate the decomposition or polymerization of the lading.

Tank cars constructed from aluminum and nickel plate: Recent tests performed for the FRA at the Transportation Test Center in Pueblo, Colorado, show that during the torch fire test the back plate temperatures[26] of a non-protected tank car constructed from aluminum plate will reach 427 °C (800 °F.) within 3 minutes and the aluminum plate will melt through in 5 minutes.

In the pool fire test, back plate temperatures reached 427 °C within 25 minutes; 75 minutes short of the carbon steel standard. The pool fire tests also showed that glass fiber insulation enclosed within an eleven gauge steel jacket offers no additional protection at all. The high temperatures from the test flame caused the glass fiber to lose tensile strength and fail, leaving the aluminum plate exposed to the direct radiant heat from the jacket. Because the glass fiber melted and fell away from the tank shortly after initiating the test, the thermocouples on the aluminum back plate showed a rapid temperature rise above 427 °C within 30-minutes, 70 minutes short of the carbon steel standard. When testing a thermal protection system and/or aluminum plate combination, however, FRA found that aluminum back plate temperatures during the 100-minute pool fire test remained well below 427 °C.[27]

Although FRA did not conduct fire tests on tank cars constructed from nickel plate, RSPA considers the properties of nickel plate similar to those of aluminum and the proposed rules will treat them similarly.

In consideration of the FRA research summarized above, and based on the comments received, FRA and RSPA consider thermal protection essential for tank cars constructed from either aluminum or nickel plate when used to transport a Class 2 or thermally reactive material. FRA and RSPA believe that all such cars will need protection. RSPA proposes to require the owner of a tank car constructed from aluminum or nickel plate that is used to transport a Class 2 or thermally reactive material to perform an analysis of the tank car in a 100-minute pool fire and in a 30-minute torch fire. If the analysis shows that there will be a release of the cargo from the tank car, other than through the safety relief valve, a thermal protection system will be required.

Compressed gases that are poisonous by inhalation: Commodities in this category include Division 2.3 materials and anhydrous ammonia. As with liquid PIH materials (see below), and based on the proven ability of tank jackets to reduce shell punctures, RSPA is proposing the use of a tank car that has a jacket conforming to § 179.100–4 of this subchapter and a tank test pressure of at least 300 psi for compressed gases that are also PIH. Bottom outlets would not be authorized.

In a 1987 report on the vulnerability of pressure tank car shells to puncture, the RPI found that shelf couplers, hardboard insulation (cork), increased shell thickness, thermal protection, small tank car size and increased jacket thickness proved effective towards reducing the frequency of shell punctures.[28] The report summarizes a 20½-year history of accident data on shell punctures of pressure tank cars and concludes that the 11-gauge steel jacket provides a measure of shell protection.

RSPA is proposing that tank cars transporting PIH materials that did not require a tank jacket prior to the effective date of any final rule in this docket must have a tank jacket that conforms to the requirements of § 179.100–4 of this subchapter no later than 10 years from the final rule's effective date.

Liquid materials poisonous by inhalation: The regulations adopted under Docket HM–181[29] require the application of a thermal protection system on a tank car used to transport a PIH liquid material. Persons seeking further information on PIH liquid materials should refer to that proceeding.

On September 24, 1993, RSPA published a final rule, under Docket HM–181F (58 FR 50224), containing provisions that removed the applicability of Special Provision B14 for tank cars (a requirement for insulation), revised Special Provision B74 to allow the optional use of an insulated DOT 105S tank car or a non-insulated, but thermally protected, DOT 112J or 114J tank car for "liquid" PIH materials, allowed the construction of pressure tank cars from ASTM Type 304L or 316L stainless steel plate, and revised Note 30 in § 173.314(c) to authorize the use of DOT 105S tank cars for chlorine; hydrogen chloride, refrigerated liquid; methyl bromide; nitrosyl chloride; nitrous oxide; and sulfur dioxide.

IV. Self-energized manways located below the liquid level of the cargo

On September 8, 1987, in a railroad yard in New Orleans, Louisiana, a tank car equipped with a self-energized bottom manway and loaded with butadiene developed a leak and caught fire. At one point, the flames were large enough that both spans of a bridge on Interstate 10 were engulfed. After the investigation, the NTSB concluded that "it is unlikely that a hazardous materials leak through a bottom manway during transportation could be stopped." The NTSB urged the FRA to prohibit the transportation of tank cars that have a manway opening located below the liquid level of the lading in hazardous materials service.[30] Because the design of bottom manways depends in part on the weight of the product and the pressure in the tank to make the seal fully effective, RSPA and FRA agree with the NTSB's conclusion.

The design was never popular and FRA believes that there are only 14 such cars in the United States fleet. Other tank cars of this construction that might operate in the United States would be of Canadian or Mexican origin. Most commenters expressed support for the removal of internal self-energized manways located below the liquid level of the cargo, with one commenter proposing no new construction and the modification of existing tank cars within 2 years. FRA and RSPA support the commenters' suggestions and RSPA is proposing to revise § 173.31 to prohibit the use of internal self-energized

[26] 49 CFR 179.105–4(d) and (e) describes the procedures for conducting the pool fire and torch fire tests, respectively. The "back plate temperature" measurement determines the heat on the non-insulated side of the test material, that is, on the side away from the direct flame. The standard for carbon steel tank cars declares a test failure if any of the nine required thermocouples detects a temperature in excess of 427 °C. (800 °F.)

[27] Larson, W.G., Fire Tests on Insulation for Aluminum Tank Cars, NTIS DOT/FRA/ORD–87/04, (1987) Federal Railroad Administration, Washington, DC.

[28] Phillips, E.A., Review of Pressure Car Shell Puncture Vulnerability, RA–09–6–52, (1987), AAR–RPI Railway Tank Car Safety Research and Test Project, AAR Technical Center, Chicago, Illinois.

[29] Performance Oriented Packaging, Docket HM–181, 55 FR 52402, (December 21, 1990).

[30] Butadiene Release and Fire from GATX 55996 at the CSX Terminal Junction Interchange, New Orleans, Louisiana, September 8, 1987, National Transportation Safety Board Report NTSB/HZM–88/01, National Transportation Safety Board, Washington, DC.

manways located below the liquid level of the cargo after a 2-year period. For new tank cars, RSPA is proposing to revise the construction standard for Class DOT 114 tank cars in § 179.103–5, thereby prohibiting further new construction of tank cars with internal self-energized manways located below the liquid level of the cargo; existing cars would have to be modified.

V. Non-Pressure tank cars for materials poisonous by inhalation

With the publication of the Docket HM–181 final rule, as of October 1, 1993, nearly all liquefied compressed gas PIH materials must be transported in Class DOT 105, 112, and 114 pressure tank cars with a test pressure that conforms to § 173.31(a)(14). In §§ 173.314 and 173.323, however, certain PIH materials are authorized in Class DOT 111A tank cars. For instance, the regulations authorize the transportation of methyl bromide (§ 173.314) and ethylene oxide (§ 173.323) in DOT 111A100W4 specification tank cars.

In a recent research report,[31] the FRA found that, in a single car national risk profile, the transportation of ethylene oxide in a DOT 111A100W4 tank car involves significantly greater risk than the transportation of the same material in a DOT 105J500W tank car. Characteristics and parameters evaluated in this assessment included the toxicity, the fire hazard, and the explosion hazard. In comments to the ANPRM, the Railway Progress Institute (RPI) reported that, during the time period of 1965 through 1986, DOT 111A tank cars involved in accidents and damaged were slightly more than three times as likely to lose cargo as were DOT 105 cars in similar situations.[32]

The Raj/Turner report amply demonstrates (and AAR/RPI Tank Car Safety Test and Research Project data support) that it is "improbable" to assume that any single DOT 111A or DOT 105 car would be involved in an accident. Based on FRA accident data, however, a significant number of such cars will be involved in accidents during their service life. Accordingly, because of the hazards associated with these materials and the performance superiority of the DOT 105 car for this service, this notice proposes to remove the Class DOT 111A tank car as an authorized packaging for Division 2.3 materials. The majority of the commenters to the ANPRM support prohibiting non-pressure tank cars for the transportation of PIH materials.

VI. Phasing out of Various Grandfather Clauses

"Grandfather" clauses in several regulations allow tank cars constructed or built before a certain date to remain in service without modification. As an example, in § 173.314(c), Notes 23 and 24 allow the continued use of DOT 105A tank cars for certain compressed and flammable gases if they were built before September 1, 1981, while tank cars built after that date must meet a more stringent DOT 105S or 105J standard.

The NTSB stated, in a March 1, 1988 letter to RSPA that it was time to stop using tank cars that fail to meet current minimum safety requirements for the transportation of hazardous materials under grandfather clauses. The NTSB indicated that grandfather clauses could result in a reduced level of safety. The AAR also petitioned RSPA to amend § 173.314(c) Note 30 (P–1138):

> Because it does not provide any assurance that tank cars with head protection will be used for PIH [poisonous by inhalation] compressed gas service in the foreseeable future. * * * [C]ompanies will be able to use tank cars without head protection for PIH compressed gas service for the next thirty years. * * *

Although the majority of commenters did not support the phasing out of grandfather clauses from the regulations, expressing special concern about banning formerly approved materials of construction, RSPA agrees with both the NTSB and the AAR that there should be no allowance for the permanent use of tank cars that do not meet minimum safety requirements. In this notice, RSPA is not proposing to abandon older materials of construction, but rather to eliminate specific grandfather clauses that are no longer compatible with the needs of safety.

As further illustration, in § 171.102, special provision "B63" continues to allow the use of DOT 105A100W, 111A100W4, 112A200W and 114A340W tank cars for ethyl chloride and ethyl methyl ether, provided the cars were constructed before September 1, 1991.[33] These tank cars do not provide an equivalent level of safety to other tank cars used for Division 2.1 materials, because these tank cars do not have head protection or thermal protection systems. This notice proposes to remove special provision "B63" from column 7 of the hazardous materials table; thereby prohibiting the use of non-protected tank cars for these two materials.

The current § 173.314(c) also allows the use of Class DOT 111A non-pressure tank cars for certain Class 2 (compressed gas) materials, such as ammonia solutions, ethylamine, ethyl chloride and ethyl methyl ether. This notice proposes to remove the authorization for the use of Class DOT 111A non-pressure tank cars for Class 2 materials.

The proposed revision to § 173.323(c)(1) will remove the DOT 111A100W4 car as a proper packaging for ethylene oxide and will "sunset" its head protected and thermally protected DOT 111J alternative. Based on information obtained by the FRA, there are no DOT 111J tank cars in the national fleet; therefore, RSPA is proposing to remove the authorization for these tank cars on the effective date of this rule.

VII. Bottom Outlets

There are two principal issues concerning bottom outlets: first, whether or not they should be permitted at all and, second, whether, if permitted, they can and should be protected against damage during a derailment, when the tank car may separate from its wheel assemblies and allow any bottom fitting to fail following a collision with the ground.

Nearly all commenters to the ANPRM opposed the total elimination of bottom outlets on tank cars. One commenter stated that the benefits to be realized from removing bottom outlets are much smaller than the costs. Another pointed out that removing the bottom outlet on approximately 45,000 tank cars would require extensive modifications to the top fittings on those cars. Another commenter stated that the elimination of the bottom outlet would have drastic economic implications, such as preventing tank car to cargo tank transfers at many facilities. Commenters also said that eliminating bottom unloading fittings would prevent the continuation of highly successful unit-train operations, with good safety records, in sulfuric acid service, and it would require the installation of top unloading racks at facilities now using the bottom outlet to unload the tank car. Finally, commenters said that prohibiting bottom outlets would make cleaning of certain cars difficult, if not impossible.

RSPA agrees with the commenters that banning bottom outlets altogether may decrease safety at tank car

[31] Raj, P.K., and Turner, C.K., Hazardous Materials Transportation in Tank Cars/Analysis of Risks—Part 1, NTIS DOT/FRA/ORD–92/34, (1993), Federal Railroad Administration, Washington, DC.

[32] Phillips, E.A., Analysis of Tank Cars Damaged in Accidents 1965 through 1986, RA–02–6–55, (1989), AAR–RPI Railway Tank Car Safety Test and Research Project, AAR Technical Center, Chicago, Illinois.

[33] Prior to the issuance of Docket HM–181, these two materials were classed as a flammable liquid.

unloading facilities by requiring employees to climb on top of cars to connect and disconnect transfer hoses. In addition, with top unloading it is typical to pump air into the car to displace the cargo out the liquid eduction line; the elimination of bottom outlets would expose more employees to high-pressure air inlet lines. The concerns at unloading facilities, however, are no less important than reducing the chances of a release of a hazardous material from the bottom outlet, sheared off in a derailment, on a tank car.

To balance these competing interests, RSPA is proposing to require accident damage protection for, instead of removal of, bottom fittings.

In 1978, the AAR developed bottom discontinuity protection requirements for new tank car construction. Over a period of years, these requirements were extended to existing tank cars on a priority schedule determined by the nature of the commodity transported. AAR-developed bottom discontinuity protection consists of either a metal "skid" protecting the portion of the bottom outlet that protrudes beyond the shell or the machining of a "breakage groove" in the valve assembly.

The Chemical Manufacturers Association, an industry association of chemical and petroleum producers and shippers, along with other tank car owners and users, supports the AAR's design. A report from the AAR/RPI Tank Car Safety Research and Test Project that shows that, taking bottom outlet valves and washouts as a group, the overall effectiveness of the AAR's bottom discontinuity protection requirements was 55 percent during the period 1971 through 1986.[34] Additionally, the RPI reports that bottom outlet protection led to a 42 percent reduction in the average cargo loss.

RSPA is proposing to require bottom outlet protection for all tank cars equipped with bottom unloading devices. New cars would have to meet the requirement as of the effective date of any final rule published under this docket. Those existing cars that are outside the scope of the AAR requirements would have 10 years from the effective date of the final rule to meet the standard. As proposed, bottom outlet protection systems would have to conform to paragraphs E9.00 and E10.00 of the AAR Specification for Tank Cars, M-1002. Paragraphs E9.00 and E10.00 generally require the protection of each valve and fitting from mechanical damage by the tank, another protective device, such as a tank saddle or skid plate, or the underframe. Furthermore, paragraphs E9.00 and E10.00 require that the protective device must be designed as follows—

(1) A load, normal to the slope of the protective device, whose vertical component equals the rail load minus the weight (mass) of the trucks;

(2) The above load must be considered as concentrated on any transverse line on the protective device;

(3) The stresses in the tank shell, the protective device, and its connections to the tank shell must not exceed the minimum tensile strength of the material. In addition, the combined stress in the tank shell due to the load specified above and an internal pressure, equal to the safety relief valve start-to-discharge pressure, may not exceed the minimum tensile strength of the shell material. The stresses in the webs of the protective device may not exceed the critical buckling stress;

(4) The longitudinal slope of the protective device must not exceed 1:3;

(5) Any vertical extension of the discontinuity below the protective device must be designed to break off without rupturing the tank or releasing lading. The protective device must extend down to, or below, the level of the discontinuity, or its designed breaking point. For bottom outlets, the skid should extend down to the breakage groove, or to the extreme outward projection of the parts comprising the equivalent of a breakage groove;

(6) The skid, when used, must be of fabricated, cast or forged design and be of a material compatible with that to which it is attached;

(7) The design of the protective device must take into account any abrupt change in stiffness from the long, rigid protective device to the flexible tank shell;

(8) Bottom outlet valve handles, unless stowed separately, must be designed to either bend or break free on impact, or the handle in the closed position must be located above the bottom surface of the skid; and

(9) Bottom profile of the protective device must provide a sliding surface without discontinuities.

VIII. Protective Coatings on Insulated Tank Cars

In recent years, it has become ever more apparent that the insulation of jacketed tank cars has an undesirable side effect. FRA has learned of several insulated tank cars with severe corrosion or pitting on the outer surface of the shell, or the inner surface of the jacket. It is not exactly known whether the corrosion stems from the physical properties of the insulation itself or whether the corrosion develops when insulation becomes impregnated or contaminated with water or a chemical from the atmosphere in which the tank car operates. Research within the industry has led to the development of protective coating materials.

In 1988, AAR petitioned RSPA[35] to amend the regulations to incorporate a require protective coatings on the exterior of a tank car and the interior of a tank car jacket to retard rust or corrosion for new car construction. Most comments received to the ANPRM supported a requirement similar to that suggested by AAR. One commenter asked RSPA to consider adopting a recommended practice for applying protective coatings on tank cars that is now under development by the National Association of Corrosion Engineers (NACE).

RSPA is proposing to adopt the suggestions made by the commenters and by the AAR to require protective coatings for all new tank cars[36] and for existing tank cars when a repair to the tank car requires the complete removal of the jacket. The NACE proposal is under consideration at meetings of the AAR Tank Car Committee and will be reviewed in that context. If warranted, a subsequent rulemaking proceeding may propose the adoption of this or other anti-corrosion protocols.

IX. Health and Environmental Risks

Beginning with the Rivers and Harbors Act of 1899, Congress has passed many laws to protect human health and the environment from hazardous substances and wastes. Major modern environmental legislative programs began after 1970 with the passage of the Resource Conservation and Recovery Act of 1976 to control and manage hazardous waste disposal sites; the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) to clean-up abandoned hazardous waste sites; the Toxic Substances Control Act to require testing of manufactured materials to determine their effect on human health and the environment; and the Federal Insecticide, Fungicide and Rodenticide Act to require the registration and

[34] Phillips, E.A., Bottom Discontinuity Protection Effectiveness on DOT 111A Stub Sill Tank Cars, RA-09-7-60, (1992), AAR-RPI Railway Tank Car Safety Test and Research Project, AAR Technical Center, Chicago, IL.

[35] Rulemaking petition No. P-1050.

[36] Current requirements, at 49 CFR 179.100-4(a) and 197.200-4(a), state ". . . protective coating is not required when foam-in-place insulation that adheres to the tank or jacket is applied." The proposal here would require protective coatings on all insulated tank cars.

regulation of chemicals that manufacturers produce. With the enactment of CERCLA in 1980, the body of law directed at environmental protection merged into hazardous materials transportation law as Congress required the Secretary of Transportation to list all hazardous substances as hazardous materials.

In 1984, Congress enacted the Hazardous and Solid Waste Amendments of 1984,[37] prohibiting the continued land disposal (including spillage or leakage) of untreated wastes because of the potential of these wastes to cause harm to human health and the environment. The statute requires the Environmental Protection Agency (EPA) to set

levels or methods of treatment, if any, which substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of the hazardous constituents from the waste so that short-term and long-term threats to human health and the environment are minimized.[38]

As enacted, the legislation set forth a series of deadlines that would restrict further land disposal of certain wastes if no levels or methods of treatment were set by EPA. Untreated wastes, as identified by Congress and set forth in the legislation, were restricted from land disposal after a certain date. All such deadlines have now passed.

The rationale for restricting wastes from land disposal focuses primarily on the relationship between disposal of a hazardous waste and ground water quality. In 40 CFR part 261, EPA classified wastes as hazardous based on the potential of those wastes to cause harm to human health and the environment. EPA's determinations include the potential harm of the material on human health and the environment as a result of the characteristics of the material (reactivity, ignitability, corrosivity, or toxicity) as seen in ground water or a surface water pathway.

Based on information on untreated wastes and on other environmental contaminants such as pesticides, RSPA proposes certain new requirements for HOCs that are banned from land disposal by the EPA. HOCs pose a risk to human health and the environment when transported in large capacity tank cars because, in addition to toxicity, when released, HOCs are persistent in soil and have the potential for large scale soil and groundwater contamination. In addition, when HOCs are released they have the potential to cause depression of the central nervous system by acting as a general anesthetic, inhibiting activity in the brain and spinal cord and lowering a person's functional capacity. After systemic absorption, other potential acute toxicities include hepatotoxicity (toxic effects in the liver), nephrotoxicity (toxic effects in the kidneys), and cardiac arrhythmias induced by sensitization of the heart to adrenaline or adrenaline-like compounds. Animal studies and accidental human poisonings have shown that these and other organ toxicities may be produced by acute exposure to organic solvents, such as certain HOCs.[39]

In addition to the acute or chronic toxicity of these materials, HOCs are persistent in soil and difficult to remove (or clean up) after a spill. Railroads have incurred enormous costs for environmental clean-up after the release or disposal of HOCs. As an example, on September 28, 1982, several cars of an Illinois Central Gulf freight train derailed at Livingston, Louisiana. As a result of the derailment, one tank car spilled approximately 14,000 gallons of perchloroethylene (an HOC). Two weeks after the incident, the Louisiana Department of Natural Resources (DNR) detected perchloroethylene in concentrations of up to 25 parts per million (ppm) in the soil at the derailment site. It was also discovered that the chemical had migrated well beyond the derailment location. The town of Livingston obtains its drinking water from wells by tapping a deep aquifer and, to prevent human health risks from the chemical, the DNR established a 0.3 ppm concentration of perchloroethylene as the criterion for the maximum safe level of groundwater contamination. Since the accident, the railroad has incurred over $20 million in environmental clean-up costs.

In creating and enacting the environmental legislation referenced earlier, Congress made evident its concern about constituents that are both mobile and potentially hazardous to human health and the environment. Based on these concerns, EPA has identified and listed in 40 CFR Part 268, Appendix III, HOCs that share these characteristics. The EPA list represents a comprehensive, yet enforceable, list of HOCs. RSPA, in keeping with Congressional intent, is concentrating first on wastes that are known to create a substantial risk of harm to human health and the environment and, in this proceeding, RSPA is proposing improved packagings for certain HOCs transported by railroad and identified as regulatory priorities by the EPA.

In a recent report on the cost effectiveness of transporting HOCs in pressure tank cars,[40] the AAR identified 10 of 83 HOCs that are currently transported by rail in non-pressure tank cars without safety improvements such as head protection and thus present a greater than acceptable risk of harm to humans and the environment. The AAR states that these HOCs should be transported by rail in pressure tank cars. In support of its thesis, AAR shows that, within the last 10 years, the release of HOCs in railroad accidents has resulted in environmental clean-up costs exceeding $50 million and that, even though these materials accounted for less than one percent of the total car volume of hazardous materials movements, their releases accounted for 60 percent of all railroad environmental clean-up costs. The AAR report concludes that the net present value of the benefit minus the costs of using a DOT 105A300W specification tank car for the transportation of HOCs over a 30-year lifetime is $60.5 million.

The AAR report suggests that shippers should use DOT 105A300W or DOT 105A500W specification tank cars to minimize the risks of transporting HOCs. RSPA and FRA have recently learned that the railroad and chemical industry associations have adopted a recommendation for the jacketed DOT 105S200W and the non-jacketed DOT 112S200W tank car to transport HOCs. From a puncture resistance standpoint, neither RSPA nor FRA considers that these tank cars provide equivalent puncture resistance, because the DOT 105S200W tank car has the additional protection afforded by its jacket.[41] This view is supported by an RPI report cited earlier.[42] RPI reviewed 20½ years of accident data and concluded that DOT 105A tank cars and non-jacketed DOT 112A tank cars had about the same

[37] The act amended RCRA secs. 3004(d)(1), (e)(1), and (g)(5) (42 U.S.C. 6924(d)(1), (e)(1), and (g)(5)).

[38] RCRA sec. 3004(m)(1) (42 U.S.C. 6924(m)(1)).

[39] Williams, Phillip L. & Burson, James L., "Industrial Toxicology," in James, Robert C., The Toxic Effects of Organic Solvents, Van Norstrand Reinhold, New York, 1985, pp 230–232.

[40] Barkan, Glickman, & Harvey, Benefit-Cost Analysis of Using Type 105 Tank Cars Instead of Type 111 Tank Cars to Ship Environmentally Sensitive Chemicals, R–794, (1991), AAR Document Distribution Center, Chicago, IL.

[41] Simple puncture resistance calculations show that the DOT 105S200W and the 112S340W have about 13 percent more shell puncture resistance than the non-jacketed DOT 112S200W tank car. Adding a jacket to the DOT 112S200W tank car removes this deficit. FRA calculated puncture resistance by multiplying 75 percent of the tensile strength of the steel used in the tank shell by the thickness of the plate. For jacketed tank cars a similar calculation was made for the 11 gauge jacket and the result was added to the tank shell calculation.

[42] Phillips, Review of Pressure Car Shell Puncture Vulnerability.

degree of vulnerability to puncture. The comparability is explained by the average thickness of the steels in the two groups of cars: The DOT 105A has an average shell thickness of 1.49 cm (0.585 inches) and a 0.30 cm (0.119 inches) steel jacket, for a total of 1.79 cm (0.705 inches); the DOT 112A has an average shell thickness of 1.757 cm (0.692 inches). In summary, the thinner 105A car achieves equivalency with the thicker 112A car through the extra protection provided by its jacket.

RSPA and FRA consider that adequate accident damage protection is provided by the use of an 11-gauge metal jacket (in addition to head shields) on DOT 105S tank cars and on DOT 112J and 114J tank cars. The metal jacket and head shields on these tank cars blunt the impacting forces from couplers, wheels, track, and other objects along the carrier's right of way. According to FRA research, this blunting effect is directly proportional to the thickness of the tank jacket or head shield and is effective in preventing tank punctures.[43]

Therefore, to provide equivalent puncture resistance, RSPA is proposing the use of a DOT 105S200W, a jacketed DOT 112S200W, or a 112S340W tank car for HOCs.

Rules developed by the EPA, require the "initial generator" of a hazardous waste to make a determination as to whether or not the waste is restricted from land disposal based on the generator's knowledge of the waste. In such cases, the generator must maintain all supporting data used to make the determination on-site in the generator's files. Under the provisions contained in this notice, shippers (i.e., generators) would retain responsibility for making a determination of whether or not an HOC is restricted from land disposal.

Furthermore, in a 1991 report, the NTSB urged RSPA and FRA to consider environmental contamination and its effects on human health when authorizing the use of tank cars.[44] The NTSB recommended RSPA and FRA:

establish [ ] a working group . . . to expeditiously improve the packaging of the more dangerous products (such as those that are highly flammable or toxic, or pose a threat to health through contamination of the environment). . . .

RSPA and FRA agree with the NTSB that there is a need to consider long-term health effects and environmental risks when authorizing packages for hazardous materials and, in this notice, RSPA proposes the mandatory use, for the transportation of materials that pose a potential harm to human health and the environment, of tank cars that are more likely to survive a railroad accident. On May 15, 1992, the NTSB closed the recommendation to FRA, but urged "FRA to expedite its rulemaking activities under Docket HM-175A. . . ." RSPA and FRA believe that the actions taken in this notice are responsive to the NTSB's letter and recommendation.

RSPA believes that using the EPA list of wastes that are prohibited from land disposal is a consistent and easily understood course of action for targeting potential materials that should be transported in improved packaging.

As to other materials that could potentially cause harm to human health and the environment, RSPA, in cooperation with other DOT agencies and the EPA, will address them in future rulemaking actions when more information on each chemical and its transportation risks becomes available. RSPA asks for comments on the number of tank car shipments, if any, and the tank car specifications used for other materials banned from land disposal by the EPA. This information will help RSPA evaluate the need to develop future rulemaking actions.

X. Implementation of New Requirements.

FRA and RSPA have considered many factors in developing the compliance periods proposed in this notice. These factors include:

- The safety benefits of the proposals made in this notice,
- The need to establish priorities for the proposed modifications,
- The possible impact of these proposals on other safety initiatives mandated by FRA, RSPA, and the railroad industry and the capacity of shops and repair facilities to handle these initiatives,
- Minimizing equipment shortages,
- The realization, based on the best estimates available of the number of tank cars affected by these proposals, that no governmental entity can achieve change overnight merely by mandating it.

For tank cars built on or after the effective date of the final rule published under this docket, the proposed requirements would take effect immediately. For tank cars built prior to the effective date ("existing tank cars"), the compliance dates are summarized in the table below.

Under "Option A," in the table, most of the proposed compliance dates are set at 10 years from the effective date of the final rule under this docket. This 10-year period will allow tank car owners to coordinate necessary retrofit modifications with the "thorough inspection" interval for tank cars in Interchange Rule 88.B.1,[45] and with the retest interval for most single-unit tank car tanks specified in § 173.31(c). A 10-year period also coincides with the duration frequently specified in typical full term tank car leases, whether a true lease or a financing vehicle.

FRA and RSPA believe that certain tank car types and car/commodity combinations should be considered for shorter retrofit periods, with 5 years given to bring existing cars into compliance. "Option B" in the table presents these intervals. For instance, aluminum and nickel tank cars are more vulnerable to tank puncture and tanks used for transporting PIH materials or thermally reactive materials present special hazards.

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[43] Coltman, M., & Hazel, M., Jr., Chlorine Tank Car Puncutre Resistance Evaluation, Report DOT/FRA/ORD-92-11, (1992) Federal Railroad Administration, Washington, DC.

[44] Transport of Hazardous Materials by Rail, National Transportation Safety Board Safety Study, Report NTSB/SS-91/01, National Transportation Safety Board, Washington, DC.

[45] Field Manual of the Interchange Rules, adopted by the Association of American Railroads, Mechanical Division, Washington, DC 1992. At intervals not to exceed ten years, major components of the car must be inspected, including body bolsters and center plates, center sills, crossbearer, cross ties, draft systems and components, end sills, side sills, and trucks.

Implementation of Requirements for Existing Tank Cars

SAFETY FEATURE	Current Requirements	Proposed Requirements	Compliance: Option "A"	Compliance: Option "B"
Tank head protection				
Tank cars currently equipped with half-head protection	Currently authorized in §§ 179.105-5 and 179.100-23	Would be authorized by § 173.31(a)(19)	N/A	N/A
Class 105 tank cars < 18,500 gallons	Head protection not required	Full-head protection would be required by § 173.31(a)(19)	10 years	10 years
Tank cars transporting Division 2.2 materials	Head protection not required	Full-head protection would be required by § 173.31(a)(19)(i)	10 years	10 years
Aluminum and nickel tank cars	Head protection not required	Full-head protection would be required by § 173.31(a)(19)(ii)	10 years	5 years
Tank cars transporting thermally reactive materials	Head protection not required	Full-head protection would be required by § 173.31(a)(19)(ii)	10 years	5 years
Shell protection				
Tank cars transporting materials poisonous by inhalation	Some require shell protection	Would be required by § 173.31(a)(21)	10 years	5 years
Thermal protection systems				
Division 2.1	Thermal protection required, except for Class DOT 105 cars < 18,500 gallons	Would be required by § 173.31(a)(20) based on an analysis	10 years	10 years
Division 2.2	Thermal protection not required	Would be required by § 173.31(a)(20) based on an analysis	10 years	10 years

SAFETY FEATURE	Current Requirements	Proposed Requirements	Compliance: Option "A"	Compliance: Option "B"
Division 2.3	Some require thermal protection	Would be required by § 173.31(a)(20) based on an analysis	10 years	5 years
Thermally reactive materials	Some require thermal protection	Would be required by § 173.31(a)(20) based on an analysis	10 years	5 years
Aluminum and nickel tank cars	Thermal protection not required	Would be required, based on an analysis, if the car is carrying a Class 2 or thermally reactive material	10 years	5 years
Self-energized manways				
	Authorized by § 179.103-5(a)(1)	Would be prohibited by §§ 173.31(a)(21) and 179.103-5.	2 years	2 years
Non-pressure tank cars for PIH materials				
	Authorized for certain materials	Would be prohibited by § 171.102, Special Provisions B72 and B74 and by §§ 173.314 and 173.323	Immediately	Immediately
Grandfather clauses				
	Authorized for certain materials	Would be removed in §§ 172.102, 173.314, and 173.323	Varies: Details are elsewhere in this chart	Varies: Details are elsewhere in this chart
Bottom outlet protection				
	Except for breakage grooves, industry requirements only	Would be required by §§ 173.31(a)(22) and 179.20	AAR standard: immediately; all others: 10 years	AAR standard: immediately; all others: 10 years
Protective coatings on insulated tank cars				
	Required, except for polyurethane foams, by §§ 179.100-4(a) and 179.200-4(a)	Would be required by §§ 173.31(f)(3), 179.100-4(a), and 179.200-4(a)	New construction: immediately; existing cars: when repair requires complete removal of the tank jacket	New construction: immediately; existing cars: when repair requires complete removal of the tank jacket

SAFETY FEATURE	Current Requirements	Proposed Requirements	Compliance: Option "A"	Compliance: Option "B"
Health and environmental risks				
	Authorized in non-pressure Class DOT 111 cars	DOT 105S200W, jacketed 112S200W, or 112S340W pressure tank cars would be required	10 years	10 years

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Substantive comments are solicited on the appropriateness of these compliance periods. Comment is also requested on the means by which proposed compliance might be scheduled, e.g., through a requirement to retrofit at the next retest date, at a change of ownership, or when a tank car is changed to a commodity service that requires the protection afforded by any of the retrofits proposed in this notice.

XI. Review by Section

Part 172

Section 172.101. In the Hazardous Materials Table, Special Provision 23 would be added, in Column 7, of the entries for the following thermally reactive materials:

Acetaldehyde
Acrolein, inhibited
Acrylic acid, inhibited
Acrylonitrile, inhibited
Butylacrylate
Chloroprene, inhibited
Crotonaldehyde, stabilized
Dimethylaminoethyl methacrylate
Dimethylhydrazine, unsymmetrical
Dinitrotoluenes, liquid
Dinitrotoluenes, molten
Dinitrotoluenes, solid
Ethyl acrylate, inhibited
Ethyl methacrylate
Ethyl nitrite solutions
Ethylene oxide, pure or with nitrogen
Ethyleneimine, inhibited
Hydrazine, anhydrous *or* Hydrazine aqueous solutions *with more than 64 per cent hydrazine, by mass*
Hydrogen cyanide, anhydrous, stabilized
Hydrogen peroxide, aqueous solutions with more than 40 per cent but not more than 60 per cent hydrogen peroxide tabilized as necessary).
Hydrogen peroxide, aqueous solutions with not less than 20 per cent but not more than 40 per cent hydrogen peroxide (stabilized as necessary)
Hydrogen peroxide, stabilized or Hydrogen peroxide aqueous solutions, stabilized with more than 60 per cent hydrogen peroxide
Isobutyl acrylate
Isoprene, inhibited
Isopropyl nitrate
Methacrylic acid, inhibited
Methacrylonitrile, inhibited
Methyl acrylate, inhibited
Methyl isopropenyl ketone, inhibited
Methyl methacrylate monomer, inhibited
Methyl vinyl ketone
Motor fuel anti-knock mixtures
Nitroethane
Propylene oxide
Propyleneimine, inhibited
Styrene monomer, inhibited
Sulfur trioxide, inhibited
Sulfur trioxide, uninhibited
Vinyl acetate, inhibited *mixed isomers*
Vinyl ethyl ether, inhibited
Vinyl isobutyl ether, inhibited
Vinyl toluene, inhibited
Vinylidene chloride, inhibited
Vinylpyridenes, inhibited
Vinyltrichlorosilane

Section 172.102. Special Provision 23 would be added to specify that thermally reactive materials must be packaged according to the HMR. Special Provision B63 would be removed, thus prohibiting the use of tank cars without head protection or thermal protection for the transportation of ethyl chloride and ethyl methyl ether.

Part 173

Section 173.31. Several changes would be made to this section.

Paragraph (a)(14) would be amended by adding a new requirement that all tank cars used to transport a PIH material must have a tank test pressure of at least 300 psi. This proposed requirement is consistent with other regulations adopted under Docket HM-181 for PIH liquids.[46] Several shipping names appearing in current § 173.31(a)(14)(i) would be revised for consistency with proper shipping names shown in the § 172.101 table.

Several new paragraphs would be added.

[46] For further information see Performance-Oriented Packaging Docket HM-181, 55 FR 52402 (December 12, 1990).

Proposed paragraph (a)(19) would require head protection for all tank cars transporting Class 2 materials or thermally reactive materials and for all tank cars constructed from aluminum and nickel plate.

Proposed paragraph (a)(20) would require a thermal protection system on tank cars transporting Class 2 materials and thermally reactive materials. For thermally reactive materials, the rule would require sufficient thermal protection to preclude the cargo from reaching the point of decomposition or polymerization. As discussed in the preamble, the need for a thermal protection is based on an analysis of the thermal characteristics of the cargo and the tank car. Taking the whole system into consideration, certain existing tank cars may have sufficient thermal resistance to meet these requirements.

Proposed paragraph (a)(21) would require shell puncture resistance protection on tank cars used for transporting PIH materials.

Proposed paragraph (a)(22) would require the removal of internal self-energized manways on certain tank cars within 2 years.

Proposed paragraph (a)(23) would require bottom discontinuity protection for all tank cars. The proposed protection requirements would conform to paragraph E9.00 and E10.00 of the AAR Specifications for Tank Cars, M-1002.

Proposed paragraph (a)(24) would be added to require the use of DOT 105S200W, jacketed 112S200W, or non-jacketed 112S340W specification tank cars for HOCs that are banned from land disposal under the Environmental Protection Agency regulations contained in 40 CFR part 268.

Proposed paragraph (f)(3) would be added to require protective coatings for all types of insulation materials if the complete jacket is removed to effect tank car repairs.

Readers should be aware that RSPA proposed to revise and restructure the provisions contained in current § 173.31

under Docket HM-201, 58 FR 48485, September 16, 1993. Therefore, any changes adopted under either of the two dockets would be made consistent with the other and in the text ultimately published in the bound volumes of the Code of Federal Regulations.

Section 173.314. The table in paragraph (c) would be amended by removing the individual authorized tank car specifications and adding the authorized tank car classes. This change will ensure that the authorized tank car conforms to § 173.31(a)(14) concerning tank test pressure. The notes following the table would also be amended by removing all tank car "design requirements." Only those notes that apply to filling limits would be retained. The current notes following the table in § 173.314(c) would be redesignated, revised, or removed as follows:

Note 1, no change.

Note 2 would be editorially revised and moved to proposed § 173.314(n).

Note 3 and *Note 4* would be revised and moved to proposed § 173.314(j), applicable to all Division 2.1 (flammable gas) materials.

Note 5 would be editorially changed for clarity.

Note 6 would be editorially revised and moved to proposed § 173.314(o).

Note 7 would be removed. This provision allows the transportation of multi-unit-tank cars tanks (ton containers) by rail and highway only. A provision restricting the transport of multi-unit tank car tanks by air is unnecessary because quantity limitations for these commodities exceeded the maximum allowed by air. RSPA also believes there is no valid reason for not authorizing the transport of these units by water.

Note 8 would be editorially revised and moved to proposed § 173.314(l).

Note 9 would be moved to proposed § 173.314(j) and made applicable to all materials with a Division 2.1 hazard.

Note 10 would be editorially revised and moved to § 173.314(m).

Note 11 would be editorially revised and included in proposed § 173.314(m).

Note 12 would be revised and the filling density requirements would be moved to proposed Note 6, and the design requirements would be moved to proposed § 173.314(k).

Note 13 would be removed to eliminate duplication of the marking requirements prescribed in Special Provision B12, §§ 173.314(a)(5), and 172.332(a)(i)(i).

Note 14 would be removed because it is not referenced in the table.

Note 15 would be included with certain other design requirements applicable to tank cars used for 2.1 materials in proposed § 173.314(j).

Note 16, which is currently reserved, would be removed.

Note 17, which references § 173.314(g) would be removed.

Note 18 would be editorially revised and moved to proposed Note 7.

Note 19 would be editorially revised and moved to proposed Note 8.

Note 20 would be editorially revised and moved to proposed Note 4.

Note 21 would be editorially revised and moved to proposed Note 3.

Note 22, referencing the requirements in § 173.245, would be incorporated into the table under the entry for Division 2.3, Zone A materials.

Note 23 and *Note 24* would be removed based on other proposals in this notice concerning the elimination of grandfather clauses.

Note 25 would be editorially revised and moved to proposed Note 2.

Note 29 and *Note 30* would be removed based on other proposals in this notice concerning the elimination of grandfather clauses.

Section 173.323. Paragraph (c)(1) would be revised to require DOT 105 tank cars used for transporting PIH materials to have a tank test pressure of at least a 300 psi. Authorization for the use of a DOT 111J100W4 tank car would be removed.

Part 179

Section 179.16. Proposed § 179.16 containing the tank head puncture resistance requirements found in current §§ 179.100–23 and 179.105–5 would be added. The test verification requirements in current § 179.105–5(b) and (c) would be editorially revised and placed in a new Appendix A of part 179.

Section 179.18. Proposed § 179.18, containing thermal protection requirements found in current § 179.105–4, would be added. Editorial revisions would be made for clarity and for consistency with other changes proposed in this notice. The proposed regulatory text in this notice references a research report[47] that contains an analytical thermal model. FRA expects that AAR will have the model available on a computer disc by the time any final rule is issued in this docket.

Section 179.20. Proposed § 179.20, containing bottom discontinuity protection requirements, would be added. As proposed in this notice, bottom discontinuity protection must conform to paragraphs E9.00 and E10.00 of the AAR Specifications for Tank Cars, M–1002.

[47] Johnson, M.R., op. cit., Temperatures, Pressures, etc.

Section 179.22. Proposed § 179.22 would be added. This section would consolidate the marking requirements currently in §§ 179.100–21, 179.105–8, 179.200–25, and 179.203–3.

Section 179.100–4. This section would be amended by removing the phrase, "except that a protective coating is not required when foam-in-place insulation that adheres to the tank or jacket is applied" at the end of the first paragraph.

Section 179.100–21. The marking requirements contained in this section would be consolidated with other marking requirements in proposed new § 179.22. Therefore, current § 179.100–21 would be removed.

Section 179.100–23. The head protection requirements contained in this section would be moved to proposed § 179.16(d). Therefore current § 179.100–23 would be removed.

Section 179.103–1. Paragraph (c), which provides that a manway may be located other than at the top of the tank, would be removed.

Section 179.103–2. Paragraph (a) containing manway cover requirements would be revised.

Section 179.103–5. Paragraph (a)(I) would be revised by removing the first two sentences, thus eliminating the authorization for a self-energizing manway located below the liquid level of the cargo in the tank car.

Section 179.105. Current §§ 179.105–through 179.105–8 containing special requirements for DOT 105S, 105J, 111J, 112S, 112J, 112T, 114S, 114J, 114T specification tank cars would be removed because they are unnecessary. The applicable requirements concerning head protection and thermal protection would be moved to proposed §§ 179.16, 179.18, and a new Appendix B to Part 179 as appropriate. The marking requirements would be moved to § 179.22.

Section 179.200–4. This section would be revised by removing the phrase, "except that a protective coating is not required when foam-in-place insulation that adheres to the tank or jacket is applied" at the end of the first paragraph.

Section 179.200–25. The marking requirements contained in this section would be consolidated with other marking requirements in proposed § 179.22. Therefore, current § 179.200–25 would be removed.

Section 179.200–27. The head protection requirements would be contained in proposed § 179.16. Therefore, current § 179.200–27 would be removed.

Section 179.203. Current § 179.203–1 through 179.203–3 containing special requirements for DOT 111 tank cars are unnecessary and would be removed. The restriction in paragraph (c) against the use of DOT 111 tank cars built after March 1, 1984, for the transportation of flammable gases or ethylene oxide would be incorporated into §§ 173.314 and 173.323. The applicable head protection and thermal protection requirements would be contained in proposed §§ 179.16 and 179.18, respectively. Therefore, current § 179.203–2 is unnecessary and would be removed. The marking requirements would be moved to proposed § 179.22.

XII. Regulatory Analysis and Notices

A. Executive Order 12291 and DOT Regulatory Policies and Procedures

This proposed rule does not meet the criteria specified in section 1(b) of Executive Order 12291 and, therefore, is not a major rule. The rule is not considered significant under the regulatory policies and procedures of the Department of Transportation (44 FR 11034). A regulatory evaluation is available for review in the Docket.

The main benefit found in the regulatory evaluation is that head protection and thermal protection would reduce the risk of rare but catastrophic accidents. The materials and tank cars selected were those which posed large potential risk, even if their accident history has not shown many accidents. One catastrophic accident would be too many.

The rule would significantly reduce the risk of fatalities and injuries from releases of gases and volatile liquids that are PIH, including anhydrous ammonia, and from explosive reactions involving ethylene oxide and thermally reactive materials. The release or explosion of these materials have the potential to affect thousands of people in urban and suburban areas. Preventing just one major release or explosion in a densely populated area could save the lives of hundreds of people and amount to hundreds of millions of dollars in benefits. By reducing the risk of fatalities, the proposal would also reduce the frequency, magnitude, and hence the cost of evacuations, which can affect thousands of people for days. The proposal would also reduce the frequency, magnitude and cost of transportation delays that can affect rail and highway traffic for many hours or even days.

The proposal would also reduce the risk of releasing some hazardous materials, especially Halogenated Organic Compounds, HOC's, into the environment. They are exceptionally costly to clean up once released. In the first year, under Option A, the cost reduction would be about $490,000, and the cost reduction would increase to about $4,900,000 in the tenth and subsequent years. That means that the reduction in cleanup costs alone would more than offset the cost of the proposal after the tenth year.

The proposals under Option A in the accompanying Notice of Proposed Rulemaking could cost up to $79 million in discounted costs over the first 10 years. They could cost up to $9.7 million in the first year, rising to $11.7 million in the tenth year. Each year after that the proposal could cost up to $2 million. Option B would cost more.

Costs, in some cases, have been difficult to estimate and, because of conservative assumptions, may significantly overstate actual costs. For example, the costs of additional protection for new and retrofit tank cars carrying thermally reactive materials account for an estimated $7.3 million annually or about $54.75 million, or 69 percent of total discounted costs under Option A over 10 years. (Seventy-six percent of costs when the weight penalty is excluded.)

However, these costs may be significantly overstated because it has been assumed that all cars carrying thermally reactive materials will require additional protection. In fact, for many tank cars, the testing of the tank car and the cargo at the given performance specification in the rule may require no additional thermal protection measures.

The relative cost-effectiveness of many of the provisions will also be influenced by the actual manner in which cars removed from one type of service cascade into other types of service. Based on available data, including data provided by commenters, the DOT seeks to determine how the requirements of this rule can be made most cost-effective while substantially reducing the risk of sometimes often rare but potentially catastrophic accidents.

B. Executive Order 12612

This proposed rule has been analyzed in accordance with the principles and criteria contained in Executive Order 12612 ("Federalism"). The Hazardous Materials Transportation Act (HMTA) contains an express preemption provision (49 App. U.S.C. 1804(a)(4)) that preempts State, local, and Indian tribe requirements on certain covered subjects. Covered subjects are:

(1) The designation, description, and classification of hazard materials;

(2) The packing, repacking, handling, labeling, marking, and placarding of hazardous materials;

(3) The preparation, execution, and use of shipping documents pertaining to hazardous materials and requirements respecting the number, content, and placement of such documents;

(4) The written notification, recording, and reporting of unintentional release in transportation of hazardous materials; or

(5) The design, manufacturing, fabrication, marking, maintenance, reconditioning, repairing, or testing of a package or container which is represented, marked, certified, or sold as qualified for use in the transportation of hazardous materials.

This proposed rule concerns design, manufacturing, repairing, and other requirements for packages represented as qualified for use in the transportation of hazardous materials.

If adopted as final, this rule would preempt any State, local, or Indian tribe requirements concerning these subjects unless the non-Federal requirements are "substantively the same" (see 49 CFR 107.202(d)) as the Federal requirements.

The HMTA (49 App. U.S.C. 1804(a)(5)) provides that if DOT issues a regulation concerning any of the covered subjects after November 16, 1990, DOT must determine and publish in the **Federal Register** the effective date of Federal preemption. That effective date may not be earlier than the ninetieth day following the date of issuance. RSPA requests comments on what the effective date of Federal preemption should be for the requirements in this proposed rule that concern covered subjects. RSPA lacks discretion in this area, and preparation of a federalism assessment is not warranted.

C. Regulatory Flexibility Act

Based on limited information concerning the size and nature of the entities likely to be affected by this proposed rule, I certify that this proposed rule would not have a significant economic impact on a substantial number of small entities. The major impacts of this rule center on tank car owners, which are primarily large corporations, and on offerers and transporters of hazardous materials in tank cars. This certification is subject to modification as a result of a review of comments received in response to this proposal.

D. Intermodalism/Modal Diversion

FRA reviewed the proposals in this notice to investigate their potential for diverting rail hazardous materials traffic to truck. FRA's concern was that, if diversion was likely, the safety impacts on highway transportation would need to be studied to fulfill the Department's responsibility for multi-modal systems safety. The study examined the amount of traffic moving by rail, the average distance each chemical moves, proportionate rail share, and the number of tank cars estimated to require modification if the proposals in this rule are made final. The study concluded that, for most commodities, disruption to rail service would occur if modification were required within one year.[48] As long as the compliance period exceeds one year, FRA believes that sufficient cars will be available to handle the projected traffic volumes. A copy of FRA's paper, "Divertibility of Certain Hazardous Materials," is available in the docket for review by interested persons.

E. Paperwork Reduction Act

The information collection requirements contained in proposed §§ 179.16 and 179.18 are being submitted to the Office of Management and Budget for review under the provisions of the Paperwork Reduction Act of 1980 (44 U.S.C. 3504(h)). Comments on the collection of information should be sent to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC, Attention: Desk Officer for the Department of Transportation. Comments must reference the title of this notice, "Crashworthiness Protection Requirements for Tank Cars."

F. Regulatory Identifier Number (RIN)

A regulation identifier number (RIN) is assigned to each regulatory action listed in the Unified Agenda of Federal Regulations. The Regulatory Information Service Center publishes the Unified Agenda in April and October of each year. The RIN number contained in the heading of this document can be used to cross-reference this action with the Unified Agenda.

List of Subjects

49 CFR Part 172

Hazardous materials transportation, Hazardous waste, Labels, Markings, Packaging and containers, Reporting and recordkeeping requirements.

49 CFR Part 173

Hazardous materials transportation, Packaging and containers, Radioactive materials, Reporting and recordkeeping requirements, Uranium.

49 CFR Part 179

Hazardous materials transportation, Railroad safety, Reporting and recordkeeping requirements.

In consideration of the foregoing, 49 CFR chapter I would be amended as follows:

PART 172—HAZARDOUS MATERIALS TABLE, SPECIAL PROVISIONS, HAZARDOUS MATERIALS COMMUNICATIONS, EMERGENCY RESPONSE INFORMATION, AND TRAINING REQUIREMENTS

1. The authority citation for part 172 would continue to read as follows:

Authority: 49 App. U.S.C. 1803, 1804, 1805, 1808; 49 CFR part 1, unless otherwise noted.

§ 172.101 [Amended]

2. In the § 172.101 Hazardous Materials Table, the following changes are made.

a. For the following entries, Special Provision "23" would be added in Column (7), in appropriate numeric sequence:

Acetaldehyde
Acrolein, inhibited
Acrylic acid, inhibited
Acrylonitrile, inhibited
Butylacrylate
Chloroprene, inhibited
Crotonaldehyde, stabilized
Dimethylaminoethyl methacrylate
Dimethylhydrazine, unsymmetrical
Dinitrotoluenes, liquid
Dinitrotoluenes, molten
Dinitrotoluenes, solid
Ethyl acrylate, inhibited
Ethyl methacrylate
Ethyleneimine, inhibited
Hydrazine, anhydrous or Hydrazine aqueous solutions with more than 64 percent hydrazine by mass
Hydrogen cyanide, anhydrous, stabilized
Hydrogen peroxide, aqueous solutions with more than 40 per cent but not more than 60 percent hydrogen peroxide (stabilized as necessary)
Hydrogen peroxide, aqueous solutions with not less than 20 percent but not more than 40 percent hydrogen peroxide (stabilized as necessary)
Hydrogen peroxide, stabilized or Hydrogen peroxide aqueous solutions, stabilized with more than 60 percent hydrogen peroxide
Isobutyl acrylate
Isoprene, inhibited
Isopropyl nitrate
Methacrylic acid, inhibited
Methyl acrylate, inhibited
Methyl isopropenyl ketone, inhibited
Methyl methacrylate monomer, inhibited
Methyl vinyl ketone
Motor fuel anti-knock mixtures
Nitroethane
Propylene oxide
Propyleneimine, inhibited
Styrene monomer, inhibited
Sulfur trioxide, inhibited
Sulfur trioxide, uninhibited
Vinyl acetate, inhibited
Vinyl ethyl ether, inhibited
Vinyl isobutyl ether, inhibited
Vinyl toluene, inhibited *mixed isomers*
Vinylidene chloride, inhibited
Vinylpyridenes, inhibited
Vinyltrichlorosilane

b. For the entry "Ethylene oxide, pure or with nitrogen", Special Provision "23" would be added in Column (7), in appropriate numeric sequence.

c. For the entries "Ethyl nitrite solutions" and "Methacrylonitrile, inhibited", Special Provision "23" would be added in Column (7), in appropriate numeric sequence.

3. In § 172.102, in paragraph (c)(1), Special Provision 23 would be added in proper numeric sequence, to read as follows:

§ 172.102 Special provisions.

* * * * *

(c) * * *

(1) * * *

Code/Special Provisions

* * * * *

23 This material is thermally reactive and must be packaged as such under the provisions of this subchapter.

* * * * *

§ 172.102 [Amended]

4. In addition, in § 172.102, in paragraph (c)(3), Special Provision "B63" would be removed.

PART 173—SHIPPERS—GENERAL REQUIREMENTS FOR SHIPMENTS AND PACKAGINGS

5. The authority citation for part 173 would continue to read as follows:

Authority: 49 App. U.S.C. 1803, 1804, 1805, 1806, 1807, 1808; 1817; 49 CFR part 1, unless otherwise noted.

6. In § 173.31, paragraph (a)(14) would be revised and paragraphs (a)(19) through (a)(24), and (f)(3) would be added to read as follows:

§ 173.31 Qualification, maintenance, and use of tank cars.

(a) * * *

(14) Tank test pressure must be equal to or greater than the greatest of the following:

(i) Except for shipments of anhydrous hydrogen chloride, refrigerated liquid;

[48] Of the many commodities affected by this proposal, 28 of those moving in the largest volume were selected for examination; 27 of the 28 commodities studied showed a relative insensitivity to diversion, at least as caused by the proposals in this notice. The remaining commodity, hydrogen cyanide, is not authorized to move in a cargo tank or a portable tank.

carbon dioxide, refrigerated liquid; ethylene, refrigerated liquid; hydrogen; or vinyl fluoride, 133 percent of the sum of lading vapor pressure at the reference temperature of 46°C (115°F) for non-insulated tank cars or 41°C (105°F) for insulated tank cars plus static head, plus gas padding pressure in the vacant space of tank car;

(ii) 133 percent of the maximum loading or unloading pressure, whichever is greater;

(iii) 300 p.s.i. for materials that are poisonous by inhalation;

(iv) The minimum pressure prescribed by the specification in Part 179 of this subchapter; or

(v) The minimum test pressure prescribed for the specific hazardous material in the applicable packaging section in Subpart F or Subpart G of this part.

* * * * *

(19) *Tank head puncture resistance requirements.* The following tank cars must have a tank head puncture resistance system meeting the requirements of § 179.16 of this subchapter, or a tank head puncture resistance system meeting the requirements of Part 179 of this subchapter in effect at the time of installation.

(i) Except as otherwise provided in this section, tank cars used for transporting Class 2 materials must conform to the requirements of § 179.16 of this subchapter. Tank cars used for transporting Class 2 materials that did not require a tank head puncture resistance system prior to [EFFECTIVE DATE OF FINAL RULE] must have a tank head puncture resistance system installed that conforms to the requirements of § 179.16 of this subchapter no later than [10 YEARS FROM EFFECTIVE DATE OF FINAL RULE].

(ii) Tank cars that are used for transporting thermally reactive materials or that are constructed of aluminum or nickel plate must have a tank head puncture resistance system conforming to the requirements of § 179.16 of this subchapter no later than [10 YEARS FROM EFFECTIVE DATE OF FINAL RULE].

(20) *Thermal protection requirements.* With the exception of Class DOT 107A tank cars, tank cars used for transporting Class 2 materials or thermally reactive materials must conform to the requirements of § 179.18 of this subchapter. In addition, tank cars used for transporting thermally reactive materials must have sufficient thermal resistance to prevent the cargo within the tank car from reaching the temperature of decomposition or polymerization within a 100-minute pool fire or a 30-minute torch fire. The use of computer assisted thermal modeling is an acceptable approach for analyzing the fire effects on the tank car. Tank cars used for transporting a Class 2 material or a thermally reactive material that did not require a thermal protection system prior to [EFFECTIVE DATE OF FINAL RULE] must have a thermal protection system installed that conforms to the requirements of § 179.18 of this subchapter no later than [10 YEARS FROM EFFECTIVE DATE OF FINAL RULE].

(21) *Shell puncture resistance requirements for materials poisonous by inhalation.* In addition to the requirements of paragraph (a)(20) of this section, each tank car used for transporting a material that is poisonous by inhalation must have a jacket that conforms to § 179.100–4 of this subchapter. Bottom outlets are not authorized. Tank cars that did not require a tank jacket prior to [EFFECTIVE DATE OF FINAL RULE] must have a tank jacket installed that conforms to the requirements of § 179.100–4 of this subchapter no later than [10 YEARS FROM EFFECTIVE DATE OF FINAL RULE].

(22) *Self-energized manways.* Tank cars constructed before [EFFECTIVE DATE OF FINAL RULE] with a self-energized manway located below the liquid level of the lading must have the self-energized manway removed no later than [2 YEARS FROM EFFECTIVE DATE OF FINAL RULE].

(23) *Bottom discontinuity protection.* Tank cars must have bottom discontinuity protection that conforms to the requirements of E9.00 and E10.00 of the AAR Specifications for Tank Cars. Tank cars that do not require bottom discontinuity protection under the terms of Appendix Y of the AAR Specifications for Tank Cars as of [EFFECTIVE DATE OF FINAL RULE] must conform to these requirements no later than [10 YEARS FROM EFFECTIVE DATE OF FINAL RULE].

(24) *Halogenated organic compounds forbidden from land disposal.* Notwithstanding any other requirement of this subchapter, tank cars used for the transportation of HOCs that are forbidden from land disposal under EPA regulations contained in 40 CFR Part 268, must conform to a DOT 105S200W, DOT 112S200W with a jacket that conforms to § 179.100–4 of this subchapter, or DOT 112S340W specification tank car no later than [10 YEARS FROM EFFECTIVE DATE OF FINAL RULE].

* * * * *

(f) * * *

(3) *Protective coatings.* Unless the exterior tank car shell or interior tank car jacket has a protective coating, after a repair that requires the complete removal of the tank car jacket, the exterior tank car shell and the interior tank car jacket must have a protective coating applied to prevent the deterioration of the tank shell and tank jacket.

7. In § 173.314, the section heading and paragraph (c) would be revised and paragraphs (j) through (o) would be added to read as follows:

§ 173.314 Compressed gases in tank cars and multi-unit tank cars.

* * * * *

(c) *Authorized gasses, filling limits for tank cars.* A compressed gas in a tank car or a multi-unit tank car must be offered for transportation in accordance with § 173.31 and this section. The named gases must be loaded and offered for transportation in accordance with the following table:

BILLING CODE 4910-60-P

Proper shipping name	Outage and filling limits (see Note 1)	Authorized tank car class
Ammonia, anhydrous, or ammonia solutions > 50 percent ammonia	Note 2	105, 112, 114
	Note 3	106
Ammonia solutions with > 35 percent ammonia by mass	Note 3	105, 109, 112, 114
Argon, compressed	Note 4	107
Boron trichloride	Note 3	105, 106
Carbon dioxide, refrigerated liquid	Note 5	105
Chlorine	Note 6	105
	125	106
Chlorine trifluoride	Note 3	106, 110
Chlorine pentafluoride	Note 3	106, 110
Dimethylamine, anhydrous	Note 3	105, 106, 112
Dimethyl ether	Note 3	105, 106, 110
Dinitrogen tetroxide, inhibited	Note 3	105, 106, 110
Division 2.1 materials not specifically identified in this table.	Note 3	105, 106, 110, 112, 114
Division 2.2 materials not specifically identified in this table.	Note 3	105, 106, 109, 110, 112, 114
Division 2.3 Zone A materials not specifically identified in this table.	None	See § 173.245
Division 2.3 Zone B materials not specifically identified in this table.	Note 3	105, 106, 110, 112, 114
Division 2.3 Zone C materials not specifically identified in this table.	Note 3	105, 106, 110, 112, 114
Division 2.3 Zone D materials not specifically identified in this table.	Note 3	105, 106, 109, 110, 112, 114
Ethylamine	Note 3	105, 106, 110, 112, 114
Helium, compressed	Note 4	107
Hydrogen	Note 4	107
Hydrogen chloride, refrigerated liquid	Note 7	105
Hydrogen sulphide, liquified	68	106
Methylamine, anhydrous	Note 3	105, 106, 112
Methyl bromide	Note 3	105, 106
Methyl chloride	Note 3	105, 106, 1121
Methyl mercaptan	Note 3	105, 106
Nitrogen, compressed	Note 4	107
Nitrosyl chloride	124	105
	110	106
Nitrous oxide, refrigerated liquid	Note 5	105
Oxygen, compressed	Note 4	107
Phosgene	Note 3	106
Sulfur dioxide, liquified	125	105, 106, 110
Sulfuryl fluoride	120	105
Vinyl fluoride, inhibited	Note 8	105

Notes:
1 The filling density for liquefied gases is hereby defined as the weight of gas in the tank to the weight of water the tank will hold. For determining the water capacity of the tank in pounds, the weight of one gallon of water at 15.55 °C (60 °F.) in air is 3.777 kg (8.32828 pounds).
2 The liquefied gas must be so loaded so that the outage is at least two percent of the total capacity of the tank at the reference temperature of 46 °C (115 °F.) for non-insulated tanks and 41 °C (105 °F.) for insulated tanks.
3 The requirements of § 173.24b(a) apply.
4 The gas pressure at 54.44 °C (130 °F.) in any non-insulated tank car may not exceed 7/10 of the marked test pressure, except that a tank may be charged with helium to a pressure 10 percent in excess of the marked maximum gas pressure at 54.44 °C (130 °F.) of each tank.
5 The liquid portion of the gas at −17.77 °C (0 °F.) must not completely fill the tank.
6 The maximum permitted filling density is 125 percent. The quantity of chlorine loaded into a single unit-tank car may not be loaded in excess of the normal lading weights nor in excess of 81.65 Mg (90 tons).
7 89 percent maximum to 80.1 percent minimum at a test pressure of 620.53 kPa (90 psig), when offered for transportation.
8 59.6 percent maximum to 53.6 percent minimum at a test pressure of 723.95 kPa (105 psig), when offered for transportation.

* * * * *

(j) *Special requirements for flammable gases.* For single unit tank cars, interior pipes of loading and unloading valves, sampling devices, and gaging devices with an opening for the passage of the cargo exceeding 1.52 mm (0.060 inch) diameter must be equipped with excess flow valves. For single unit tank cars constructed before December 30, 1971, gaging devices must conform to this paragraph no longer than [10 YEARS FROM EFFECTIVE DATE OF FINAL RULE]. The protective housing cover must be provided with an opening, with a weatherproof cover, above each safety relief valve that is concentric with the discharge of the safety relief valve and that has an area at least equal to the valve outlet area. Class 109 tank cars and tank cars manufactured from aluminum or nickel plate are not authorized.

(k) *Special requirements for chlorine.* The requirements of § 173.31(a)(20) do not apply. Tank cars built after September 30, 1991, must have an insulation system consisting of 5.08 cm (2 inches) glass fiber placed over 5.08 cm (2 inches) of ceramic fiber. Tank cars must have excess flow valves on the interior pipes of liquid discharge valves. Tank cars constructed to a DOT 105A500W specification may be marked as a DOT 105A300W specification with the size and type of safety relief valves required by the marked specification.

(l) *Special requirements for hydrogen sulphide.* Each multi-unit tank car must be equipped with adequate safety relief devices of the fusible plug type having a yield temperature not over 76.66 °C (170 °F.), and not less than 69.44 °C (157 °F.). Each device must be resistant to extrusion of the fusible alloy and leak tight at 55 °C (130 °F.). Each valve outlet must be sealed by a threaded solid plug. In addition, all valves must be protected by a metal cover.

(m) *Special requirements for nitrosyl chloride.* Single unit tank cars and their associated service equipment, such as venting, loading and unloading valves, and safety relief valves, must be made of metal or clad with a material that is not subject to rapid deterioration by the lading. Multi-unit tank car tanks must be nickel clad and have safety relief devices incorporating a fusible plug having a yield temperature of 79.44 °C (175 °F.). Safety relief devices must be vapor tight at 54.44 °C (130 °F.).

(n) *Special requirements for hydrogen chloride.* Each tank car must be equipped with one or more safety relief devices. The discharge outlet for each safety relief device must be connected to a manifold having a non-obstructive discharge area of at least 1.5 times the total discharge area of the safety relief devices connected to the manifold. All manifolds must be connected to a single common header having a non-obstructed discharge pointing upward and extending above the top of the car. The header and the header outlet must each have a non-obstructive discharge area at least equal to the total discharge area of the manifolds connected to the header. The header outlet must be equipped with an ignition device that will instantly ignite any hydrogen discharged through the safety relief device.

(o) *Special requirements for carbon dioxide, refrigerated liquid and nitrous oxide, refrigerated liquid.* The requirements of § 173.31(a)(20) do not apply. Each tank car must have an insulation system so that the thermal conductance is not more than 0.03 B.t.u. per square foot per hour, per degree fahrenheit temperature differential. Each tank car must be equipped with one safety relief valve set to open at a pressure not exceeding 75 percent of the tank test pressure and one rupture disc set to function at a pressure less than the tank test pressure. The discharge capacity of each safety relief device must be sufficient to prevent building up of pressure in the tank in excess of 82.5 percent of the test pressure of the tank. Tanks must be equipped with two regulating valves set to open at a pressure not to exceed 350 psi on DOT 105A500W tanks and at a pressure not to exceed 400 psi on DOT 105A600W tanks. Each regulating valve and safety relief device must have its final discharge piped to the outside of the protective housing.

8. In § 173.323, paragraph (c)(1) would be revised to read as follows:

§ 173.323 Ethylene oxide.

* * * * *

(c) * * *

(1) *Tank cars.* Class DOT 105 tank cars. Notwithstanding the requirements of § 173.31(a)(14) of this subchapter, each tank car must have a tank test pressure of at least 300 psi no later than [10 YEARS FROM EFFECTIVE DATE OF FINAL RULE].

* * * * *

PART 179—SPECIFICATIONS FOR TANK CARS

9. The authority citation for part 179 would continue to read as follows:

Authority: 49 App. U.S.C. 1803, 1804, 1805, 1806, 1808; 49 CFR part 1, unless otherwise noted.

10. Section 179.16 would be added to read as follows:

§ 179.16 Tank head puncture resistance systems.

(a) *Performance standard.* When the regulations in this subchapter require a tank head puncture resistance system, the system shall be capable of sustaining, without any loss of cargo, coupler-to-tank head impacts at relative car speeds of 18 mph when:

(1) The weight of the impact car is at least 119,294.79 kg (263,000 pounds);

(2) The impacted tank car is coupled to one or more backup cars that have a total weight of at least 217,724.33 kg (480,000 pounds) and the hand brake is applied on the first car; and

(3) The impacted tank car is pressurized to at least 100 psi.

(b) Compliance with the requirements of paragraph (a) of this section shall be verified by full scale testing according to Appendix A of this part or by installing full head shields or full tank head jackets on each end of the tank car conforming to the following—

(1) Th tank head puncture resistance system must be at least ½-inch thick, shaped to the contour of the tank head and made from steel having a tensile strength greater than 55,000 psi.

(2) The securement of the tank head puncture resistance system must meet the impact test requirements of the AAR Specifications for Tank Cars, paragraph AAR 24-5.

(3) The workmanship requirements of the AAR Specifications for Design, Fabrication and Construction of Freight Cars apply.

11. Section 179.18 would be added to read as follows:

§ 179.18 Thermal protection systems.

(a) *Performance standard.* When the regulations in this subchapter require thermal protection on a tank car, the tank car must have sufficient thermal resistance that an analysis conforming to paragraph (b) of this section shows that there will be no release of any cargo within the tank car, except release through the safety relief valve, when subjected to:

(1) A pool fire for 100-minutes; and

(2) A torch fire for 30-minutes.

(b) *Thermal Analysis.* (1) Compliance with the requirements of paragraph (a) of this section shall be verified by modelling the fire effects on the entire surface of the tank car according to the procedures outlined in [*a future document for incorporation by reference based on "Temperatures, Pressures and Liquid Levels of Tank Cars Engulfed in Fires", NTIS DOT/FRA/OR&D-84/08.11, (1984), Federal Railroad Administration, Washington D.C.*]. The analysis must also consider the fire effects on and the heat flux through tank discontinuities, protective housings, underframes, metal jackets, insulation, and thermal protection. A complete record of each analysis shall be made, retained and, upon request, made available for inspection and copying by an authorized representative of the Department.

(2) When the analysis shows the thermal resistance of the car does not conform to paragraph (a) of this section, the thermal resistance of the car must be increased by using a listed material under paragraph (c) of this section or by testing an unlisted system and verifying it according to appendix B of this part.

(c) *Systems that no longer require test verification.* RSPA maintains a list of thermal protection systems that comply with the requirements of Appendix B of this Part and that no longer require test verification. Information necessary to equip tank cars with one of these systems is available in the Dockets Unit, room 8421, Research and Special Programs Administration, 400 Seventh Street, SW., Washington, DC 20590-0001, between the hours of 8 a.m. and 5 p.m., Monday through Friday.

(d) *Exterior tank car color.* Notwithstanding the provisions of § 179.101-1(a) Table, Note 4, each DOT 112 and 114 specification tank car equipped with a thermal protection system that complies with the requirements of paragraph (a) of this section is not required to be painted white.

12. Section 179.20 would be added to read as follows:

§ 179.20 Service equipment; protection systems.

If an applicable tank car specification authorizes location of filling or discharge connections in the bottom shell, the connections must be designed, constructed, and protected according to paragraphs E9.00 and E10.00 of the AAR Specifications for Tank Cars, M-1002.

13. Section 179.22 would be added to read as follows:

§ 179.22 Marking.

In addition to any other marking requirement in this subchapter, the following marking requirements apply:

(a) Each tank car must be marked according to the requirements in Appendix C of the AAR Specifications for Tank Cars.

(b) Each tank car that is equipped with a tank head puncture resistance system must have the letter "S" substituted for the letter "A" in the specification marking.

(c) Each tank car that is equipped with a tank head puncture resistance system and a thermal protection system enclosed in a metal jacket must have the letter "J" substituted for the letter "A" or "S" in the specification marking.

(d) Each tank car that is equipped with a tank head puncture resistance system and a non-jacketed thermal protection system must have the letter "T" substituted for the letter "A" or "S" in the specification marking.

14. In § 179.100-4, in paragraph (a), the last sentence would be amended by removing the phrase "except that a protective coating is not required when foam-in-place insulation that adheres to the tank or jacket is applied".

15. In § 179.103-1, paragraph (c) would be removed and reserved.

16. In § 179.103-2, paragraph (a) would be revised to read as follows:

§ 179.103-2 Manway cover.

(a) Manway cover must be of approved design.

* * * * *

17. In § 179.103-5, paragraph (a)(1) would be amended by removing the first two sentences.

18. In § 179.200-4, in paragraph (a), the last sentence would be amended by removing the phrase ", except that protective coating is not required when foam-in-place insulation that adheres to the tank or jacket is applied".

19. In addition to the amendments set forth above, part 179 would be amended by removing the following sections:

§ 179.100-21
§ 179.100-23
§ 179.105
§ 179.105-1
§ 179.105-2
§ 179.105-3
§ 179.105-4
§ 179.105-5
§ 179.105-6
§ 179.105-7
§ 179.105-8
§ 179.200-25
§ 179.200-27
§ 179.203
§ 179.203-1
§ 179.203-2
§ 179.203-3

20. Appendix A to part 179 would be added to read as follows:

Appendix A to Part 179—Procedures for Tank Head Puncture Resistance Test

This test procedure is designed to verify the integrity of new or untried tank head puncture resistance systems and to test for system survivability after coupler-to-tank head impacts at relative speeds of 18 mph.

(a) *Tank head puncture resistance test.* A tank head puncture resistance system must be tested under the following conditions:

(1) The ram car used must weigh at least 119,294.79 kg (263,000 pounds), be equipped with a coupler, and duplicate the condition of a conventional draft sill including the draft yoke and draft gear. The coupler must protrude from the end of the ram car so that it is the leading location of perpendicular contact with the standing tank car.

(2) The impacted test car must be loaded with water at six percent outage with internal pressure of at least 100 psi and coupled to one or more "backup" cars which have a total weight of 217,724.33 kg (480,000 pounds) with hand brakes applied on the first car.

(3) At least two separate tests must be conducted with the coupler on the vertical centerline of the ram car. One test must be conducted with the coupler at a height of 53.34 cm (21 inches), plus-or-minus one-inch, above the top of the sill; the other test must be conducted

with the coupler height at 78.74 cm (31 inches), plus-or-minus 2.54 cm (1 inch) above the top of the sill. If the combined thickness of the tank head and any additional shielding material is less than the combined thickness on the vertical centerline of the car, a third test must be conducted with the coupler positioned so as to strike the thinnest point.

(b) One of the following test procedures must be applied:

Minimum weight of attached ram cars in kg (pounds).	Minimum velocity of impact in km/hour (mph).	Restrictions
119,294.79 (263,000) . . .	28.96 (18)	One ram car only
155,582.18 (343,000) . . .	25.49 (16)	One ram car or one car plus one rigidly attached car.
311,164.36 (686,000) . . .	22.53 (14)	One ram car plus one or more rigidly attached cars.

(c) A test is successful if there is no visible leak from the standing tank car within one hour after impact.

22. Appendix B to part 179 would be added to read as follows:

Appendix B to Part 179—Procedures for Simulated Pool and Torch Fire Testing

This test procedure is designed to measure the thermal effects of new or untried thermal protection systems and to test for system survivability when exposed to a 100-minute pool fire and a 30-minute torch fire.

(a) *Simulated pool fire test.* (1) A pool fire environment must be simulated in the following manner:

(i) The source of the simulated pool fire must be hydrocarbon fuel with a flame temperature of 871 °C (1600 °F) plus-or-minus 37.8 °C (100 °F) throughout the duration of the test.

(ii) A square bare plate with thermal properties equivalent to the material of construction of the tank car must be used. The plate dimensions must be not less than one foot by one foot by nominal 1.59 cm (5/8-inch) thick. The bare plate must be instrumented with not less than nine thermocouples to record the thermal response of the bare plate. The thermocouples must be attached to the surface not exposed to the simulated pool fire and must be divided into nine equal squares with a thermocouple placed in the center of each square.

(iii) The pool fire simulator must be constructed in a manner that results in total flame engulfment of the front surface of the bare plate. The apex of the flame must be directed at the center of the plate.

(iv) The bare plate holder must be constructed in such a manner that the only heat transfer to the back side of the bare plate is by heat conduction through the plate and not by other heat paths.

(v) Before the bare plate is exposed to the simulation pool fire, none of the temperature recording devices may indicate a plate temperature in excess of 37.8 °C (100 °F) nor less than 0 °C (32 °F).

(vi) A minimum of two thermocouple devices must indicate 427 °C (800 °F) after not less than twelve minutes nor more than fourteen minutes of simulated pool fire exposure.

(2) A thermal protection system must be tested in the simulated pool fire environment described in paragraph (a)(1) of this appendix in the following manner:

(i) The thermal protection system must cover one side of a bare plate as described in paragraph (a)(1)(ii) of this appendix.

(ii) The non-protected side of the bare plate must be instrumented with not less than nine thermocouples placed as described in paragraph (a)(1)(ii) of this appendix to record the thermal response of the plate.

(iii) Before exposure to the pool fire simulation, none of the thermocouples on the thermal protection system configuration may indicate a plate temperature in excess of 37.8 °C (100 °F) nor less than 0 °C (32 °F).

(iv) The entire surface of the thermal protection system must be exposed to the simulated pool fire.

(v) A pool fire simulation test must run for a minimum of 100-minutes. The thermal protection system must retard the heat flow to the plate so that none of the thermocouples on the non-protected side of the plate indicate a plate temperature in excess of 427 °C (800 °F).

(vi) A minimum of three consecutive successful simulation fire tests must be performed for each thermal protection system.

(b) *Simulated torch fire test.* (1) A torch fire environment must be simulated in the following manner:

(i) The source of the simulated torch must be a hydrocarbon fuel with a flame temperature of 1,204 °C (2200 °F) plus-or-minus 37.78 °C (100 °F) throughout the duration of the test. Furthermore, torch velocities must be 64.37 km/h ± 16.09 km/h (40 mph ± 10 mph) throughout the duration of the test.

(ii) A square bare plate with thermal properties equivalent to the material of construction of the tank car must be used. The plate dimensions must be at least four feet by four feet by nominal 1.59 cm (5/8-inch) thick. The bare plate must be instrumented with not less than nine thermocouples to record the thermal response of the plate. The thermocouples must be attached to the surface not exposed to the simulated torch and must be divided into nine equal squares with a thermocouple placed in the center of each square.

(iii) The bare plate holder must be constructed in such a manner that the only heat transfer to the back side of the plate is by heat conduction through the plate and not by other heat paths. The apex of the flame must be directed at the center of the plate.

(iv) Before exposure to the simulated torch, none of the temperature recording devices may indicate a plate temperature in excess of 37.8 °C (100 °F) or less than 0 °C (32 °F).

(v) A minimum of two thermocouples must indicate 427 °C (800 °F) in a time of four plus-or-minus five minutes of torch simulation exposure.

(2) A thermal protection system must be tested in the simulation torch fire

environment described in paragraph (b)(1) of this appendix in the following manner:

(i) The thermal protection system must cover one side of the bare plate identical to that used to simulate a torch fire under paragraph (b)(1)(ii) of this appendix.

(ii) The back of the bare plate must be instrumented with not less than nine thermocouples placed as described in paragraph (b)(1)(ii) of this appendix to record the thermal response of the material.

(iii) Before exposure to the simulated torch, none of the thermocouples on the back side of the thermal protection system configuration may indicate a plate temperature in excess of 37.8 °C (100 °F) nor less than 0 °C (32 °F).

(iv) The entire outside surface of the thermal protection system must be exposed to the simulated torch fire environment.

(v) A torch simulation test must be run for a minimum of 30-minutes. The thermal protection system must retard the heat flow to the plate so that none of the thermocouples on the backside of the bare plate indicate a plate temperature in excess of 427 °C (800 °F).

(vi) A minimum of two consecutive successful torch simulation tests must be performed for each thermal protection system.

Issued in Washington, DC, on September 29, 1993, under authority delegated in 49 CFR part 106, Appendix A.

Alan I. Roberts,

Associate Administrator for Hazardous Materials Safety.

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