Annex 1

HM-224B Final Rule

downgraded to Channel 231C0 at its existing transmitter site. Additionally, the petition filed by Opelika Broadcasting Company, requesting the allotment of Channel 232A at Opelika, Alabama, as its second local FM transmission service was denied.

DATES: Effective February 26, 2007.

ADDRESSES: Federal Communications Commission, 445 Twelfth Street, SW., Washington, DC 20554.

FOR FURTHER INFORMATION CONTACT: Sharon P. McDonald, Media Bureau, (202) 418–2180.

SUPPLEMENTARY INFORMATION: This is a synopsis of the Commission's *Report and Order*, MB Docket No. 05–79, adopted January 10, 2007, and released January 12, 2007. The full text of this Commission decision is available for inspection and copying during regular business hours at the FCC's Reference Information Center, Portals II, 445 Twelfth Street, SW., Room CY–A257, Washington, DC 20554. The complete text of this decision may also be purchased from the Commission's duplicating contractor, Best Copy and Printing, Inc., 445 12th Street, SW., Room CY–B402, Washington, DC 20054, telephone 1–800–378–3160 or *http://www.BCPIWEB.com*. The Commission will send a copy of the *Report and Order* in a report to be sent to Congress and the Government Accountability Office pursuant to the Congressional Review Act, *see* 5 U.S.C. 801(a)(1)(A).

List of Subjects in 47 CFR Part 73

Radio, Radio broadcasting.

■ As stated in the preamble, the Federal Communications Commission amends 47 CFR part 73 as follows:

PART 73—RADIO BROADCAST SERVICES

■ 1. The authority citation for part 73 continues to read as follows:

Authority: 47 U.S.C. 154, 303, 334, 336.

§ 73.202 [Amended]

■ 2. Section 73.202(b), the Table of FM Allotments under Alabama, is amended by adding Waverly, Channel 232A.

Federal Communications Commission.

John A. Karousos,

Assistant Chief, Audio Division, Media Bureau.

[FR Doc. E7–1523 Filed 1–30–07; 8:45 am]

BILLING CODE 6712–01–P

DEPARTMENT OF TRANSPORTATION

Pipeline and Hazardous Materials Safety Administration

49 CFR Parts 171, 172, 173, 175 and 178

[Docket No. RSPA–04–17664 (HM–224B)]

RIN 2137–AD33

Hazardous Materials Regulations: Transportation of Compressed Oxygen, Other Oxidizing Gases and Chemical Oxygen Generators on Aircraft

AGENCY: Pipeline and Hazardous Materials Safety Administration (PHMSA), DOT.

ACTION: Final rule.

SUMMARY: PHMSA (also, ''we'' or ''us'') is amending the Hazardous Materials Regulations (HMR) to: require cylinders of compressed oxygen and other oxidizing gases and packages of chemical oxygen generators to be placed in an outer packaging that meets certain flame penetration and thermal resistance requirements when transported aboard an aircraft; revise the pressure relief device (PRD) setting limit on cylinders of compressed oxygen and other oxidizing gases transported aboard aircraft; limit the types of cylinders authorized for transporting compressed oxygen aboard aircraft; and convert most of the provisions of an oxygen generator approval into requirements in the HMR. PHMSA is issuing this final rule in cooperation with the Federal Aviation Administration (FAA) to increase the level of safety associated with transportation of these materials aboard aircraft.

DATES: *Effective Date:* The effective date of these amendments is October 1, 2007.

Voluntary Compliance: Voluntary compliance with all these amendments, including those with a delayed mandatory compliance date, is authorized as of March 2, 2007.

FOR FURTHER INFORMATION CONTACT: John A. Gale or T. Glenn Foster, Office of Hazardous Materials Standards, telephone (202) 366–8553, Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, 400 Seventh Street, SW., Washington, DC 20590–0001, or David Catey, Office of Flight Standards Service, telephone (202) 267–3732, Federal Aviation Administration, U.S. Department of Transportation, 800 Independence Avenue, SW., Washington, DC 20591.

SUPPLEMENTARY INFORMATION:

List of Topics

I. Background

The National Transportation Safety Board (NTSB) determined that one of the probable causes of the May 11, 1996 crash of ValuJet Airlines flight No. 596 was a fire in the airplane's cargo compartment initiated and enhanced by the actuation of one or more chemical oxygen generators carried as cargo in violation of requirements in the Hazardous Materials Regulations (HMR; 49 CFR Parts 171 through 180). Recommendations issued by the NTSB following this tragedy, in which 110 lives were lost, addressed both the initiation of the fire by the improperly packaged generators (which produce external heat when activated) and the possible enhancement of an aircraft cargo compartment fire (of any origin) by the oxygen produced by the generators or other cargo, such as gaseous oxygen in cylinders and other oxidizing agents. In response to the NTSB recommendations, the Department of Transportation has:

—Prohibited the transportation of chemical oxygen generators (including personal-use chemical oxygen generators) on board passenger-carrying aircraft and the transportation of spent chemical oxygen generators on both passenger-carrying and cargo-only aircraft [61 FR 26418 (May 24, 1996), 61 FR 68952 (Dec. 30, 1996), 64 FR 45388 (Aug. 19, 1999)];

—Issued standards governing the transportation of chemical oxygen generators on cargo-only aircraft (and by motor vehicle, rail car and vessel), including the requirement for an approval issued by PHMSA [62 FR 30767 (June 5, 1997), 62 FR 34667 (June 27, 1997)];

—Upgraded fire safety standards for cargo compartments on aircraft to require a smoke or fire detection system and a means of suppressing a fire or minimizing the available oxygen, on certain transport-category aircraft [63 FR 8033 (Feb. 17, 1998)]; and

—Imposed additional requirements on the transportation of cylinders of compressed oxygen by aircraft and prohibited the carriage of chemical oxidizers in inaccessible aircraft cargo compartments that do not have a fire or smoke detection and fire suppression system [64 FR 45388 (Aug. 19, 1999)].

In the August 19, 1999 final rule, ''Hazardous Materials: Chemical Oxidizers and Compressed Oxygen Aboard Aircraft,'' (Docket No. HM–224A), we amended the HMR to: (1) Allow a limited number of cylinders containing medical-use oxygen to be carried in the cabin of a passenger-carrying aircraft; (2) limit the number of oxygen cylinders that may be carried as cargo in compartments lacking a fire suppression system and require cylinders to be stowed horizontally on the floor or as close as practicable to the floor of the cargo compartment or unit load device; and (3) require each cylinder of compressed oxygen transported in the passenger cabin or a cargo compartment to be placed in an overpack or outer packaging that meets the performance criteria of Air Transport Association Specification 300 for Type I (ATA 300) shipping containers. In the HM–224A rulemaking, we received more than 55 written comments, and 14 persons made oral statements at a public meeting on January 14, 1998. Based on the comments submitted in that proceeding and our assessment of alternatives, we did not adopt the proposal in Docket No. HM–224A to prohibit all transportation of all oxidizers, including compressed oxygen, on passenger-carrying aircraft.

In the preamble to the August 19, 1999 final rule, we explained that testing conducted by FAA indicated the ATA 300 container provides an ''incremental'' level of thermal protection for oxygen cylinders by increasing the time before a cylinder exposed to a fire would release its contents. However, FAA's testing also indicated the risk posed by a compressed oxygen cylinder in a cargo compartment can be further reduced, or even eliminated, if the cylinder is placed in an overpack or outer packaging providing more thermal protection and flame resistance than the ATA 300 containers currently in use. Accordingly, we announced we were ''considering a requirement that an oxygen cylinder may be carried in an inaccessible cargo compartment on an aircraft only when the cylinder is placed in an outer packaging or overpack meeting certain flame penetration resistance, thermal protection, and integrity standards.'' (64 FR 45393). In our earlier June 5, 1997 final rule (also in Docket No. HM–224A), we also indicated we were considering additional packaging requirements for chemical oxygen generators (62 FR at 30769).

On May 6, 2004, we published a notice of proposed rulemaking under Docket HM–224B (69 FR 25469). In the NPRM, we proposed to amend the HMR to: (1) Require cylinders of compressed oxygen and packages of chemical oxygen generators to be placed in an outer packaging that meets certain flame penetration and thermal resistance requirements when transported aboard an aircraft; (2) revise the PRD setting limit on cylinders of compressed oxygen transported aboard aircraft; (3) limit the types of cylinders authorized to transport compressed oxygen aboard aircraft; (4) prohibit the transportation of all oxidizing gases, other than compressed oxygen aboard cargo-only or passenger aircraft; and (5) incorporate most of the provisions of an oxygen generator approval into the HMR.

II. Safety Issues Associated With the Air Transportation of Compressed Oxygen Cylinders and Oxygen Generators

When installed on an aircraft or provided during flight for the use of passengers or crew members, compressed oxygen in cylinders and oxygen generators are subject to requirements in FAA's regulations in Title 14 of the Code of Federal Regulations, and are not subject to the HMR. When transported as cargo, cylinders of compressed oxygen and oxygen generators are subject to requirements in the HMR. Air carriers routinely transport their own oxygen cylinders and oxygen generators as replacement items for use on other aircraft. Some also transport cylinders for their passengers or other customers. Commenters to Docket HM–224A identified a continuing need for the transportation of oxygen cylinders as cargo on both passenger and cargo-only aircraft.

As determined through testing conducted by FAA in 1999, cylinders of compressed oxygen release their contents at temperatures well below those that aircraft cargo compartment liners and structures are designed to withstand. When the surface temperature of a cylinder of compressed oxygen reaches approximately 300 °F, the increase in internal pressure causes the cylinder's pressure relief device to open and release oxygen. In addition to the ValuJet tragedy, three accidents and ten incidents involving airplane cargo compartment fires have occurred between 1986 and 2002. While some of these events involved hazardous materials, in some instances the fire was caused by a malfunction of the aircraft's electrical system. The origin of other fires could not be determined. Regardless of the cause of the fire, the presence of an oxygen generator or a cylinder containing oxygen or another oxidizing gas creates the potential for oxygen or another oxidizing gas to be released and to vent directly into a fire, which significantly increases the risks posed by the fire.

FAA also found that use of an outer packaging may significantly lengthen the time a cylinder will retain its contents when exposed to fire or heat. Some outer packagings meeting the ATA specification 300 Category I extended the time by up to 60 minutes or more. However, the ATA 300 standard does not specifically address thermal protection or flame penetration. An outer packaging designed to provide both thermal protection and flame penetration could provide even more protection. A copy of the test report is available for review in the public docket.

In additional tests conducted in 2002, FAA determined that a sodium chlorate oxygen generator will initiate and release oxygen at a minimum temperature of 600 °F. However, due to uncertainties with other designs and the physical properties of sodium chlorate, the FAA has recommended that oxygen generators not be exposed to temperatures above 400 °F. A copy of this test report is also available in the public docket. This test report shows that an unprotected oxygen cylinder or oxygen generator can quickly and violently release its contents when exposed to temperatures that can be expected from an aircraft cargo compartment fire.

III. Summary of Final Rule

Because of safety concerns associated with the air transportation of compressed oxygen cylinders and oxygen generators, we are amending the HMR to require cylinders of compressed oxygen and chemical oxygen generators to be transported in an outer packaging that: (1) Meets the same flame penetration resistance standards as required for cargo compartment sidewalls and ceiling panels in transport category airplanes; and (2) provides certain thermal protection capabilities so as to retain its contents during an otherwise controllable cargo compartment fire. The outer packaging standard that is being adopted addresses two safety concerns: (1) Protecting a cylinder and an oxygen generator that could be exposed directly to flames from a fire; and (2) protecting a cylinder and an oxygen generator that could be exposed indirectly to heat from a fire. These performance requirements must remain in effect for the entire service life of the outer packaging.

Under this final rule, an outer packaging for a cylinder containing compressed oxygen or another oxidizing gas and a package containing an oxygen generator must meet the standards in Part III of Appendix F to 14 CFR Part 25, Test Method to Determine Flame Penetration Resistance of Cargo Compartment Liners. An outer packaging's materials of construction must prevent penetration by a flame of 1,700 °F for five minutes, in accordance with Part III of Appendix F, paragraphs (a)(3) and (f)(5) of 14 CFR Part 25.

In addition, a cylinder of compressed oxygen or another oxidizing gas must remain below the temperature at which its pressure relief device would activate and an oxygen generator must not actuate when exposed to a temperature of at least 400 °F for three hours. The 400 °F temperature is the estimated mean temperature of a cargo compartment during a halon-suppressed fire.[1] Three hours and 27 minutes is the maximum estimated diversion time world-wide; based on an aircraft flying a southern route over the Pacific Ocean. Data collected during the FAA tests indicate that, on average, a 3AA oxygen cylinder with a pressure relief device set at cylinder test pressure will open when the cylinder reaches a temperature of approximately 300 °F. This result is consistent with calculations performed by PHMSA. In analyzing PRD function, PHMSA calculated that a 3HT cylinder with a PRD set at 90% of cylinder test pressure will vent at temperatures greater than 220 °F. In order to assure an adequate safety margin for all authorized cylinders, including 3HT cylinders, we are amending the HMR to require cylinders of compressed oxygen and other oxidizing gases, which are contained in the specified outer packaging, to maintain an external temperature below 93 °C (199 °F) when exposed to a 400 °F temperature for three hours.

[1] The FAA is currently evaluating other non-ozone-depleting suppression agents that could eventually be used in cargo compartments. Some of these agents can maintain an adequate level of safety in the compartment, but the mean temperature may be slightly higher than 400 °F, which is the level found during typical halon-suppressed fires. If an alternate agent is used, the oven soak temperature level may need to be adjusted accordingly.

IV. Comments and Regulatory Changes

A. General

PHMSA received comments from 24 entities in response to proposals and specific questions in the NPRM concerning outer packaging, PRDs, authorized cylinders, oxidizing gases aboard aircraft, and chemical oxygen generator approvals. These comments were submitted by representatives of trade organizations, hazardous materials shippers, carriers, and packaging manufacturers, including Airbus, Air Line Pilots Association (ALPA), Air Products and Chemicals, Air Transport Association (ATA), Alaska Airlines, Aviation Excellence, Aviation Mobility, Aviosupport, BE Aerospace, Carleton Technologies, Continental Airlines, Draeger Aerospace, Federal Express (FedEx), International Federation of Air Line Pilots Association (IFALPA), Intertechnique, National Transportation Safety Board (NTSB), Northwest Airlines (NWA), Satair, Scott Aviation (Scott), SR Technics Switzerland, United Parcel Service (UPS), Viking Packing Specialist (Viking), and two individuals.

Commenters generally noted our continued efforts to enhance the safe transportation of hazardous materials by air. For example, ALPA applauds our efforts to address the potential hazards associated with oxidizing chemicals, oxygen generators, and gaseous oxygen. Relevant portions of these comments are discussed in the following sections of the preamble.

B. Outer Packaging for Compressed Oxygen Cylinders, Other Oxidizing Gases, and Chemical Oxygen Generators

In the NPRM, we proposed to require an outer packaging for an oxygen cylinder and a package containing an oxygen generator to meet the standards in Part III of Appendix F to 14 CFR Part 25, Test Method to Determine Flame Penetration of Cargo Compartment Liners. We proposed to require the outer packaging to conform to these performance requirements with no deterioration for its entire service life. We also proposed to prohibit cylinders of compressed oxygen contained in an outer packaging from reaching an external temperature of 93 °C (199 °F)—which is below the temperature at which its PRD would actuate—when exposed to a 205 °C (400 °F) temperature for three hours. We proposed to add a thermal resistance test for packagings for oxygen cylinders and oxygen generators in appendix D to Part 178. We further proposed to remove the limits in § 175.85(i) on the number of oxygen cylinders that may be transported in cargo compartments not equipped with sufficient fire suppression systems. We proposed to allow outer packaging to be built either to the ATA Specification 300 standard or to a UN standard at the Packing Group II performance level. We proposed to authorize only rigid outer packagings for compressed oxygen cylinders. In addition, we proposed one year after publication of the final rule as the mandatory date to comply with the thermal resistance and flame penetration standards for outer packagings for oxygen cylinders and oxygen generators transported on board aircraft.

1. Scope of Rulemaking

FedEx and NWA ask PHMSA to reconsider its approach to this rulemaking and begin a more comprehensive assessment with other Federal agencies (including FAA and NTSB), equipment manufacturers, and the air carrier industry. NWA states the requirements on compressed oxygen cylinders proposed in the NPRM are not adequately justified. It differentiates oxygen cylinders from oxygen generators because the latter provide their own heat source and, once initiated, release an uncontrolled flow of oxygen. FedEx suggests the origins and results of cargo compartment fires should be examined in a more comprehensive manner before this rulemaking is implemented. Continental states PHMSA should seek input from both the International Air Transport Association (IATA) and International Civil Aviation Organization (ICAO) regarding the potential impact of the proposed packaging requirement on international regulations and international carriers serving the United States.

ATA states thermal protection of oxygen cylinders and oxygen generators does not increase the level of safety under the extreme conditions assumed in test protocols. ATA also states passenger carriers no longer transporting oxygen generators on passenger aircraft due to post-1996 regulations must transport oxygen generators by ground, and ground transportation of oxygen generators in compliance with post-1996 regulations has not resulted in any incidents involving oxygen generators. ATA recommends PHMSA thoroughly review all incidents pertaining to burned aircraft in order to investigate the condition of any oxygen cylinders or oxygen generators that were on board.

Aviation Excellence, an aircraft parts distributor holding a Competent Authority Approval to ship oxygen generators (UN3356) questions why the transportation of oxygen generators has become a critical concern, and, along with other commenters, cites ValuJet as the only accident of note involving oxygen generators. This commenter asserts the ValuJet incident was likely due to improper marking and loading, not improper packaging standards, and that thick smoke was the likely cause of the ValuJet incident. Aviation Excellence suggests PHMSA should address the reasons a fire occurred in the cargo bay, rather than what effect the fire had on oxygen, and notes non-hazardous materials, such as rubber and plastic, generate deadly gases and smoke when exposed to fire.

Scott notes chemical oxygen generators are currently transported by air as either components or as larger assemblies. When transported as components, the commenter states chemical oxygen generators are cylinders ranging from 2 ½ to 4 inches in diameter and 5 to 11 inches in overall length. The commenter states the size of chemical oxygen generator outer packaging would depend on whether the shipping requirement is for individual generators or a group of generators.

Intertechnique also suggests the exception in § 175.501(c) of the HMR allowing a limited number of oxygen cylinders to be transported in the aircraft cabin should recognize that oxygen cylinders used for carrying supplemental oxygen on board frequently have a large capacity, up to 213 cubic feet. Intertechnique states these cylinders must be transported from their respective manufacturing sites to the aircraft manufacturing facility, as well as to and from maintenance facilities, and restrictions on air transportation would increase turnaround times and operational costs when surface transportation is required. Intertechnique also notes that equipment containing an oxygen cylinder must be considered an oxygen cylinder, even when the cylinder is not apparent as in the case of the large number of protective breathing equipment units used on aircraft.

We disagree with the commenters' assertions that PHMSA did not conduct a comprehensive assessment before initiating this rulemaking and that the requirements proposed in the NPRM were not effectively justified. The safe transportation of hazardous materials by air is an ongoing area of significant concern for the Department. We regularly assess methods to increase the safe transportation of hazardous materials, and incorporate input from other Federal agencies (including NTSB), equipment manufacturers, and the regulated community as we develop new or revised regulatory requirements. This process was applied to this current rulemaking as well.

The FAA and PHMSA have taken a number of steps to reduce the likelihood of a fire on board an aircraft. These include limiting the transport of known flammable materials; imposing restrictions on aircraft systems likely to increase the risk of a fire, requiring increased inspection and maintenance of wiring systems; and incorporating designs to prevent the spread of fire from highly flammable zones. Despite all these measures, it is not possible to totally eliminate fires aboard aircraft. In addition to the risks presented by hazardous materials (whether shipped in violation or conformance with the HMR), structural failures, improper maintenance, and the ignition of non-hazardous materials remain possibilities. For these reasons, we cannot accept claims that PHMSA and the FAA did not conduct a sufficient assessment before initiating this rulemaking.

We also disagree with the commenter that suggested we only addressed the reasons a fire occurs in a cargo bay, rather than what effect a fire has on oxygen. A fire in cargo compartments aboard an aircraft can result from several causes, some of which cannot be controlled through regulations, including illegal shipments of oxidizing agents, heat- or fire-producing chemical interaction between certain goods damaged during shipment, or human error. FAA concluded that the use of an outer packaging may significantly lengthen the time an oxygen cylinder or chemical oxygen generator will retain its contents when exposed to fire or heat. The provisions of this final rule will reduce the risk that a fire on board an aircraft will be significantly worsened by the presence of compressed oxygen cylinders or chemical oxygen generators.

Because the possibility of fire in a cargo compartment cannot be completely eliminated, the FAA has adopted requirements to mitigate risk and increase the likelihood that a fire can be suppressed and contained long enough to land the aircraft. The FAA has upgraded fire safety standards to require inaccessible cargo compartments on passenger aircraft to have a fire detection and three-hour suppression system, by minimizing the available oxygen (e.g., 14 CFR 25.857(c), 25.858, 121.314(c)). In addition, flame penetration and fire resistance requirements apply to cargo compartments on both passenger and cargo-only aircraft (e.g., 14 CFR 25.855, 121.314(a)). However, these requirements do not, and cannot, address those situations where a fire is actually fed by oxygen provided by other cargo, such as cylinders of compressed oxygen or other oxidizing gases or oxygen generators.

Accordingly, as discussed in the "Background" section above, we have prohibited the transportation of chemical oxygen generators on board passenger-carrying aircraft and the transportation of spent chemical oxygen generators on both passenger-carrying and cargo-only aircraft, and we issued standards governing the transportation of chemical oxygen generators on cargo-only aircraft, including the requirement for an approval issued by PHMSA. We have also imposed additional requirements on the transportation of compressed oxygen cylinders by aircraft; and prohibited the carriage of chemical oxidizers in inaccessible aircraft cargo compartments that do not have a fire or smoke detection and fire suppression system. The amendments adopted in this final rule are a continuation of our ongoing objective to reduce the risk of another catastrophic event like the ValuJet crash.

Because fires on aircraft cannot be totally eliminated, and the consequences of fire in air transportation are far greater than those in highway transportation, an absence of incidents involving ground transportation of oxidizing gases and oxygen generators does not justify postponing these actions. The fact that an oxygen cylinder or generator did not release oxygen during a particular aircraft fire does not diminish the potential for enhancement of a cargo compartment fire by the release of oxygen and the likely consequences. For these reasons, we disagree with the comment that PHMSA should only address the reasons a fire occurs in a cargo bay, rather than what effect a fire has on oxygen.

We accept the suggestion that international carriers and international regulations should be considered when undertaking any rulemaking potentially affecting international commerce. The escalating quantity of hazardous materials transported in international commerce necessitates the harmonization of domestic and international requirements to the greatest extent possible. However, we cannot wait for an international agreement when it is necessary to address a known safety hazard. Therefore, we intend to submit a paper to the ICAO Dangerous Goods Panel proposing that the ICAO Technical Instructions be amended consistent with this final rule.

We also considered this proposal based on its overall impact on transportation safety and the economic implications associated with its adoption into the HMR. Our goal in this rulemaking is to increase the level of safety for the transportation of oxygen cylinders and oxygen generators currently in the HMR in the most cost-effective manner possible. We believe the adoption of this final rule contributes to meeting that goal.

Larger cylinders used as part of an aircraft's supplemental oxygen system (up to 213 cubic feet) makes it impractical for them to be transported (as cargo) in the aircraft cabin under the exception in § 175.501(c). As noted above, when these cylinders are installed on the aircraft, they are not subject to the HMR, nor are Protective Breathing Equipment (PBEs) that are part of the required equipment on board the aircraft—but alternate packagings may be used for these cylinders and PBEs when carried or shipped as replacement items (or company material), ''provided such packagings provide at least an equivalent level of protection to those that would be required by this'' final rule. 49 CFR 175.8(a)(3) (as adopted at 71 FR 14605 [March 22, 2006]).

We disagree with the commenter's opinion that thick smoke was the likely cause of the ValuJet incident. First, that view has little support in the NTSB's findings (at p. 134 of the accident report) that ''[o]nly a small amount of smoke entered the cockpit before the last recorded flightcrew verbalization * * * including the period when the cockpit door was open,'' and the ''loss of control was most likely the result of flight control failure from the extreme heat and structural collapse,'' although ''the Safety Board cannot rule out the possibility that the flightcrew was incapacitated by smoke or heat in the cockpit during the last 7 seconds of the flight.'' Moreover, even if the commenter were correct, that circumstance would support the measures we are adopting to prevent the enhancement of a cargo compartment fire (and the associated smoke) caused by the release of oxygen from a cylinder or an oxygen generator.

BP Aerospace and Intertechnique recommend an exception from the proposed packaging requirements for cylinders that are nominally empty, with only a small amount of residual pressure, on the ground that the hazards of these ''empty'' cylinders are negligible. BP Aerospace states it is a common practice to transport such cylinders in order to avoid possible contamination of the cylinder from inward leakage. Intertechnique notes many cylinders are shipped before filling (new or repaired cylinders) or after being emptied (for maintenance).

Oxygen is a Division 2.2 gas and, as such, is only subject to the regulations when the pressure in the container (cylinder) equals or exceeds 280 kPa (40.6 psia) at 20 °C (68 °F) (see § 173.115(b)(1)). Therefore, oxygen cylinders where the pressure has been reduced to less than 280 kPa (40.6 psia) are not subject to the regulations and are considered to have been purged to the extent necessary for the purposes of § 173.29(b)(2)(ii). In addition, a completely empty cylinder (either new and never filled or purged of all its contents) is not subject to the packaging requirements adopted in this final rule (or to other transportation requirements in the HMR).

2. Other Oxidizing Gases Aboard Aircraft

Several commenters also addressed our proposal to prohibit the transportation of all oxidizing gases (other than compressed oxygen) aboard both passenger and cargo-only aircraft. In the NPRM, we discussed our concern that cylinders containing these materials, if exposed to a fire, could intensify the fire to the extent that it would overcome the compartment's halon fire suppression system, penetrate the cargo compartment sidewalls, and cause severe damage or destruction of the aircraft. We stated we had no information to support the need for the following materials to be transported aboard aircraft: ''Air, refrigerated liquid, (cryogenic liquid),'' ''Carbon dioxide and oxygen mixtures, compressed,'' ''Nitrous oxide,'' ''Nitrogen trifluoride, compressed,'' ''Compressed gas, oxidizing, n.o.s.,'' and ''Liquefied gas, oxidizing, n.o.s.''

Air Products expressed agreement with the Department on the need to increase the level of safety in the transportation of oxidizing gases by aircraft, and it states the list should not be limited to oxygen. Air Products suggests materials in Division 2.2 with a subsidiary risk of 5.1 can be transported safely by aircraft and pose no great risk to the aircraft unless the oxidizing material is exposed to abnormally high temperatures over an extended period of time. This commenter suggested packaging performance requirements can be met by limiting the fill density pressure of the oxidizing material and configuring the cylinder so that oxidizing material cannot escape at temperatures up to and including 205 °C (400 °F). Air Products submitted alternative wording for a new section under § 173.302a that would pertain to nitrogen trifluoride and nitrous oxide.

Alaska Airlines opposes the proposal to ban Division 2.2 gases with a 5.1 subsidiary risk for transportation by air, stating it is not aware of any experience indicating a safety problem. According to the Alaska Airlines' comments, consumers in Alaska use some of these gases, and in many cases, could not obtain them if not via air transportation. One Anchorage vendor of gas products estimates 20,000 to 50,000 pounds of cylinders of compressed oxygen and nitrous oxide are transported by air every month to medical facilities around the State, with empty cylinders constantly being returned for refilling and return to the hospitals. Alaska Airlines states DOT needs to consider the impact of this proposed rule on the health and welfare of Alaskans, not to mention the subsequent increased cost of medical care. This commenter also notes international regulations identify two additional materials classified as Division 2.2 materials with a 5.1 subsidiary hazard that are permitted on passenger aircraft: ''UN2037, Receptacles, small, containing gas (oxidizing) without a release device, non-spillable,'' and ''UN2037, Gas cartridges (oxidizing) without a release device, non-spillable.'' The commenter concludes that if PHMSA does ban oxidizing gases, it will create additional variances between United States and United Nations dangerous goods regulations DOT has been working to harmonize.

The comments summarized above indicate a continuing need for air transportation of most of the oxidizing gases we had proposed to prohibit on aircraft, including Compressed gas, oxidizing, n.o.s.; Nitrogen trifluoride, compressed; and Nitrous oxide. Based on those comments, we conclude we should not prohibit air transportation of these oxidizing gases; however, the same outer packaging standards adopted for cylinders of compressed oxygen and oxygen generators should also be required for these other oxidizing gases. The only exception is that Air, refrigerated liquid (cryogenic liquid), which is already prohibited on passenger aircraft, will also be prohibited on cargo-only aircraft.

3. Packaging Design Standards

In the NPRM, we proposed to require a cylinder of compressed oxygen to remain below the temperature at which its PRD would activate, and an oxygen generator not actuate, when exposed to a temperature of at least 205 °C (400 °F) for three hours. ALPA recommends the design standards be raised to 260 °C (500 °F), instead of 205 °C (400 °F), and to 3.5 hours, instead of three hours, in cargo compartments required to have an active fire suppression system, and maintain the knock-down fire status to allow for a safety margin for temperature in excess of the expected mean of 205 °C (400 °F). In addition, Aviation Mobility states there is no aircraft that would survive the extreme conditions for the three-hour duration which the rule would require the cylinder to survive without the actuation of the PRD.

We disagree. We continue to believe that these requirements for outer packagings are the most appropriate means to prevent the release of oxidizing gases from a cylinder or chemical generator, which could feed an aircraft compartment fire. The U.S. DOT/FAA Report titled ''Evaluation of Oxygen Cylinder Overpacks Exposed to Elevated Temperature'' (included in the docket of this rulemaking), found that: ''In a Class C compartment, the fire would be detected and agent discharged to extinguish the fire. In the event of a suppressed but not fully extinguished fire, which would be the case if the origin were a deep-seated fire, the temperatures in the compartment could reach 205 °C (400 °F).'' For a deep-seated fire in a Class C cargo compartment, a temperature of 205 °C (400 °F) is the estimated mean temperature of a cargo compartment during a halon-suppressed fire.

The FAA test results support our conclusion that a temperature of at least 205 °C (400 °F) is sufficient for the flame resistant penetration test method. In addition, the conditions noted in the NPRM are a worst-case scenario, and were based on a deep-seated fire in a Class C cargo compartment, the duration of which would be the maximum estimated diversion flight time for an aircraft flying a southern route over the Pacific Ocean. However, limiting the requirement for overpacks capable of meeting the three-hour suppression performance standard to overseas flights would be impractical, since this rulemaking anticipates in most instances the overpacks will be provided with the containers, rather than purchased and maintained by an air carrier. Since the initial shipper may not know the final destination of its product, it would also be unable to reliably determine when to use a three-hour overpack as opposed to a one-hour overpack. In any case, applying a lesser fire penetration and thermal protection standard to overpacks because of the shorter flight times to diversion airports in geographic areas other than the South Pacific would undermine the existing rationale behind our requirements that Class C cargo compartments on airplanes be equipped to meet the three-hour fire suppression standard. Therefore, we are amending the HMR to require each cylinder of compressed oxygen remain below the temperature at which its PRD would activate, and that an oxygen generator not actuate, when exposed to a temperature of at least 205 °C (400 °F) for three hours.

We also received comments on the proposal to require an outer packaging to be built either to the ATA Specification 300 standard or to a UN standard at the Packing Group II performance level. One commenter (Aviation Mobility) states it encloses oxygen cylinders in a manner that provides safe delivery to the gate and use of the cylinder in the passenger compartment without altering the outer packaging. The commenter notes that, under Special Provision A52 of the HMR, an oxygen cylinder may be carried in the passenger compartment or an inaccessible cargo compartment on a passenger aircraft if it is in ''an overpack or outer packaging that conforms to the performance criteria of Air Transport Association (ATA) Specification 300 for Category I shipping containers.'' The same commenter states its specific outer packaging meets the ATA 300 definition of a ''rigid pack'' and questions whether PHMSA intended any difference in its use of the term ''rigid'' in the NPRM.

For clarification, we proposed requiring an outer packaging to be built either to the ATA Specification 300 standard or to a UN standard at the Packing Group II performance level to provide greater flexibility in the design of outer packaging for oxygen cylinders. In the NPRM, we proposed to authorize only rigid outer packagings in order to clarify our original intent to ensure outer packaging provides an adequate level of safety. In addition to meeting the flame penetration and thermal resistance protection requirement, we will continue to require the outer packaging for compressed oxygen cylinders to meet certain performance criteria. Therefore, we are amending the HMR to allow the outer packaging be built either to the ATA Specification 300 standard or to a UN standard at the Packing Group II performance level. In addition, we are amending the HMR to authorize only rigid outer packaging for compressed oxygen cylinders.

4. Packaging Availability and Cost

Commenters expressed concern about the availability and cost of the proposed outer packaging, and the number of different types of outer packagings meeting the proposed thermal resistance and flame penetration requirements. For example, Continental states because this packaging is not yet available, any cost estimate is subject to significant error. Continental estimates the initial cost to provide outer packagings meeting the required flame and temperature penetration standards will exceed $850,000. The same commenter estimates costs of at least $500,000 to modify its medical oxygen service.

Scott states it would need a minimum of nine (9) different-sized ATA 300 specification containers to accommodate all of the high-pressure oxygen cylinders it currently supplies, and additional size packages may be required to adequately accommodate high pressure oxygen cylinders supplied by other entities or to accommodate cylinder configurations for new aircraft development programs. This commenter estimates the average cost of currently used outer packagings would range from $300 to $500 per container. Scott recommends PHMSA conduct additional analyses to determine the number of different outer containers that would be required to accommodate chemical oxygen generators.

Scott also disputes our statement in the NPRM that only a few small aviation entities will require flame and heat protective reusable packaging and suggests PHMSA did not consider the major potential impact of this rule on small entities. According to Scott, ''many small aircraft operators do not provide their own oxygen system maintenance or have extensive spare part inventories but, rather, rely on the shipping of these components to specialized oxygen repair stations, by air, in order to maintain their aircraft in a timely manner.'' Scott states these companies would be required to obtain outer packages meeting the requirements of this proposed rule in order to ship oxygen cylinders and valve and regulator assemblies to oxygen service shops for maintenance. These outer packages ''would then be used to return these items to the operator in the same manner that the present rule has required the operators to purchase ATA 300 specification containers for that purpose.''

ATA contends the requirement for carriers to comply with the proposed outer packaging requirements would be costly and prohibitive to air carriers of oxygen generators, forcing carriers to refuse passengers or cancel flights because of the lack of generators supplying emergency oxygen to aircraft passenger seats. It states it conferred with vendors and found neither existing packaging, nor a design amenable to the proposed requirements in the developmental stage of manufacturing. ATA estimates replacement packaging costs of approximately $2,200,000 to $3,350,000 for its members, without any substantial improvement in safety. This commenter states this cost could effectively double as existing ATA Specification 300 packaging, acquired in response to the final rule in HM–224A, could not be converted for other uses.

NWA states it uses seven cylinder types and estimates four separate sized boxes will be required for its seven cylinder types to meet the proposed packaging requirement. NWA foresees the replacement of 1,400 boxes at twice the cost necessary to replace the boxes that were required by HM–224A. In addition, the commenter says it would be forced to scrap the boxes purchased in compliance with HM–224A before the exhaustion of their useful life. FedEx notes the proposed outer packaging is neither currently available for purchase, nor does it know when it will be available, or at what cost. It estimates the required packaging will range between $600 and $900 per unit, for an estimated cost imposed on its operations of between $360,000 and $540,000.

Intertechnique states the introduction of the packaging proposed in the NPRM will lead to added costs for shipping cylinders from the cylinder manufacturer to aircraft manufacturers and airlines, and to and from airline maintenance sites. Intertechnique asserts there are approximately 500 new cylinders per year requiring outer packagings and those packagings delivered to aircraft manufacturers may be sent back for future shipment (with an estimated loss of 20% per year). It says the outer packagings of cylinders shipped to airlines will be retained by the airlines for their own shipment or repair, and new packagings will have to be bought for each shipment. Intertechnique estimates a replacement rate of 10% per year, with a best estimate need of 300 new outer packagings per year, leading to an average cost increase of the oxygen cylinders and repairs of 10 to 15% depending on the final cost of packaging not yet available on the market.

Satair states it is currently spending approximately $50,000.00 on packaging and other materials to facilitate the shipping of chemical oxygen generators. It estimates a ten-fold increase in packaging and other material costs needed to implement the requirements in the NPRM, for a total of approximately $500,000.00. This commenter considers this to be a significant impact on its business and would have to bill and recover this expense from its customers, the airlines. Aviation Excellence states the additional cost for packaging and return shipments will impose a prohibitive financial burden.

Many of the commenters indicate they do not provide medical oxygen service to persons with disabilities, and, therefore, do not address whether the proposals would increase the cost to transport medical oxygen. However, Continental and ATA state they offer this service and this requirement would have to be evaluated for the cost impacts and feasibility of this service. Aviation Mobility states it is not aware of any outer packaging in existence that would meet the fire resistance criteria proposed in the NPRM. The commenter states the cost of this service would become too expensive to pass along to customers, or for carriers to absorb. This same commenter asserts that, as a result of the costs to acquire the outer packaging specified in this rulemaking and the added weight of such a packaging, most carriers transporting medical oxygen to passenger air carriers will discontinue this service. Further, this commenter states all cost speculations with regard to such a packaging are merely theoretical. ATA recommends PHMSA reconsider this rulemaking action to consider possible disadvantages to disabled passengers requiring medical oxygen.

We considered possible cost increases and the availability of outer packaging for oxygen generators and cylinders containing compressed oxygen and other oxidizing gases. At least one packaging manufacturer (Viking) appears to have addressed the flame penetration and thermal penetration standard and states it is able to produce the required packaging. That manufacturer provided estimates of costs for the existing ATA specification 300 packagings and the new outer packagings, and those estimates were used in our complete analysis of the associated costs to implement this final rule in the regulatory evaluation (available for review in the public docket for this rulemaking).

In that regulatory evaluation, we specifically discussed cost figures provided by other commenters and the basis on which we estimated a total cost of $10.8 million ($7.6 million discounted to present value) over 15 years, for the transport of oxygen cylinders; and $27.0 million ($16.9 million discounted to present value) over 15 years, for the costs associated with the transport of chemical oxygen generators. While some of the cost figures provided by other commenters are higher, those figures are reasonably close to the estimates used in the regulatory evaluation; moreover, the estimates used in the regulatory evaluation do not reflect the likelihood that, when this requirement becomes effective, additional manufacturers will produce the required packaging, thereby reducing purchase prices. With competitive packaging pricing available in the marketplace, air carriers will be in a better position to make cost-effective business decisions to continue providing medical oxygen service to the disabled community and will continue to do so. Even if we were to assume the industry commenters were correct, and the cost of this rule was to double, the benefits would still outweigh the higher costs. Thus, the agency has carefully weighed these comments in deciding to proceed with this rulemaking initiative.

We also estimated benefits of this rule over the next 15 years range from $30 million, if a single cargo aircraft accident is averted, to $357 million, if a single passenger aircraft accident is averted. This indicates a significant potential to improve the level of safety associated with the continued transportation aboard aircraft of packages of chemical oxygen generators and cylinders containing compressed oxygen and other oxidizing gases.

PHMSA continues to believe that only a few small entities will be affected by this rulemaking. For example, we learned from container manufacturers that only ten small air carriers transport cylinders of compressed oxygen. Outside of Alaska, air shipments of other oxidizing gases are very infrequent, according to the comment of Air Products, and most small entities will be able to utilize ground transportation or local companies for shipping cylinders of compressed oxygen or other oxidizing gases.

Therefore, we are amending the HMR to require an outer packaging for an oxygen cylinder and a package containing an oxygen generator to meet the standards in Part III of Appendix F to 14 CFR Part 25, Test Method to Determine Flame Penetration of Cargo Compartment Liners. We are also amending the HMR to require cylinders of compressed oxygen and chemical oxygen generators to be transported in an outer packaging meeting certain flame penetration and thermal resistance requirements when transported aboard an aircraft. In addition, we are amending the HMR to require that the outer packaging be capable of meeting the requirements throughout its service life.

5. Compliance Date

PHMSA received several comments regarding the proposed effective date of one year after publication of the final rule as the mandatory date to comply with this final rule. Many commenters state one year does not provide adequate time to resolve concerns regarding a lack of packaging development and availability, manufacturing lead times, inventory, logistics, and documentation. For instance, Scott states the currently proposed rule, with a proposed compliance date of one year after promulgation, provides neither the time necessary for an orderly process of ensuring compliance, nor a mechanism by which compliance can be readily determined. The commenter also states the demand for reusable flame and heat-resistant packagings required by the proposed rule may be much higher than PHMSA currently envisions. Another commenter (ATA) states a one-year effective date would impose additional costs on carriers by forcing the removal of aircraft from service to replace the outer packaging proposed in the NPRM. In response to our inquiries in the NPRM regarding the effective date, we received recommendations ranging from one to three years for implementation of the effective date of this final rule.

It appears compliance with the additional overpack requirements of one year following the publication of the final rule as proposed in the NPRM may result in insufficient time or undue hardship on the affected parties to come into compliance with the new requirements. A compliance date that allows flexibility for the affected parties and sufficient time for various manufacturers to develop and market the necessary equipment would better serve the overall objectives of this rulemaking. Therefore, we are amending the HMR to establish a mandatory compliance date of two years following the effective date of the final rule.

C. Pressure Relief Device Settings and Authorized Cylinders for Compressed Oxygen and Other Oxidizing Gases

In the NPRM, we proposed amendments to the HMR pertaining to limits on PRD settings and cylinders authorized for the transportation of oxygen aboard aircraft. Compressed Gas Association (CGA) Pamphlet S–1.1, which has been incorporated by reference in the HMR, specifies the rated burst pressure of a rupture disk must be no greater than the cylinder minimum test pressure. However, CGA Pamphlet S–1.1 does not set a lower burst limit on the disks, increasing the risk of oxygen releases at elevated temperatures. To better prevent a cylinder from releasing its contents when exposed to a fire, we proposed to require an oxygen cylinder to be equipped with a PRD that has a rated burst pressure equal to the cylinder test pressure with allowable tolerances of −10 to plus zero percent.

We also proposed to limit cylinders authorized for the transportation of compressed oxygen aboard aircraft to DOT specifications 3A, 3AA, 3AL, and 3HT in order to minimize numerous PRD setting requirements for oxygen cylinders aboard aircraft. Although numerous specifications are authorized for oxygen and other oxidizing gases (49 CFR 173.201, 173.202a, 173.204, 173.204a), we understand these four specifications account for the vast majority of the cylinders used to transport these materials aboard aircraft—in addition to cylinders made of composite materials and authorized under special permit. (Specification 3HT cylinders are only authorized for aircraft use, and specification 3A and 3AA cylinders represent approximately 70% of the cylinders in all service.) This proposed limitation was not intended to restrict the use of composite cylinders that are currently, or may in the future be, authorized for transporting oxygen and other oxidizing gases under special permits.

Several commenters, including ATA, noted the proposed PRD setting for a DOT specification 3HT was incorrect. The NPRM should have stated the rated burst pressure of a rupture disk on a 3HT cylinder must be 90% of the cylinder test pressure. In this final rule, we have corrected this error.

ATA also asks about the proposal for replacement of PRDs specifically on 3HT cylinders, and whether this standard will be applied to other types of cylinders. Aviation Mobility expresses concern that raising the discharge pressure of PRDs on any gas cylinder will increase the potential for catastrophic failure. Continental Airlines states the limit on PRD settings proposed in the NPRM does not significantly increase the level of safety beyond current hazardous materials regulations. It questions the need to raise the PRD standards based on the lack of incidents related to compressed oxygen that meet existing temperature and pressure relief standards. It argues the level of protection of the aircraft transporting the oxygen cylinders is not increased even if the level of protection to the oxygen cylinders is increased.

Continental also raises cost concerns and estimates the costs for its company to meet the new PRD settings could exceed $2,500,000, of which $500,000 would be required to modify its medical oxygen service. According to this commenter, these costs will result in additional expense to disabled customers via increased oxygen service fees, and may force airlines to consider discontinuing this service. Scott suggests the requirement for PRDs apply after the next requalification.

NWA expresses concern about the cost to replace approximately 2,800 PRDs in its current supply of cylinders. The commenter states its cylinder maintenance is performed by a vendor and this rulemaking will force cylinders out of service for an extended period of time. NWA also recommends PHMSA perform an analysis to determine the effects a slow venting cylinder will have on the concentration of oxygen in cargo holds.

For cost reasons and ease of maintenance, according to Intertechnique, most PRDs are standard items, and changing the PRDs to match the new requirements will increase costs and delays. Intertechnique recommends that the reliability of PRDs with a smaller tolerance should be considered. In addition, Intertechnique states increasing the PRD setting does not drastically change the safety level. The leaking of the cylinder will be delayed until the temperature is higher (as will be the pressure), but the energy released at the moment of bursting the device will be higher, thus propelling oxygen with a higher flow and a larger velocity to a larger area. Intertechnique also states proof pressure varies from steel to composite cylinders, and the same PRD can be used for both types. It says changing the tolerance will lead to duplicating the PRD part numbers and cost increases, resulting in confusion within workshops that could lead to errors in installing PRDs. In addition, Intertechnique states the packaging should include a pressure balancing device (PBD) to prevent packaging burst due to pressure change within the cargo compartment during ascents and descents.

PHMSA continues to believe increasing the discharge pressure of PRDs on cylinders used to transport oxygen and other oxidizing gases will significantly increase the level of safety without increasing the potential for catastrophic failure of the packaging. One objective of this rulemaking is to prevent the actuation of the cylinder PRD so as to retain the cylinder's contents during an otherwise controllable cargo compartment fire. The outer packaging requirement proposed in the NPRM is designed to protect a cylinder and oxygen generator that could be exposed directly to flames from a fire, or indirectly, to heat from a fire. A new limit on the PRD settings on cylinders containing compressed oxygen or other oxidizing gases transported aboard aircraft will help ensure the contents of the cylinder are not released into an aircraft cargo compartment in the event of a fire. The design safety margin on the cylinder is high enough that the risk of catastrophic failure of the cylinder is not a serious concern.

Therefore, we are amending the HMR to require a new limit on the PRD settings on cylinders containing compressed oxygen or other oxidizing gases when transported aboard aircraft to ensure the cylinder contents are not released into an aircraft cargo compartment in the event of a fire. In order to accomplish this, we are amending the HMR to limit the PRD to a setting that will prevent it from releasing at temperatures the cylinder will experience while protected by the outer packaging. We are also amending the HMR to require cylinders containing oxidizing gases, including oxygen, to be equipped with PRDs that have a set pressure equal to the cylinder test pressure with allowable tolerances of −10 to plus zero percent.

In order to eliminate a significant portion of the costs associated with this requirement, we are adopting the commenter's suggestion to apply this requirement to cylinders beginning with each individual cylinder's next requalification date. Although not required, many cylinder owners replace the PRD during the five-year requalification as recommended by CGA Pamphlet S–1.1. Because relatively few cylinders are shipped by air, any additional costs associated with replacing the PRD at the next requalification date will be negligible.

Several commenters (Airbus, ATA, Carleton, Draeger, Intertechnique, Satair, Scott Aviation, and UPS) ask PHMSA to reconsider the requirement to limit the transportation of compressed oxygen aboard aircraft to DOT specifications 3A, 3AA, 3AL, and 3HT cylinders. Airbus states this proposed restriction is based on the assumption that these cylinders are the most commonly used for the transportation of compressed oxygen aboard aircraft, and on an apparent intention by PHMSA to limit the number of PRD settings. BE Aerospace contends the large volume of these cylinders is primarily because they have been in existence for many years. Scott confirms that the majority of oxygen cylinders currently in aviation service are DOT specification 3AA and 3HT cylinders.

Several commenters appear to believe we were proposing to exclude composite cylinders on board aircraft, despite the fact that a significant portion of compressed oxygen cylinders are currently made of composite material. For example, Airbus states composite cylinders combine weight-saving potential with significant cost reductions; perform as well as steel/aluminum cylinders; are subject to the same qualification tests as steel/aluminum cylinders; and are likely to be used increasingly in the future, especially the storage of oxygen as part of a gaseous oxygen system and portable oxygen cylinders for first aid. Airbus and others suggest that, if composite oxygen cylinders are not allowed aboard aircraft, many airlines will experience difficulty and increased costs regarding the maintenance and servicing of these composite oxygen cylinders. Carleton recommends that 49 CFR 173.302a(c)(1) be amended to include ''DOT Exemption Cylinders manufactured to the requirements of DOT FRP–1 or DOT–CFFC,'' and that § 173.302a(e)(2) define the PRD requirements for compressed oxygen cylinders and be amended to include ''DOT Exemption Cylinders must be equipped with a PRD as required by the appropriate Specification.'' Carleton also recommends PHMSA amend paragraph (e)(2) to read ''90% of cylinder test pressure'' and change ''−10 to zero percent of cylinder test pressure'' to ''−10 to plus zero percent of cylinder test pressure.''

Composite cylinders are lightweight, possess weight- and fuel-saving potential, and may lead to an overall reduction in the associated costs for air transportation of compressed oxygen. PHMSA recognizes the prevalence of composite cylinders in air transportation, the increased use of these cylinders by industry for the transportation of compressed oxygen, and that these trends are likely to continue in the future. We acknowledge that composite cylinders are currently authorized for the transportation of compressed oxygen aboard aircraft under special permit. No change in the HMR is required to permit composite cylinders to be used in oxygen service. The limitation of cylinders authorized for the transportation of compressed oxygen and other oxidizing gases aboard aircraft to DOT specifications 3A, 3AA, 3AL, and 3HT does not exclude composite cylinders from being utilized for the transport of compressed oxygen by air transportation under the terms of a special permit, which is issued only upon a finding that the use of a composite cylinder achieves a level of safety that is at least equal to that required by this rulemaking. The PRD requirements for composite cylinders will be updated to match the new requirements of this final rule. Consistent with our past practice of adopting special permits into the HMR, we will review these special permits to determine if they are suitable for inclusion into the HMR.

Therefore, we are amending the HMR to require cylinders authorized for the transportation of compressed oxygen aboard aircraft to be limited to DOT specifications 3A, 3AA, 3AL, and 3HT.

D. Limits on Number of Oxygen Cylinders Transported on Aircraft

In HM–224A, we adopted a limitation on the number of cylinders of compressed oxygen allowed to be carried on aircraft: (1) Up to six cylinders belonging to the aircraft carrier plus one cylinder per passenger needing oxygen at destination could be transported in the passenger cabin, and (2) no more than a combined total of six cylinders of compressed oxygen may be carried in inaccessible aircraft cargo compartments that lack a fire or smoke detection system and a fire suppression system. See former 49 CFR 175.10(b), 175.85(i), recodified at 175.501(b) & (c) (71 FR 14586). In the NPRM in this rulemaking, we proposed to remove the limits on the number of oxygen cylinders that may be transported in cargo compartments not equipped with sufficient fire suppression systems.

NTSB did not support the proposal to remove the current limit on the number of compressed oxygen cylinders that may be transported aboard aircraft until sufficient data on the performance and durability of the proposed overpacks has been collected. ALPA notes that, in justifying the proposal to require cylinders of compressed oxygen contained in an outer packaging not reach a temperature of 93 °C (199 °F) when exposed to a 205 °C (400 °F) temperature for three hours, PHMSA outlines conditions expected to be encountered within a cargo compartment during a suppressed cargo fire. The commenter states these conditions are then used as a basis for the requirement that an oxygen cylinder withstand a 1,700 °F flame for 5 minutes, followed by a temperature of 205 °C (400 °F) for 3 hours.

ALPA questions why PHMSA would propose to allow these oxygen cylinders in cargo compartments without any fire or smoke detection or an active fire suppression system. The commenter states if there were to be a fire in a cargo compartment without an active fire suppression system, the temperatures in the compartment would far exceed 205 °C (400 °F). According to ALPA, the only method available to limit the severity of such a fire is to limit the oxygen present within the compartment, either through an airtight under-floor design or by depressurizing the aircraft in the case of the main deck (Class E compartment) of an all-cargo aircraft. By introducing an oxygen cylinder unable to withstand the high temperatures of an unsuppressed fire, the commenter states either method would be negated. The commenter recommends oxygen cylinders be prohibited from transport in compartments without a fire or smoke detection system and an active fire suppression system.

Further, ALPA stresses any fire suppression system required by the rulemaking should be an active fire suppression system, with a knock-down agent (e.g., Halon). While a cargo compartment that limits the flow of oxygen may be considered to have a suppression system, the commenter contends this is clearly not the intent of the rulemaking, and asks that the word ‘‘active’’ be included in any discussion of suppression systems. The commenter also requests specific criteria to determine what constitutes passing or failing a visual inspection of oxygen generators by accepting personnel, and suggests a requirement for this person to provide a signature indicating the cylinder has passed a visual inspection. Finally, this commenter expresses concern with the proposal to allow oxygen generators aboard cargo-only aircraft in cargo compartments without an active fire suppression system, as the compartment design criteria are insufficient to withstand the conditions encountered in an unsuppressed fire. The objections by this commenter to this scenario are the same as for oxygen cylinders; specifically, the compartment design criteria are insufficient to withstand the conditions that would be encountered in an unsuppressed fire. The commenter concludes by recommending that oxygen generators be prohibited from transport on both passenger and cargo-only aircraft due to the additional hazard potential even in the presence of fire suppression systems.

Other commenters suggest alternatives to this rulemaking. Intertechnique recommends PHMSA conduct further investigation into this area before incorporating this proposal into the HMR. The commenter notes one procedure to control or suppress fire involves depressurizing the aircraft and suggests tests should include a rapid pressure change of the test chamber to simulate rapid decompression followed by a rapid descent of the burning aircraft. The commenter argues this decompression should not lead to bursting the packaging, and the ingestion of hot gas into the packaging during descent may lead to a rapid increase of the internal temperature that should be evaluated before the introduction of this regulatory change.

We acknowledge the commenters' concerns regarding the transportation of oxygen cylinders in cargo compartments without an active fire suppression system, and have reconsidered this proposed regulatory change. Based on these comments and consistent with current requirements, we are revising § 175.501 to require that, except for Oxygen, compressed, no person may load or transport a hazardous material for which an OXIDIZER label is required in an inaccessible cargo compartment that does not have a fire or smoke detection system and a fire suppression system. We are also revising this section to simplify the stowage requirements of cylinders of compressed oxygen previously located in § 175.85(i)(2) and (3), and to retain the limit of a combined total of six cylinders of compressed oxygen that may be stowed on an aircraft in the inaccessible aircraft cargo compartment(s) that do not have fire or smoke detection systems and fire suppression systems.

E. Chemical Oxygen Generator Approval

In the NPRM, we proposed to add a new § 173.168 that would: (1) Specify the means to be incorporated into an oxygen generator to prevent inadvertent actuation; (2) require the oxygen generator to be capable of withstanding a 1.8 meter drop with no loss of contents or actuation; and (3) specify packaging, shipping paper, and marking requirements for those oxygen generators that are installed in a piece of equipment sealed or otherwise packaged so it is difficult to determine if an oxygen generator is present.

SR Technics supports the additional marking requirement contained in the newly proposed § 173.168. This commenter states it is currently undergoing an evaluation involving the inadvertent transportation of chemical oxygen generators assembled in sealed components. In this situation, personnel handling this material did not realize the generators were installed in the component (passenger service units). In addition, this same commenter suggests chemical oxygen generators are not properly identified on Material Safety Data Sheets (MSDS). The commenter recommends we coordinate efforts with the Occupational Safety and Health Administration (OSHA) so critical safety transportation information is included on a MSDS for chemical oxygen generators.

Scott argues the proposed rule would reword paragraph 173.168(d) to require ‘‘a chemical oxygen generator installed in equipment, (e.g., a PBE) [to] be placed in a rigid packaging * * * that conforms to the requirements capable of meeting the flame penetration and thermal resistance requirements of this proposed rule for shipment by air.'' PBEs, manufactured by Scott, are all one size and shape and, therefore, one size outer packing may suffice for Scott. This commenter states other manufacturers offering PBEs will most likely need a different outer packing. The commenter says PBEs are not the only aviation ‘‘equipment'' in which oxygen generators are installed. For instance, Scott states that, in certain aircraft, it may be practical to replace just the chemical oxygen generator when maintenance is required. However, in other aircraft, it may be safer and more convenient to replace what is termed the ‘‘dropout box,'' or passenger service unit (PSU), rather than just the oxygen generator. According to Scott, the dropout box is an assembly containing one or more oxygen masks, a chemical oxygen generator, and the related equipment needed to cause the box to open and the masks to deploy during a depressurization event.

The same commenter further states chemical oxygen generators are often contained in PSUs, which are segments of the cabin interior ceiling containing a chemical oxygen generator, several passenger oxygen masks, the reading lights, ventilation ducting, attendant call button, and other associated appliances. The commenter suggests the great variety of sizes and shapes of these assemblies means a large number of different sized packages may be required, or that these items may have to be disassembled, their chemical oxygen generators removed for shipment in a separate package, and the items reassembled at destination. The commenter says disassembly for shipment and subsequent reassembly increases cost and the possibility of mis-assembly and the subsequent failure of the oxygen equipment to function properly in an emergency.

Other commenters also express concern about the elimination of approvals for any person except manufacturers of chemical oxygen generators. Aviosupport recommends the proposal to eliminate distributors from being able to handle or repackage chemical oxygen generators to the airline industry be removed from this rulemaking, altogether. Satair states this proposal would not allow it to handle, repack and offer for transportation chemical oxygen generators and PBEs on any mode of transportation, including air. The commenter states such a limitation would create a significant loss of support in the commercial aerospace supply chain and would negatively impact its company. The same commenter further states the Competent Authority approval is a proven tool to ensure safe storage, handling and transportation of chemical oxygen generators and PBEs.

The approval requirement for a chemical oxygen generator is still necessary and will be retained. However, the approval process will apply only to manufacturers of the chemical oxygen generator. This will eliminate the need for other persons to obtain shipment approvals, because we are incorporating into the HMR those aspects of the approvals specifically focused on safety controls, packaging, and marking. Accordingly, in this final rule, we are amending the HMR by adding a new § 173.168 to: (1) Specify means to be incorporated into an oxygen generator design to prevent actuation; (2) require an oxygen generator to be capable of withstanding a 1.8 meter drop with no loss of contents or actuation; and (3) establish packaging, shipping paper, and marking requirements for those oxygen generators that are installed in sealed equipment (or equipment in which it otherwise is difficult to determine if an oxygen generator is present). In addition, we have reconsidered the proposal to amend the shipping paper requirements and are not adopting this provision at this time. The recommendation that we coordinate efforts with OSHA to ensure that critical safety transportation information is included on a MSDS is beyond the scope of this rulemaking, but may be considered in the future.

We also proposed to specify in the HMR that a chemical oxygen generator that has passed the manufacturer's expiration date is forbidden for transportation by aircraft. Through the approval process, PHMSA had not allowed the transportation of expired oxygen generators aboard aircraft. With the elimination of the approval for other than oxygen generator manufacturers, we believe it is now necessary to specify this restriction in the HMR. We did not receive any adverse comments to this specific proposal. Therefore, we are amending the HMR to specify that a chemical oxygen generator that has passed the manufacturer's expiration date is forbidden for transportation by aircraft.

V. Effects on Individuals With Disabilities

Under separate PHMSA and FAA requirements [49 CFR 175.8(b)(1), and 14 CFR 121.574, 125.219, and 135.91, respectively], which this rulemaking would not amend, passengers may not carry their own oxygen dispensing systems aboard aircraft for use during flight. Air carriers are permitted to provide oxygen for passenger use in accordance with specified requirements in the aforementioned rules, although some air carriers may choose not to provide this service for their passengers. In the NPRM, PHMSA requested comments on whether the new proposed provisions placed on carriage of air carriers' own oxygen cylinders will significantly interfere with carriers' ability to provide this service, or increase the costs of this service, to passengers. This topic is covered above under ''Outer Packaging for Compressed Oxygen Cylinders and Oxygen Generators.''

The Office of the Secretary, PHMSA and FAA have initiated projects separate from this rulemaking action to explore whether safe alternatives exist for accommodating passenger needs in regard to use of medical oxygen. These projects may result in proposals to amend the relevant portions of the HMR and FAA regulations, as well as those of the Office of the Secretary implementing the Air Carrier Access Act of 1986 (49 U.S.C. 41705), which prohibits discrimination in regard to air traveler access on the basis of disability.

VI. Regulatory Analyses and Notices

A. Statutory/Legal Authority for Rulemaking

This final rule is published under the authority of Federal hazardous materials transportation law (Federal hazmat law; 49 U.S.C. 5101 *et seq.*) and 49 U.S.C. 44701. Section 5103(b) of Federal hazmat law authorizes the Secretary of Transportation to prescribe regulations for the safe transportation, including security, of hazardous material in intrastate, interstate, and foreign commerce. Section 1.53 of 49 CFR delegates the authority to issue regulations in accordance with 49 U.S.C. 5103(b) to the Administrator of the Pipeline and Hazardous Materials Safety Administration. United States Code § 44701 authorizes the Administrator of the Federal Aviation Administration to promote safe flight of civil aircraft in air commerce by prescribing regulations and minimum standards for practices, methods, and procedure the Administrator finds necessary for safety in air commerce and national security. Under 49 U.S.C. 40113, the Secretary of Transportation has the same authority to regulate the transportation of hazardous material by air, in carrying out § 44701, that he has under 49 U.S.C. 5103.

B. Executive Order 12866 and DOT Regulatory Policies and Procedures

This final rule is considered a significant regulatory action under section 3(f) of Executive Order 12866 and, therefore, was reviewed by the Office of Management and Budget (OMB). This rule is significant under the Regulatory Policies and Procedures of the Department of Transportation (44 FR 11034). The costs associated with the transport of oxygen cylinders are estimated to be $10.8 million over 15 years ($7.6 million discounted; the majority of which is believed to be associated with the transport of oxygen cylinders aboard passenger-carrying aircraft). The costs associated with the transport of chemical oxygen generators is estimated to be $27.0 million over 15 years ($16.9 million discounted). All costs have been discounted to present value at 7% and are expressed in 2004 dollars). The benefits of this rulemaking range from $30 million, if a single cargo aircraft accident is averted to $357 million, if a passenger aircraft accident is averted. Therefore, we conclude this final rule will be cost beneficial. A copy of the regulatory evaluation is available for review in the public docket.

C. Executive Order 12988

This final rule meets applicable standards in sections 3(a) and 3(b)(2) of Executive Order 12988, Civil Justice Reform, to minimize litigation, eliminate ambiguity, and reduce burden. The changes to the HMR in this final rule will not have a retroactive effect. Under PHMSA's procedural rules, there is a right to administratively appeal this final rule to PHMSA's Administrator (49 CFR 106.100 *et seq.*), but such an administrative appeal is not a prerequisite to seeking judicial review in accordance with 49 U.S.C. 5127.

D. Executive Order 13132

This final rule has been analyzed in accordance with the principles and criteria contained in Executive Order 13132 (''Federalism''). This final rule preempts State, local and Indian tribe requirements, but does not amend any regulation that has direct effects on the States, the relationship between the national government and the States, or the distribution of power and responsibilities among the various levels of government. Therefore, the consultation and funding requirements of Executive Order 13132 do not apply.

The Federal hazardous materials transportation law, 49 U.S.C. 5101–5127, contains an express preemption provision (49 U.S.C. 5125(b)) that preempts State, local, and Indian tribe requirements on the following subjects:

(1) The designation, description, and classification of hazardous material;

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

(3) The preparation, execution, and use of shipping documents related to hazardous material and requirements related to the number, contents, and placement of those documents;

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

(5) The design, manufacture, fabrication, marking, maintenance, recondition, repair, or testing of a packaging or container represented, marked, certified, or sold as qualified for use in transporting hazardous material.

This final rule addresses items 2 and 5 above and would preempt any State, local, or Indian tribe requirements not meeting the ''substantially the same'' standard.

Federal hazardous materials transportation law provides at § 5125(b)(2) that, if DOT issues a regulation concerning any of the covered subjects, DOT must determine and publish in the **Federal Register** the effective date of Federal preemption. The effective date may not be earlier than the 90th day following the date of issuance of the final rule and not later than two years after the date of issuance. This effective date of preemption is 90 days after the publication of this final rule in the **Federal Register**.

E. Executive Order 13175

This final rule has been analyzed in accordance with the principles and criteria contained in Executive order 13175 (''Consultation and Coordination with Indian Tribal Governments''). Because this final rule will not have tribal implications and does not impose substantial direct compliance costs on Indian tribal governments, the funding and consultation requirements of Executive Order 13175 do not apply, and a tribal summary impact statement is not required.

F. Regulatory Flexibility Act, Executive Order 13272, and DOT Procedures and Policies

The Regulatory Flexibility Act of 1980 establishes ''as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation.'' To achieve that principle, the Act requires agencies to solicit and consider flexible regulatory proposals and to explain the rational for their actions. The Act covers a wide-range of small entities, including small businesses, not-for-profit organizations and small governmental jurisdictions.

Agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. If the determination is that it will, the agency must prepare a regulatory flexibility analysis (RFA) as described in the Act.

However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, 5 U.S.C. 605(b) provides that the head of the agency may so certify and an RFA is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

The Small Business Administration recommends that ''small'' represent the impacted entities with 1,500 or fewer employees. For this final rule, small entities are part 121 and part 135 air carriers with 1,500 or fewer employees that are approved to carry hazardous materials. DOT identified 729 air carriers that meet this definition. DOT contacted several of these entities to estimate the number of containers that each small air carrier uses to transport oxygen cylinders aboard aircraft in other than the passenger cabin. All the entities that were contacted maintained that although they are approved to carry hazardous materials, they transport no oxygen cylinders in cargo compartments. From conversations with container manufacturers, DOT learned that approximately ten small air carriers transport compressed oxygen cylinders. DOT believes that each of the ten small air carriers would need approximately 5 compressed oxygen containers to comply with the final rule. DOT also estimates that each of ten small carriers will need approximately 5 oxygen generator containers to comply with the final rule.

After calculating the prorated annualized costs per entity using the same assumptions that were used in the cost section (all costs have been discounted to present value at 7% and are expressed in 2004 dollars), DOT has determined that the incremental cost impact per small entity would be $451 (See Table 3 of the regulatory evaluation in the public docket), which PHMSA considers ''de minimus'' for a small business (See Appendix C) . The baseline costs per small entity shown in Table 3 are generated from Appendix C by adding the baseline discounted costs of oxygen cylinders and chemical oxygen generator overpacks. Similarly, the costs in Table 3 are generated by adding discounted costs of the rule for oxygen cylinder and chemical oxygen generator overpacks. Annualized costs are calculated by applying a capital recovery factor to total incremental costs and measuring the annual impact of the regulation.

Thus, DOT has determined that this final rule will not have a significant impact on a substantial number of small entities. Accordingly, pursuant to the Regulatory Flexibility Act, 5 U.S.C. 605(b), DOT certifies that this rule will not have a significant economic impact on a substantial number of small entities.

G. International Trade Impact Assessment

The Trade Agreements Act of 1979 prohibits Federal agencies from establishing any standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. The FAA has assessed the potential affect of this final rule and has determined that it will have only a domestic impact and therefore it will not affect any trade-sensitive activity.

H. Unfunded Mandates Reform Act of 1995

The Unfunded Mandates Reform Act of 1995 (the Act) is intended, among other things, to curb the practice of imposing unfunded Federal mandates on State, local, and tribal governments. Title II of the Act requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of $100 million or more (adjusted annually for inflation) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a ''significant regulatory action.'' The FAA currently uses an inflation-adjusted value of $120.7 million in lieu of $100 million.

This final rule does not contain such a mandate. The requirements of Title II do not apply.

I. Paperwork Reduction Act

This final rule results in an information collection and recordkeeping burden increase under OMB Control Number 2137–0572, due to changes in package design and testing requirements for compressed oxygen and oxygen generators. There is an editorial change with no change in burden under OMB Control Number 2137–0557, due to changes in section designations regarding approval requirements for oxygen generators. PHMSA currently has approved information collections under OMB Control Number 2137–0572, ''Testing Requirements for Non-Bulk Packaging'' with 32,500 burden hours, and an expiration date of July 31, 2007, and OMB Control Number 2137–0557, ''Approvals for Hazardous Materials'' with 25,605 burden hours, and an expiration date of March 31, 2008. Under the Paperwork Reduction Act of 1995, no person is required to respond to an information collection unless it displays a valid OMB control number.

PHMSA estimates this rulemaking will result in approximately 10 additional respondents, 500 additional responses, 2,500 additional burden hours, and $750,000 additional burden costs. The new total information collection and recordkeeping burden for OMB Control Number 2137–0572 would be as follows:

''Testing Requirements for Non-Bulk Packaging''
OMB Number 2137–0572:

Total Annual Number of Respondents: 5,010.
Total Annual Responses: 15,500.
Total Annual Burden Hours: 32,500.
Total Annual Burden Cost: $812,500.00.

Requests for a copy of this information collection should be directed to Deborah Boothe or T. Glenn Foster, Office of Hazardous Materials Standards (PHH–11), Pipeline and Hazardous Materials Safety Administration, Room 8430, 400 Seventh Street, SW., Washington, DC 20590–0001, Telephone (202) 366–8553.

J. Environmental Assessment

The National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. 4321–4347) requires Federal agencies to consider the consequences of major Federal actions and prepare a detailed statement on actions significantly affecting the quality of the human environment. We developed an environmental assessment (EA) to consider the effects of these revisions on the environment and determine whether a more comprehensive environmental impact statement may be required. We have concluded that there are no significant environmental impacts associated with this final rule. An environmental assessment prepared for this final rule has been placed in the public docket for this rulemaking.

K. Regulation 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.

L. Privacy Act

Anyone is able to search the electronic form of all comments received into any of our dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act Statement in the **Federal Register** published on April 11, 2000 (Volume 65, Number 70; Pages 19477–78) or you may visit *http://dms.dot.gov.*

List of Subjects

49 CFR Part 171

Exports, Hazardous materials transportation, Hazardous waste, Imports, Reporting and recordkeeping requirements.

49 CFR Part 172

Education, Hazardous materials transportation, Hazardous waste, Labeling, 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 175

Air Carriers, Hazardous materials transportation, Radioactive materials, Reporting and recordkeeping requirements.

49 CFR Part 178

Hazardous materials transportation, Motor vehicle safety, Packaging and containers, Reporting and recordkeeping requirements.

■ In consideration of the foregoing, we are amending 49 CFR chapter I as follows:

PART 171—GENERAL INFORMATION, REGULATIONS, AND DEFINITIONS

■ 1. The authority citation for part 171 continues to read as follows:

Authority: 49 U.S.C. 5101–5128, 44701; 49 CFR 1.45 and 1.53; Pub. L. 101–410, section 4 (28 U.S.C. 2461 note); Pub. L. 104–134, section 31001.

■ 2. In § 171.11, paragraph (d)(16) is revised to read as follows:

§ 171.11 Use of ICAO Technical Instructions.

* * * * *

(d) * * *

(16) A package containing Oxygen, compressed, or any of the following oxidizing gases must be packaged as required by parts 173 and 178 of this subchapter: carbon dioxide and oxygen mixtures, compressed; compressed gas, oxidizing, n.o.s.; liquefied gas, oxidizing, n.o.s.; nitrogen trifluoride; and nitrous oxide.

* * * * *

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

■ 3. The authority citation for part 172 continues to read as follows:

Authority: 49 U.S.C. 5101–5128, 44701; 49 CFR 1.45 and 1.53.

§ 172.101 [Amended]

■ 4. In the Hazardous Materials Table in § 172.101, for the shipping name ''Air, refrigerated liquid, (cryogenic liquid),'' Column (9B) is revised to read ''Forbidden.''

§ 172.101 [Amended]

■ 5. In the Hazardous Materials Table in § 172.101, for the shipping name ''Oxygen, compressed,'' in column (7), Special Provision ''A52'' is removed.

§ 172.101 [Amended]

■ 6. In the Hazardous Materials Table in § 172.101, for the shipping name ''Oxygen generator, chemical,'' in Column (7), Special Provisions ''60, A51'' are removed and Column (8B) is revised to read ''168.''

§ 172.102 [Amended]

■ 7. In § 172.102, in paragraph (c)(1), Special Provisions ''60'' is removed.

§ 172.102 [Amended]

■ 8. In § 172.102, in paragraph (c)(2), Special Provisions ''A51'' and ''A52'' are removed.

PART 173—SHIPPERS—GENERAL REQUIREMENTS FOR SHIPMENTS AND PACKAGINGS

■ 9. The authority citation for part 173 continues to read as follows:

Authority: 49 U.S.C. 5101–5128, 44701; 49 CFR 1.45 and 1.53.

■ 10. Section 173.168 is added to read as follows:

§ 173.168 Chemical oxygen generators.

An oxygen generator, chemical (defined in § 171.8 of this subchapter) may be transported only under the following conditions:

(a) *Approval.* A chemical oxygen generator that is shipped with a means of initiation attached must be classed and approved by the Associate Administrator in accordance with the procedures specified in § 173.56 of this subchapter.

(b) *Impact resistance.* A chemical oxygen generator, without any packaging, must be capable of withstanding a 1.8 meter drop onto a rigid, non-resilient, flat and horizontal surface, in the position most likely to cause actuation or loss of contents.

(c) *Protection against inadvertent actuation.* A chemical oxygen generator must incorporate one of the following means of preventing inadvertent actuation:

(1) A chemical oxygen generator that is not installed in protective breathing equipment (PBE):

(i) Mechanically actuated devices:

(A) Two pins, installed so that each is independently capable of preventing the actuator from striking the primer;

(B) One pin and one retaining ring, each installed so that each is independently capable of preventing the actuator from striking the primer; or

(C) A cover securely installed over the primer and a pin installed so as to prevent the actuator from striking the primer and cover.

(ii) Electrically actuated devices: The electrical leads must be mechanically shorted and the mechanical short must be shielded in metal foil.

(iii) Devices with a primer but no actuator: A chemical oxygen generator that has a primer but no actuating mechanism must have a protective cover over the primer to prevent actuation from external impact.

(2) A chemical oxygen generator installed in a PBE must contain a pin installed so as to prevent the actuator from striking the primer, and be placed in a protective bag, pouch, case or cover such that the protective breathing equipment is fully enclosed in such a manner that the protective bag, pouch, case or cover prevents unintentional actuation of the oxygen generator.

(d) *Packaging.* After September 30, 2009 a chemical oxygen generator and a chemical oxygen generator installed in equipment, (e.g., a PBE) must be placed in a rigid outer packaging that—

(1) Conforms to the requirements of either:

(i) Part 178, subparts L and M, of this subchapter at the Packing Group I or II performance level; or

(ii) The performance criteria in Air Transport Association (ATA) Specification No. 300 for a Category I Shipping Container.

(2) With its contents, is capable of meeting the following additional requirements when transported by cargo-only aircraft:

(i) The Flame Penetration Resistance Test in part III of Appendix F to 14 CFR part 25, modified as follows:

(A) At least three specimens of the outer packaging materials must be tested;

(B) Each test must be conducted on a flat 16 inch x 24 inch test specimen mounted in the horizontal ceiling position of the test apparatus to represent the outer packaging design;

(C) Testing must be conducted on all design features (latches, seams, hinges, etc.) affecting the ability of the outer packaging to safely prevent the passage of fire in the horizontal ceiling position; and

(D) There must be no flame penetration of any specimen within 5 minutes after application of the flame source, and the maximum allowable temperature at a point 4 inches above the test specimen, centered over the burner cone, must not exceed 205 °C (400 °F).

(ii) The Thermal Resistance Test specified in Appendix D to part 178 of this subchapter.

(iii) None of the following conditions may occur when one generator in the package is actuated:

(A) Actuation of other generators in the package;

(B) Ignition of the packaging materials; and

(C) A temperature above 100 °C (212 °F) on the outside surface temperature of the package.

(iv) All features of the packaging must be in good condition, including all latches, hinges, seams, and other features, and the packaging must be free from perforations, cracks, dents, or other abrasions that may negatively affect the flame penetration resistance and thermal resistance characteristics of the packaging, verified by a visual inspection of the package before each shipment.

(e) *Equipment marking.* The outside surface of a chemical oxygen generator must be marked to indicate the presence of an oxygen generator (e.g., ''oxygen generator, chemical''). The outside surface of equipment containing a chemical oxygen generator that is not readily apparent (e.g., a sealed passenger service unit) must be clearly marked to indicate the presence of the oxygen generator (example: ''Oxygen Generator Inside'').

(f) *Items forbidden in air transportation.* (1) A chemical oxygen generator is forbidden for transportation on board a passenger-carrying aircraft.

(2) A chemical oxygen generator is forbidden for transportation by both passenger-carrying and cargo-only aircraft after:

(i) The manufacturer's expiration date; or

(ii) The contents of the generator have been expended.

■ 11. In § 173.302a, paragraph (f) is added to read as follows:

§ 173.302a Additional requirements for shipment of nonliquefied (permanent) compressed gases in specification cylinders.

* * * * *

(f) *Compressed oxygen and oxidizing gases.* A cylinder containing oxygen, compressed; compressed gas, oxidizing, n.o.s.; or nitrogen trifluoride is authorized for transportation by aircraft only when it meets the following requirements:

(1) Only DOT specification 3A, 3AA, 3AL, and 3HT cylinders, and UN pressure receptacles ISO 9809–1, ISO 9809–2, ISO 9809–3 and ISO 7866 cylinders are authorized.

(2) Cylinders must be equipped with a pressure relief device in accordance with § 173.301(f) and, beginning with the first requalification due after October 1, 2007:

(i) The rated burst pressure of a rupture disc for DOT 3A, 3AA, and 3AL cylinders must be 100% of the cylinder minimum test pressure with a tolerance of −10 to plus zero percent; and

(ii) The rated burst pressure of a rupture disc for a 3HT must be 90% of the cylinder minimum test pressure with a tolerance of −10 to plus zero percent.

(3) After September 30, 2009, the cylinder must be placed in a rigid outer packaging that—

(i) Conforms to the requirements of either part 178, subparts L and M of this subchapter at the Packing Group I or II performance level or the performance criteria in Air Transport Association (ATA) Specification No. 300 for a Category I Shipping Container;

(ii) Is capable of passing, as demonstrated by design testing, the Flame Penetration Resistance Test in part III of Appendix F to 14 CFR part 25, modified as follows:

(A) At least three specimens of the outer packagings materials must be tested;

(B) Each test must be conducted on a flat 16 inch x 24 inch test specimen mounted in the horizontal ceiling position of the test apparatus to represent the outer packaging design;

(C) Testing must be conducted on all design features (latches, seams, hinges, etc.) affecting the ability of the outer packaging to safely prevent the passage of fire in the horizontal ceiling position; and

(D) There must be no flame penetration of any specimen within 5 minutes after application of the flame source and the maximum allowable temperature at a point 4 inches above the test specimen, centered over the burner cone, must not exceed 205 °C (400 °F); and

(iii) Prior to each shipment, passes a visual inspection that verifies that all features of the packaging are in good condition, including all latches, hinges, seams, and other features, and that the packaging is free from perforations, cracks, dents, or other abrasions that may negatively affect the flame penetration resistance and thermal resistance characteristics of the packaging.

(4) After September 30, 2009, the cylinder and the outer packaging must be capable of passing, as demonstrated by design testing, the Thermal Resistance Test specified in Appendix D to part 178 of this subchapter.

(5) The cylinder and the outer packaging must both be marked and labeled in accordance with part 172, subparts D and E of this subchapter.

(6) A cylinder of compressed oxygen that has been furnished by an aircraft operator to a passenger in accordance with 14 CFR 121.574, 125.219, and 135.91 is excepted from the outer packaging requirements of paragraph (f)(3) of this section.

■ 12. In § 173.304a, paragraph (f) is added to read as follows:

§ 173.304a Additional requirements for shipment of liquefied compressed gases in specification cylinders.

* * * * *

(f) *Oxidizing gases.* A cylinder containing carbon dioxide and oxygen mixture, compressed; liquefied gas, oxidizing, n.o.s.; or nitrous oxide is authorized for transportation by aircraft only when it meets the following requirements:

(1) Only DOT specification 3A, 3AA, 3AL, and 3HT cylinders, and UN pressure receptacles ISO 9809–1, ISO 9809–2, ISO 9809–3 and ISO 7866 cylinders are authorized.

(2) Cylinders must be equipped with a pressure relief device in accordance with § 173.301(f) and, beginning with the first requalification due after October 1, 2007:

(i) The rated burst pressure of a rupture disc for DOT 3A, 3AA, and 3AL cylinders must be 100% of the cylinder minimum test pressure with a tolerance of −10 to plus zero percent; and

(ii) The rated burst pressure of a rupture disc for a 3HT must be 90% of the cylinder minimum test pressure with a tolerance of −10 to plus zero percent.

(3) After September 30, 2009, the cylinder must be placed in a rigid outer packaging that—

(i) Conforms to the requirements of either part 178, subparts L and M, of this subchapter at the Packing Group I or II performance level, or the performance criteria in Air Transport Association (ATA) Specification No. 300 for a Category I Shipping Container;

(ii) Is capable of passing, as demonstrated by design testing, the Flame Penetration Resistance Test in part III of Appendix F to 14 CFR part 25, modified as follows:

(A) At least three specimens of the outer packaging materials must be tested;

(B) Each test must be conducted on a flat 16 inch x 24 inch test specimen mounted in the horizontal ceiling position of the test apparatus to represent the outer packaging design;

(C) Testing must be conducted on all design features (latches, seams, hinges, etc.) affecting the ability of the outer packaging to safely prevent the passage of fire in the horizontal ceiling position; and

(D) There must be no flame penetration of any specimen within 5 minutes after application of the flame source and the maximum allowable temperature at a point 4 inches above the test specimen, centered over the burner cone, must not exceed 205 °C (400 °F); and

(iii) Prior to each shipment, passes a visual inspection that verifies that all features of the packaging are in good condition, including all latches, hinges, seams, and other features, and the packaging is free from perforations, cracks, dents, or other abrasions that may negatively affect the flame penetration resistance and thermal resistance characteristics of the container.

(4) After September 30, 2009, the cylinder and the outer packaging must be capable of passing, as demonstrated by design testing, the Thermal Resistance Test specified in Appendix D to part 178 of this subchapter.

(5) The cylinder and the outer packaging must both be marked and labeled in accordance with part 172, subparts D and E of this subchapter.

(6) A cylinder of compressed oxygen that has been furnished by an aircraft operator to a passenger in accordance with 14 CFR 121.574, 125.219, and 135.91 is excepted from the outer packaging requirements of paragraph (f)(3) of this section.

PART 175—CARRIAGE BY AIRCRAFT

■ 13. The authority citation for part 175 continues to read as follows:

Authority: 49 U.S.C. 5101–5128, 44701; 49 CFR 1.53.

■ 14. Section 175.501 is revised to read as follows:

§ 175.501 Special requirements for oxidizers and compressed oxygen.

(a) Compressed oxygen, when properly labeled Oxidizer or Oxygen, may be loaded and transported as provided in this section. Except for Oxygen, compressed, no person may load or transport a hazardous material for which an OXIDIZER label is required under this subchapter in an inaccessible cargo compartment that does not have a fire or smoke detection system and a fire suppression system.

(b) In addition to the quantity limitations prescribed in § 175.75, no more than a combined total of six cylinders of compressed oxygen may be stowed on an aircraft in the inaccessible aircraft cargo compartment(s) that do not have fire or smoke detection systems and fire suppression systems.

(c) When loaded into a passenger-carrying aircraft or in an inaccessible cargo location on a cargo-only aircraft, cylinders of compressed oxygen must be stowed horizontally on the floor or as close as practicable to the floor of the cargo compartment or unit load device. This provision does not apply to cylinders stowed in the cabin of the aircraft in accordance with paragraph (e) of this section.

(d) When transported in a Class B aircraft cargo compartment (see 14 CFR 25.857(b)) or its equivalent (i.e., an accessible cargo compartment equipped with a fire or smoke detection system, but not a fire suppression system), cylinders of compressed oxygen must be loaded in a manner that a crew member can see, handle and, when size and weight permit, separate the cylinders from other cargo during flight. No more than six cylinders of compressed oxygen and, in addition, one cylinder of medical-use compressed oxygen per passenger needing oxygen at destination—with a rated capacity of 1000 L (34 cubic feet) or less of oxygen—may be carried in a Class B aircraft cargo compartment or its equivalent.

(e) A cylinder containing medical-use compressed oxygen, owned or leased by an aircraft operator or offered for transportation by a passenger needing it for personal medical use at destination, may be carried in the cabin of a passenger-carrying aircraft in accordance with the following provisions:

(1) No more than six cylinders belonging to the aircraft operator and, in addition, no more than one cylinder per passenger needing the oxygen at destination, may be transported in the cabin of the aircraft under the provisions of this paragraph (e);

(2) The rated capacity of each cylinder may not exceed 1,000 L (34 cubic feet);

(3) Each cylinder must conform to the provisions of this subchapter and be placed in:

(i) An outer packaging that conforms to the performance criteria of Air Transport Association (ATA) Specification 300 for a Category I Shipping Container; or

(ii) A metal, plastic or wood outer packaging that conforms to a UN standard at the Packing Group I or II performance level.

(4) The aircraft operator shall securely stow the cylinder in its overpack or outer packaging in the cabin of the aircraft and shall notify the pilot-in-command as specified in § 175.33 of this part; and

(5) Shipments under this paragraph (e) are not subject to—

(i) Sections 173.302(f) and 173.304a(f) of this subchapter, subpart C of part 172 of this subchapter, and, for passengers only, subpart H of part 172 of this subchapter;

(ii) Section 173.25(a)(4) of this subchapter; and

(iii) Paragraph (b) of this section.

PART 178—SPECIFICATIONS FOR PACKAGINGS

■ 15. The authority citation for part 178 continues to read as follows:

Authority: 49 U.S.C. 5101–5128, 44701; 49 CFR 1.53.

■ 16. A new Appendix D to part 178 is added to read as follows:

Appendix D to Part 178—Thermal Resistance Test

1. *Scope.* This test method evaluates the thermal resistance capabilities of a compressed oxygen generator and the outer packaging for a cylinder of compressed oxygen or other oxidizing gas and an oxygen generator. When exposed to a temperature of 205 °C (400 °F) for a period of not less than three hours, the outer surface of the cylinder may not exceed a temperature of 93 °C (199 °F) and the oxygen generator must not actuate.

2. *Apparatus.*

2.1 *Test Oven.* The oven must be large enough in size to fully house the test outer package without clearance problems. The test oven must be capable of maintaining a minimum steady state temperature of 205 °C (400 °F).

2.2 *Thermocouples.* At least three thermocouples must be used to monitor the temperature inside the oven and an additional three thermocouples must be used to monitor the temperature of the cylinder. The thermocouples must be 1⁄16 inch, ceramic packed, metal sheathed, type K (Chromel-Alumel), grounded junction with a nominal 30 American wire gauge (AWG) size conductor. The thermocouples measuring the temperature inside the oven must be placed at varying heights to ensure even temperature and proper heat-soak conditions. For the thermocouples measuring the temperature of the cylinder: (1) two of them must be placed on the outer cylinder side wall at approximately 2 inches (5 cm) from the top and bottom shoulders of the cylinder; and (2) one must be placed on the cylinder valve body near the pressure relief device.

2.3 *Instrumentation.* A calibrated recording device or a computerized data acquisition system with an appropriate range should be provided to measure and record the outputs of the thermocouples.

3. *Test Specimen.*

3.1 *Specimen Configuration.* Each outer package material type and design must be tested, including any features such as handles, latches, fastening systems, etc., that may compromise the ability of the outer package to provide thermal protection.

3.2 *Test Specimen Mounting.* The tested outer package must be supported at the four corners using fire brick or other suitable means. The bottom surface of the outer package must be exposed to allow exposure to heat.

4. *Preparation for Testing.*

4.1 It is recommended that the cylinder be closed at ambient temperature and configured as when filled with a valve and pressure relief device. The oxygen generator must be filled and may be tested with or without packaging.

4.2 Place the package or generator onto supporting bricks or a stand inside the test oven in such a manner to ensure even temperature flow.

5. *Test Procedure.*

5.1 Close oven door and check for proper reading on thermocouples.

5.2 Raise the temperature of the oven to a minimum temperature of 205 °C ± 2 °C (400 °F ± 5 °F). Maintain a minimum oven temperature of 205 °C ± 2 °C (400 °F ± 5 °F) for at least three hours. Exposure time begins when the oven steady state temperature reaches a minimum of 205 °C ± 2 °C (400 °F ± 5 °F).

5.3 At the conclusion of the three-hour period, the outer package may be removed from the oven and allowed to cool naturally.

6. *Recordkeeping.*

6.1 Record a complete description of the material being tested, including the manufacturer, size of cylinder, etc.

6.2 Record any observations regarding the behavior of the test specimen during exposure, such as smoke production, delamination, resin ignition, and time of occurrence of each event.

6.3 Record the temperature and time history of the cylinder temperature during the entire test for each thermocouple location. Temperature measurements must be recorded at intervals of not more than five (5) minutes. Record the maximum temperatures achieved at all three thermocouple locations and the corresponding time.

7. *Requirements.*

7.1 For a cylinder, the outer package must provide adequate protection such that the outer surface of the cylinder and valve does not exceed a temperature of 93 °C (199 °F) at any of the three points where the thermocouples are located.

7.2 For an oxygen generator, the generator must not actuate.

Issued in Washington, DC on January 25, 2007 under authority delegated in 49 CFR part 1.

Thomas J. Barrett,

Administrator.

[FR Doc. E7–1487 Filed 1–30–07; 8:45 am]

BILLING CODE 4910–60–P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 648

RIN 0648–AT67

[Docket No. 061109296–7009–02; I.D. 110606A]

Fisheries of the Northeastern United States; Atlantic Bluefish Fisheries; 2007 Atlantic Bluefish Specifications; Quota Adjustment; 2007 Research Set-Aside Project

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Final rule; final specifications for the 2007 Atlantic bluefish fishery.

SUMMARY: NMFS issues final specifications for the 2007 Atlantic bluefish fishery, including state-by-state commercial quotas, a recreational harvest limit, and recreational possession limits for Atlantic bluefish off the east coast of the United States. The intent of these specifications is to establish the allowable 2007 harvest levels and possession limits to attain the target fishing mortality rate (F), consistent with the stock rebuilding program contained in Amendment 1 to the Atlantic Bluefish Fishery Management Plan (FMP), as well as ensuring compliance with the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). This action will publish final specifications that are modified from those contained in the proposed rule.

DATES: This rule is effective March 2, 2007, through December 31, 2007.

ADDRESSES: Copies of the specifications document, including the Environmental Assessment (EA) and the Initial Regulatory Flexibility Analysis (IRFA) are available from Daniel Furlong, Executive Director, Mid-Atlantic Fishery Management Council, Room 2115, Federal Building, 300 South Street, Dover, DE 19901–6790. The specifications document is also accessible via the Internet at *http://www.nero.noaa.gov*. NMFS prepared a Final Regulatory Flexibility Analysis (FRFA), which is contained in the classification section of this rule. The FRFA consists of the IRFA, public comments and responses contained in this final rule, and a summary of impacts and alternatives contained in this final rule. The small entity compliance guide is available from Patricia A. Kurkul, Regional Administrator, Northeast Regional Office, National Marine Fisheries Service, One Blackburn Drive, Gloucester, MA 01930–2298, and on the Northeast Regional Office's website at *http://www.nero.noaa.gov/nero/nr/*.

The Northeast Fisheries Science Center (Center) 41st Stock Assessment Review Committee (SARC) Bluefish Assessment Report (updated for 2006) is available at: *http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0514*.

FOR FURTHER INFORMATION CONTACT: Allison McHale, Fishery Policy Analyst, (978) 281–9103, or Michael Pentony, Supervisory Policy Analyst, (978)281–9283.

SUPPLEMENTARY INFORMATION:

Background

The Atlantic bluefish fishery is cooperatively managed by the Mid-Atlantic Fishery Management Council (Council) and the Atlantic States Marine Fisheries Commission (Commission). The management unit for bluefish (*Pomatomus saltatrix*) is the U.S. waters of the western Atlantic Ocean.

The FMP requires that the Council recommend, on an annual basis, total allowable landings (TAL) for the fishery, consisting of a commercial quota and recreational harvest limit (RHL). A research set aside (RSA) quota is deducted from the bluefish TAL (after any applicable transfer) in an amount proportional to the percentage of the overall TAL as allocated to the commercial and recreational sectors. The annual review process for bluefish requires that the Council's Bluefish Monitoring Committee (Monitoring Committee) review and make recommendations based on the best available data including, but not limited to, commercial and recreational catch/landing statistics, current estimates of fishing mortality, stock abundance, discards for the recreational fishery, and juvenile recruitment. Based on the recommendations of the Monitoring Committee, the Council makes a recommendation to the Northeast Regional Administrator (RA). Because the Bluefish FMP is a joint plan with the Atlantic States Marine Fisheries Commission (Commission), the Commission meets during the annual specification process to adopt complimentary measures.

In July 2006, the Monitoring Committee met to discuss the updated estimates of bluefish stock biomass and project fishery yields for 2007. In August 2006, the Council approved the Monitoring Committee's recommendations and the Commission's Bluefish Board (Board) adopted complementary management measures. Detailed background information regarding the status of the bluefish stock and the development of the 2007 specifications for this fishery was provided in the proposed specifications (71 FR 68524, November 27, 2006). That information is not repeated here.

RSA Quota

A request for proposals was published on December 23, 2005, to solicit research proposals to utilize RSA in 2007 based on research priorities identified by the Council (70 FR 76253). One research project that would utilize 363,677 lb (164,961 kg) of bluefish RSA has been conditionally approved by NMFS and is currently awaiting notice of award. Therefore, this final rule implements a 363,677–lb (164,961–kg) RSA quota for the 2007 bluefish fishery. If this project is not approved by the NOAA Grants Office, the research quota associated with the disapproved proposal will be restored to the bluefish TAL through publication in the **Federal Register**.

Final Specifications

The FMP specifies that the bluefish stock is to be rebuilt to B_{MSY} over a 9–year period and requires the Council to recommend, on an annual basis, a level of total allowable catch (TAC) consistent with the rebuilding program in the FMP. An estimate of annual discards is deducted from the TAC to calculate the TAL that can be made during the year by the commercial and recreational fishing sectors combined. The FMP rebuilding program requires the TAC for any given year to be set based either on the target F resulting from the stock rebuilding schedule specified in the FMP (0.31 for 2007), or the F estimated in the most recent fishing year (F_{2005} = 0.15), whichever is lower. An overall TAC of 32.033 million lb (14,530 mt) is recommended as the coastwide TAC by the Council at its August 2006 meeting to achieve the target fishing mortality rate (F = 0.15) in 2007, consistent with the rebuilding schedule specified in Amendment 1.

The TAL for 2007 is derived by subtracting an estimate of discards of

Annex 2

Evaluation of Oxygen Cylinder Overpacks Exposed to Elevated Temperature

technical note technical note technical

Evaluation of Oxygen Cylinder Overpacks Exposed to Elevated Temperature

Timothy R. Marker
Ricardo Diaz

June 1999

DOT/FAA/AR-TN98/30

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U.S. Department of Transportation
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15. Supplementary Notes

16. Abstract

Tests were conducted inside a large industrial convection furnace to determine the temperature and time required to cause pressure relief activation of three different size oxygen cylinders commonly used in commercial transport aircraft. The cylinders were first emptied of gaseous oxygen for safety reasons and refilled with nitrogen to the original pressure. The furnace temperature was ramped to 400°F, which represented the temperature reached during a Halon 1301 suppressed deep-seated cargo compartment fire. Cylinder pressure relief activation typically occurred after the surface temperature had reached only 300°F.

Additional tests were conducted using a 76.5-cubic-foot oxygen cylinder placed inside several types of cylinder cases, commonly referred to as overpacks. The overpacks were available in a variety of constructions, all for the purpose of protecting the cylinder from impact damage that may occur during shipment. The tests were run to determine the level of thermal protection, if any, that the overpacks might provide when the cylinders are subjected to elevated temperatures. Two custom-made overpacks were also tested that contained insulating materials aimed specifically at providing thermal protection. Tests showed that some common overpacks have the ability to protect the cylinder from pressure relief activation for nearly 60 minutes while other types designed specifically for thermal insulation can provide significant additional protection.

17. Key Words	18. Distribution Statement
Pressurized oxygen cylinder, Rupture disc, Overpack	This document is available to the public through the National Technical Information Service (NTIS), Springfield, Virginia 22161.

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EXECUTIVE SUMMARY

Since the fatal in-flight fire accident on May 11, 1996, attributed to the improper shipment of chemical oxygen generators, the shipment of oxidizers and pressurized oxygen has been restricted. In early 1998, at Public Hearings convened by the Research and Special Programs Administration (RSPA), interested parties proposed that the transport of pressurized and medical oxygen cylinders be permitted in cargo compartments protected with fire detection and suppression systems (Class C cargo compartments). During the meeting it became apparent that appropriate test data did not exist regarding the performance of oxygen cylinder overpacks in cargo compartments. Consequently, the FAA committed to performing two different test protocols. One protocol entitled "Oxygen Enhanced Fires in LD-3 Cargo Containers" demonstrated the inadequacy of the LD-3 cargo container in controlling the spread of an oxygen fed fire. The second test protocol entitled "Evaluation of Oxygen Cylinder Overpacks Exposed to Elevated Temperature" evaluated the performance of various cylinder overpacks to determine whether a specially designed overpack would prevent a cylinder from overheating and releasing the oxygen into the cargo bin, thus creating a catastrophic fire.

Two series of tests were undertaken in a large industrial furnace to examine the response on unprotected oxygen cylinders and cylinders encased in overpacks, when subjected to elevated temperatures representative of a suppressed Class C cargo compartment fire. In the first test series, unprotected oxygen cylinders were subjected to a furnace temperature of 400°F. When the surface temperature of the cylinder reached approximately 300°F, the pressure relief disc failed and the stored oxygen was discharged. In the second test series, several types of overpacks were tested in a similar manner to determine the degree of thermal protection that the overpacks might provide. The overpacks were designed to carry a 76.5-cubic-foot oxygen cylinder and were the largest size that could be tested in the convection furnace. These overpacks, which are designed mainly to protect oxygen cylinders against impact damage during shipment, prevented pressure relief activation for nearly 60 minutes. By contrast, an unprotected 76.5-cubic-foot oxygen cylinder experienced pressure relief in less than 10 minutes. Two overpacks designed specifically for thermal insulation provided significant additional protection. The tests demonstrated that oxygen cylinder overpacks, particularly when designed to provide thermal insulation, would prevent cylinder overpressurization during a suppressed cargo fire and the potential increase in fire hazards associated with the release of oxygen.

BACKGROUND

On May 11, 1996, a fatal in-flight fire occurred onboard a ValuJet DC-9. During this accident, an extremely intense fire fueled by solid oxygen generators erupted in the class D compartment, burned out of control into the passenger cabin, and eventually caused the aircraft to crash, resulting in 110 fatalities. In the wake of this accident, the FAA issued a ban on the shipment of oxidizers in all transport aircraft cargo compartments. Industry, pilot, and user groups have requested an exemption to allow for the shipment of bottled oxygen in class C cargo compartments which have fire detection and suppression systems. In a class C compartment, the fire would be detected and agent discharged to extinguish the fire. In the event of a suppressed but not fully extinguished fire, which would be the case if the origin was a deep-seated fire, the temperatures in the compartment could reach 400°F. A deep-seated fire typically involves class A materials such as paper, cardboard, or clothing that burns deep within the contents where it is difficult for an extinguishing agent to penetrate. In contrast, a surface-burning fire involves the combustion of materials more superficially and is much easier to extinguish. The major concern with the shipment of oxygen cylinders under this scenario is that the elevated temperatures could cause the cylinder pressure to increase, resulting in the opening of the pressure relief mechanism. If this occurs, the contents of oxygen could vent directly into the fire, causing a significant intensification of the fire and possibly overtaxing the suppression system.

Different types of pressure relief devices and cylinders are used for storing breathable oxygen. There are two types of rupturing relief valves, a frangible disc that will fail under excessive pressure (typically 2500 psi) and a thermal disc that will fail when the temperature exceeds 165°F or 225°F, depending on the type. There is also a spring-loaded relief valve that will slowly vent the contents of a pressurized cylinder in order to maintain pressure at or below 2000 psi, so that only a percentage of the oxygen would be vented if exposed to elevated temperatures. The rupture disc pressure relief device is the only type used on gaseous oxygen cylinders for crew and passenger breathing systems on commercial transport aircraft, so the research was limited to this type only. Ironically, the rupture disc type pressure relief devices pose a more serious concern in a fire environment because, with these relief devices, it is possible for the entire contents of the oxygen cylinder to be discharged at elevated temperatures.

FURNACE TEST ARRANGEMENT

The primary focus of the furnace tests was to determine the oxygen cylinder temperature/ pressure required to induce bursting of the pressure relief disc. A parallel activity was also initiated to investigate the hazards associated with gaseous oxygen release from a cylinder during an aircraft cargo compartment fire. Since there are inherent dangers associated with the heating of pressurized oxygen cylinders, it was determined that all cargo fire tests would be conducted using a remotely placed oxygen cylinder. In order to determine the appropriate time and rate of oxygen release during the fire, a series of tests were first run in an industrial furnace to measure the pressure relief response of several different sized cylinders. For safety purposes, the cylinders were emptied of all gaseous oxygen then repressurized with gaseous nitrogen to 1800 psi.

A large, industrial-type high-temperature electric box furnace was used for testing. The furnace was heated by means of coiled electric resistance-type alloy elements that are supported in hard ceramic element holders. The furnace insulation consists of a primary layer of lightweight refractory insulating firebrick which is backed up with 2 inches of high-temperature mineral fiber board. The temperature control system includes two separate zones of heating elements, which are controlled independently with manual rheostat/bimetal percentage-type input controls. In addition, the overall furnace temperature is set by means of an automatic temperature control, which allowed ramping to 400°F in approximately 6 minutes. The internal dimensions of the furnace measured 37.5 by 26 by 25 inches (figure 1).

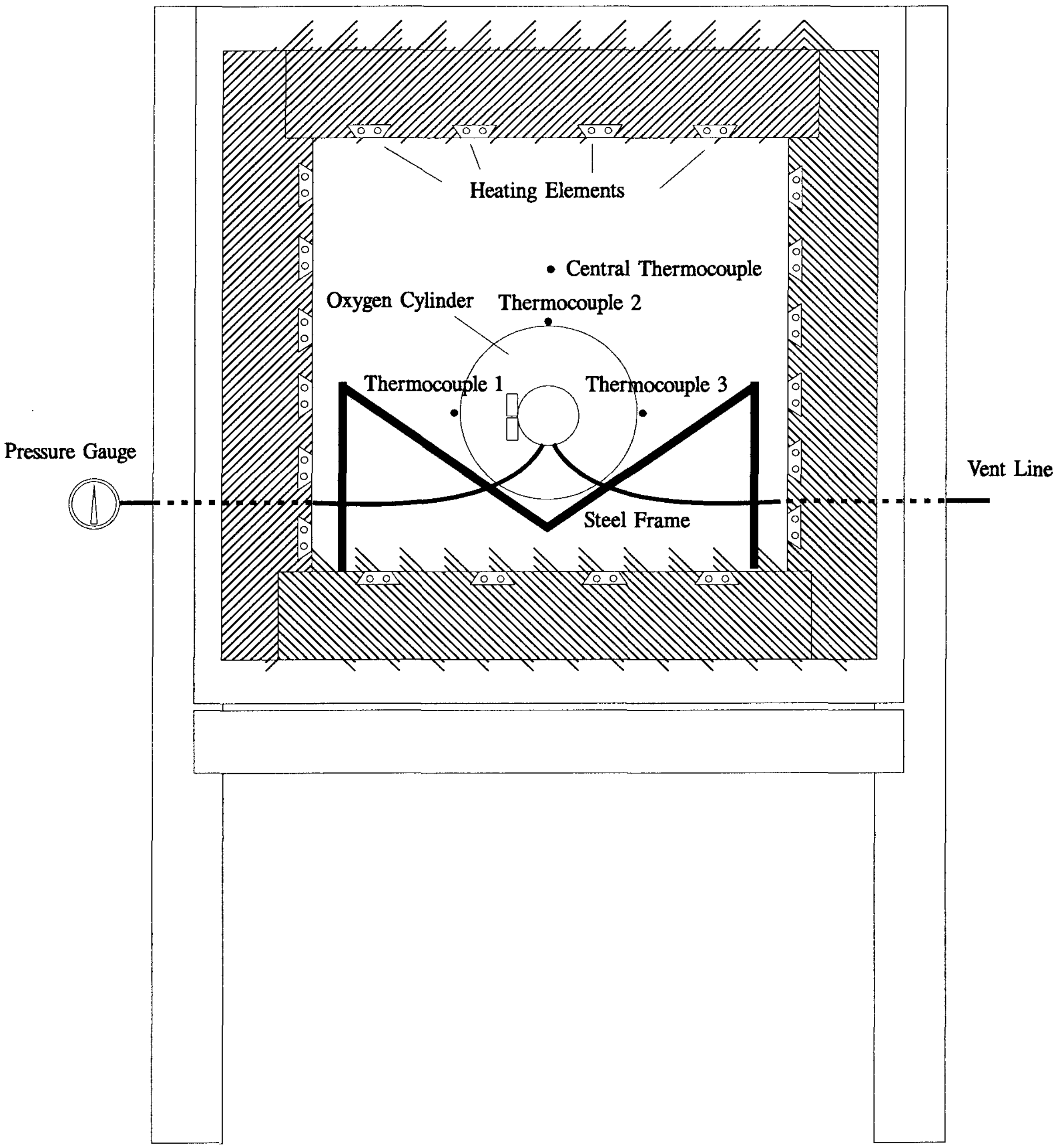

FIGURE 1. TEST FURNACE

During the tests, the cylinders were attached to a steel frame that fit snugly into the test furnace to prevent cylinder movement and subsequent damage to the furnace. The cylinder surface temperature was continuously monitored using three thermocouples attached directly to the cylinders. The furnace temperature was measured with a thermocouple located in the geometric center. A stainless steel line was run from the cylinder valve head, which connected to a pressure gauge, allowing the internal pressure of the cylinder to be measured continuously during the heating process. An additional line was connected to the valve pressure relief port for venting the pressurized gas external to the test furnace to reduce the likelihood of damage to the fragile interior surfaces.

FURNACE TEST RESULTS

During the first furnace test, a 3HT-type 76.5-cubic-foot cylinder was placed in the test frame holder. The cylinder measured 7.25 inches in diameter by 29.75 inches in length, excluding valve assembly. After start of the test, the rupture disc activated at 9 minutes 53 seconds and required 33 seconds for the cylinder to fully evacuate. The temperature of the cylinder was 285°F, and the temperature inside the furnace was approximately 380°F at the time of release (figure 2). The cylinder internal pressure was approximately 2650 psi at the time of rupture disc activation. A second test was run under nearly identical conditions using a larger 115-cubic-foot cylinder that measured 9.00 inches by 29.56 inches. During this test, the rupture disc activated at 15 minutes 23 seconds and required 1 minute 12 seconds to fully empty. At the time of disc failure, the internal pressure was 2600 psi, and the cylinder surface temperature ranged between 300 and 320°F (figure 3). A final test was run using a small, 11 cubic-foot "walkaround" bottle that is typically used by flight attendants in the event of cabin depressurization. The cylinder was a type 3AA and measured 3.25 by 18.75 inches. A malfunction with the furnace temperature control resulted in a lengthy heating period; however, the rupture disc activated during temperature ramp-up at 17 minutes 12 seconds. The furnace temperature had reached between 350 and 370°F during release, at which point the cylinder surface temperature was between 300 and 325°F. The cylinder required only 5 seconds to fully discharge, and the pressure was observed to be approximately 2500 psi (figure 4). The average rate of release of nitrogen from the three cylinders was calculated to be approximately 2 ft^3/sec.

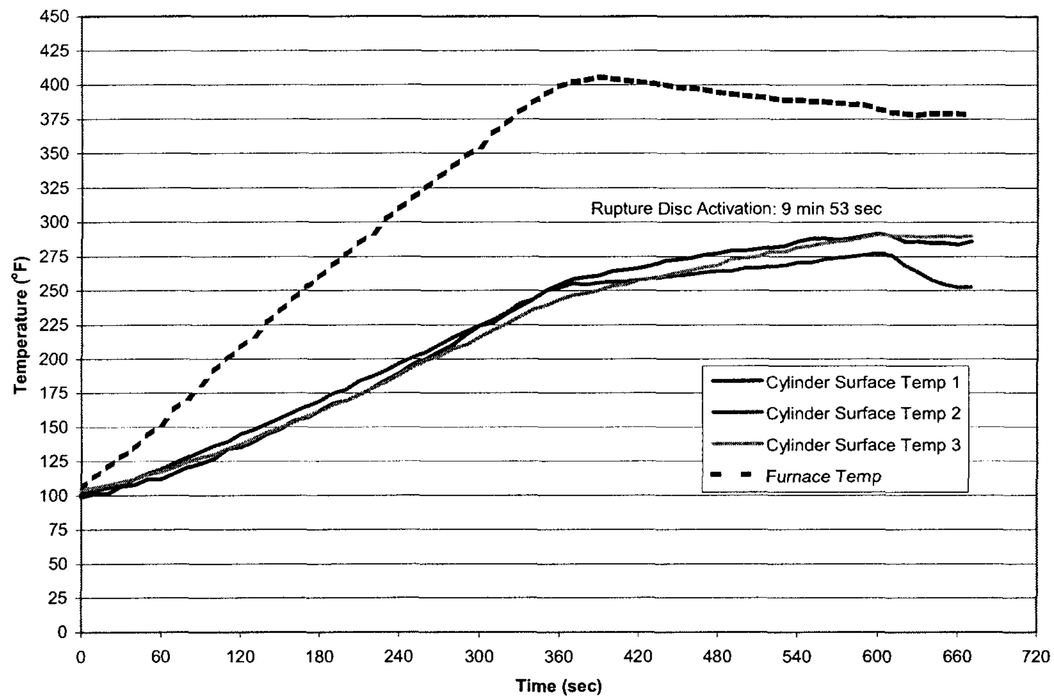

FIGURE 2. FURNACE TEST RESULTS USING 76.5-CUBIC-FOOT CYLINDER

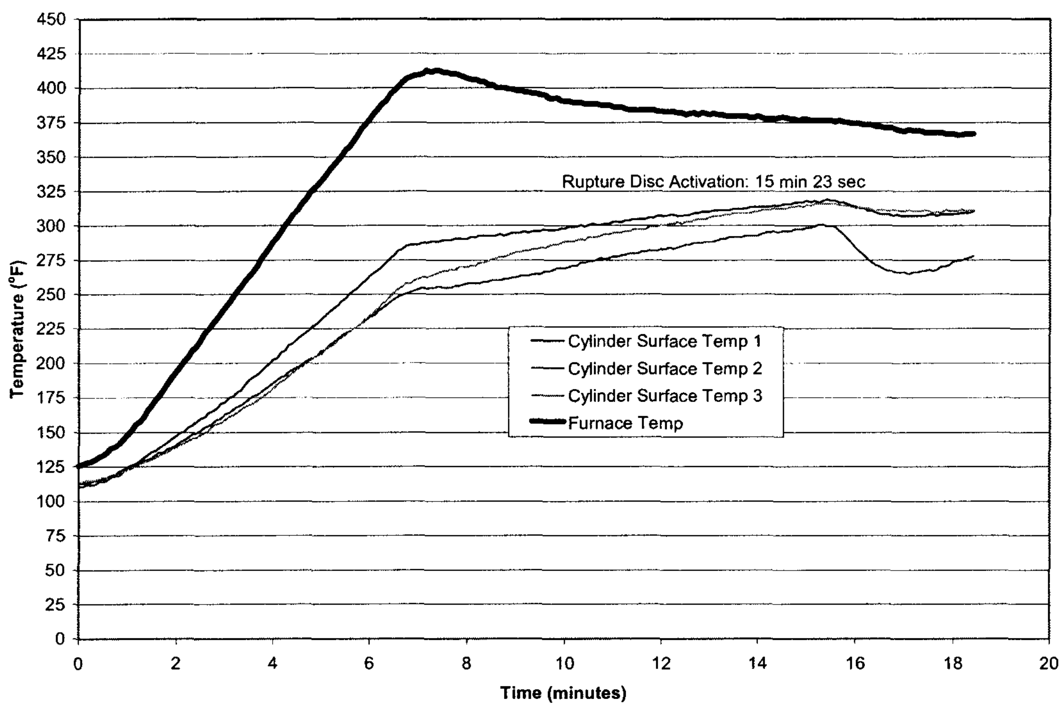

FIGURE 3. FURNACE TEST RESULTS USING 115-CUBIC-FOOT CYLINDER

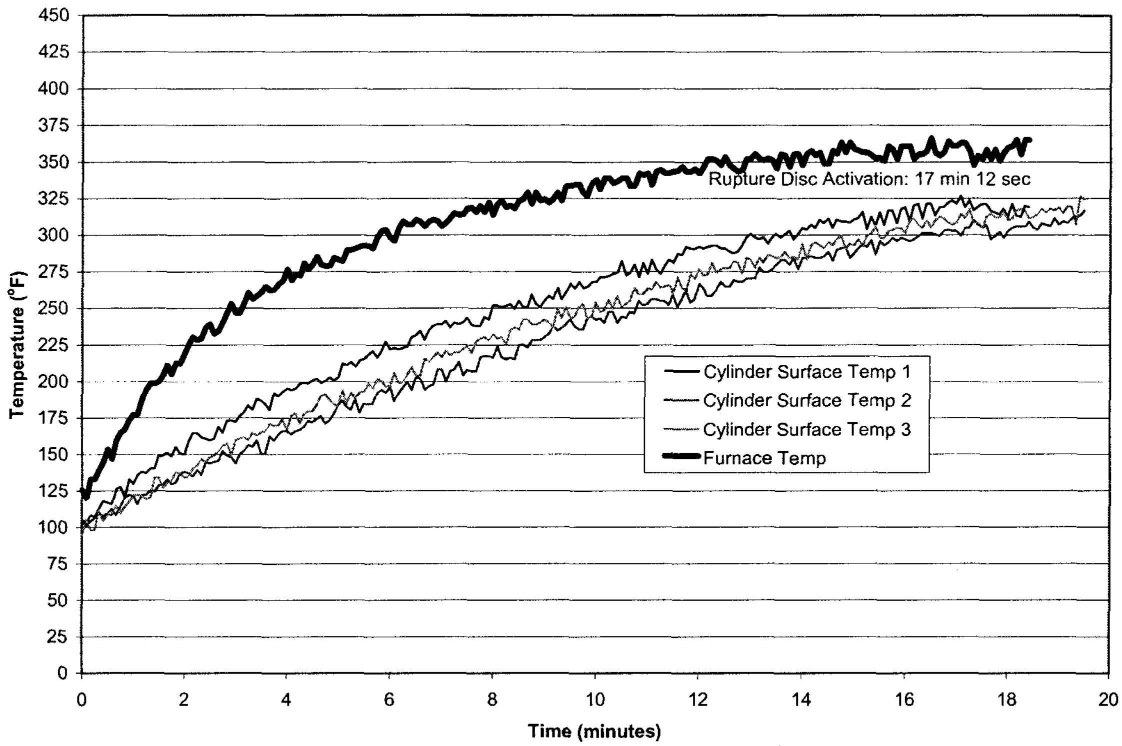

FIGURE 4. FURNACE TEST RESULTS USING 11-CUBIC-FOOT CYLINDER

TESTING OF ATA SPECIFICATION 300, CATEGORY I OVERPACKS

The furnace tests on unprotected oxygen cylinders demonstrated that a fairly insignificant amount of heat was capable of initiating a rupture disc activation. Additional tests were conducted to evaluate the insulative properties of several currently available overpacks meeting ATA Specification 300, Category I. The most common overpacks are manufactured from plywood laminated with ABS plastic. Other designs include rotationally molded polyethylene, aluminum, fiberglass, and injection-molded plastic. The test overpacks were designed to house the 76.5-cubic-foot cylinder (9 inches by 30 inches). Because some of the overpacks could not be designed properly to provide adequate wall thickness and still remain small enough to fit inside the test furnace, the testing was limited to three particular overpacks: Bill Thomas Associates (BTA), Viking Packing Specialists, and Anvil. During the tests, the overpacks with stored oxygen cylinder were subjected to the identical 400°F environment as the tests performed on the unprotected cylinders. Small access holes were drilled into each overpack and fitted with compression-type bulkhead fittings to allow for the passage of the three thermocouple wires used to monitor the cylinder surface temperature.

OVERPACK TEST EXECUTION

During the first test, an empty 76.5-cubic-foot oxygen cylinder was placed inside the Viking overpack, and the three thermocouples were attached to the cylinder surface. The overpack exterior was constructed of 0.1875-inch-thick polyethylene thermoplastic. Polyethylene foam was glued to the interior side of the overpack for impact resistance (figure 5). Within 10 minutes of the start of the test, the furnace temperature rose to 350°F (figure 6). At approximately 60 minutes, the cylinder surface temperatures were observed to be below the point of rupture disc activation, ranging from 230°F to 280°F. However, significant quantities of smoke began to emerge from the test furnace vents, causing the test to be terminated at 69 minutes. The maximum surface temperature was 300°F. Posttest examination revealed the entire overpack had melted and formed a plastic coating around the cylinder, with excess material puddled at the floor of the test furnace.

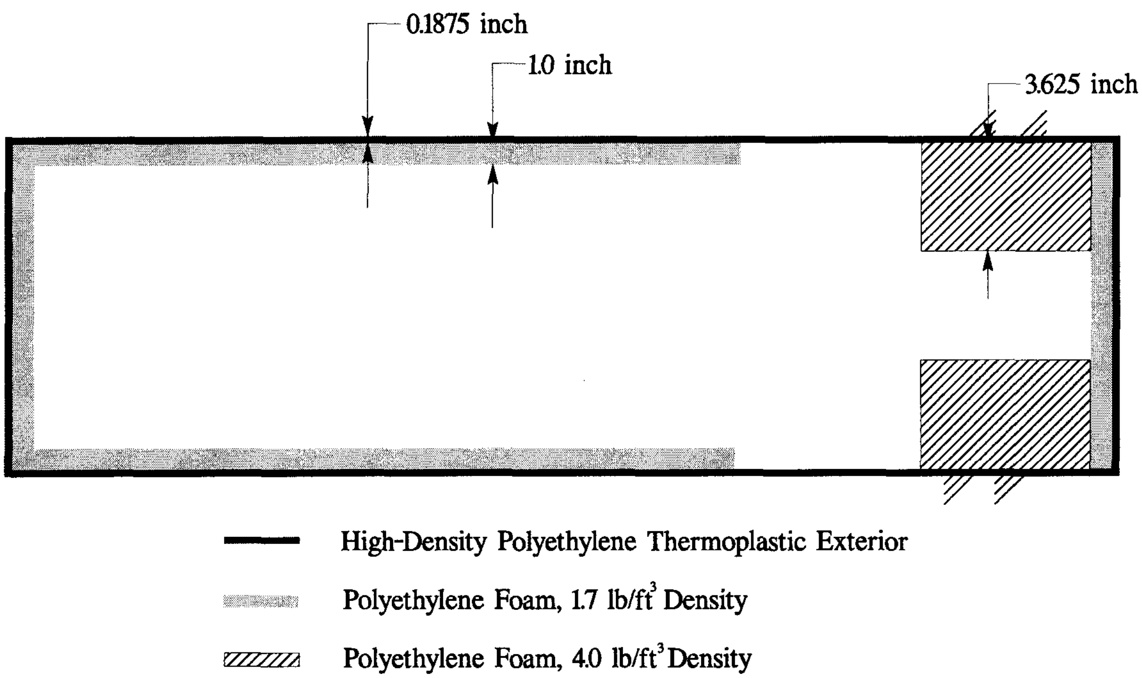

FIGURE 5. SCHEMATIC OF STANDARD VIKING OVERPACK CONSTRUCTION

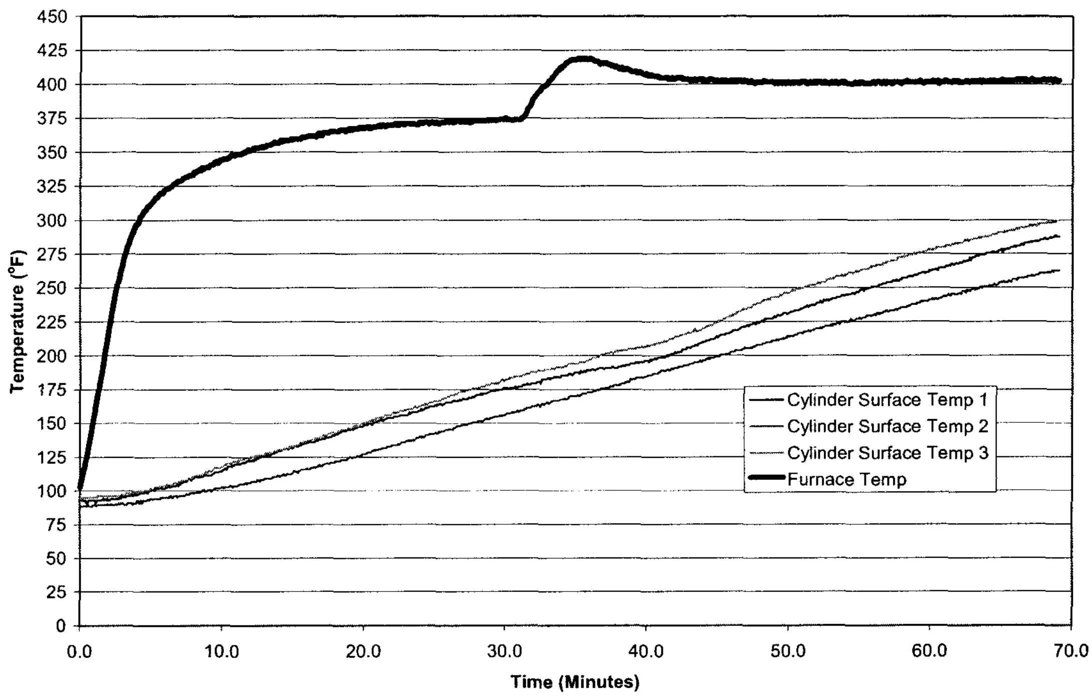

FIGURE 6. FURNACE TEST RESULTS USING 76.5-CUBIC-FOOT CYLINDER INSIDE STANDARD VIKING OVERPACK

Subsequent tests were conducted on ATA Specification 300 overpacks in which the 76.5-cubic-foot cylinder was charged with nitrogen. A line piped from the relief valve through a bulkhead fitting in the overpack to a furnace access hole allowed pressure venting external to the test furnace. Cylinder pressure was monitored continuously through an additional line from the valve to an externally mounted pressure gauge. Due to a problem with the nitrogen charging system, the cylinder could only be charged to 1500 psi and not the full 1800 psi normally achieved. Although the cylinder was not fully charged, the tests were conducted with thermocouples attached to the surface of the cylinder to monitor its temperature. This would provide an accurate estimate of when the pressure relief mechanism would normally activate if the cylinder was initially fully charged to 1800 psi.

During the second test, the charged cylinder was loaded into the overpack supplied by Bill Thomas Associates (manufactured by A&J Manufacturing Company). This overpack was constructed of plywood laminated with fiberglass matting impregnated with epoxy resin. On the interior of the overpack, urethane foam was glued to the inner sidewalls to provide the required impact protection. A plywood brace was also mounted near one end to support the neck of the cylinder, and a 2-inch-thick layer of polyethylene foam was glued to the other end (figure 7). After placing the cylinder/overpack on several bricks inside the test furnace, the unit was ramped to 400°F (figure 8). After 60 minutes, the cylinder surface temperature had reached 300°F, the temperature at which the relief disc typically fails (due to the slightly lower pressure inside the bottle at the start of the test, the pressure was below the level needed to activate the burst disc at this temperature). The test was terminated, and the overpack was inspected. The inspection revealed slight delamination of the fiberglass exterior surface, as the heat began to break down the epoxy resin. The interior of the overpack revealed no damage to the urethane foam; however, the polyethylene foam used in the end had completely melted.

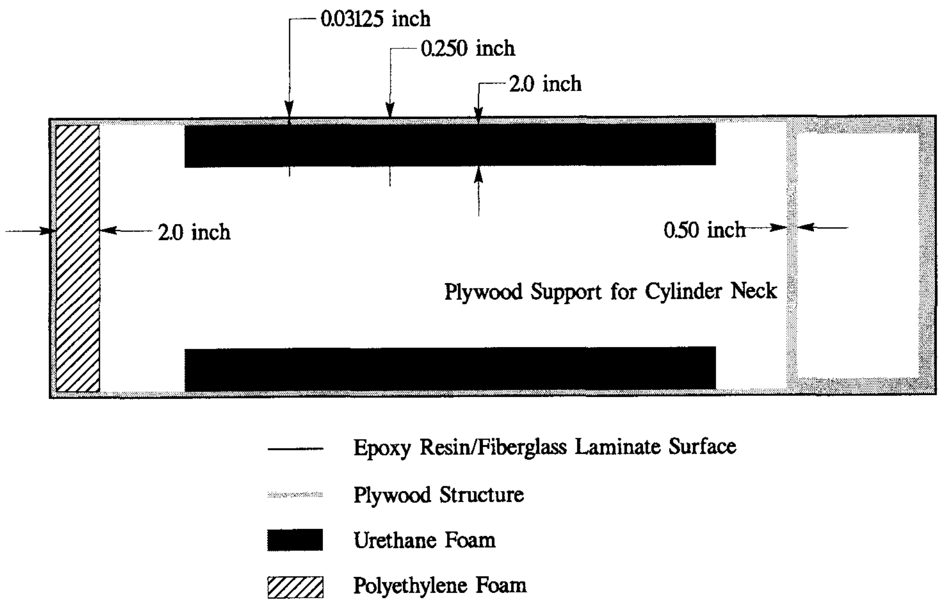

FIGURE 7. SCHEMATIC OF BILL THOMAS ASSOCIATES OVERPACK CONSTRUCTION

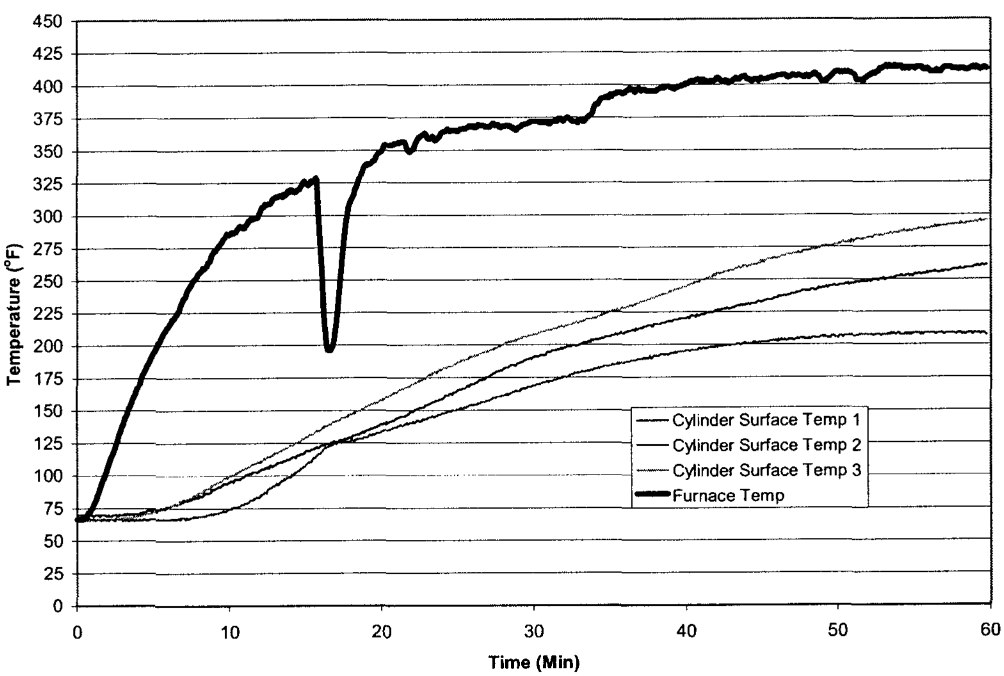

FIGURE 8. FURNACE TEST RESULTS USING 76.5-CUBIC-FOOT CYLINDER INSIDE BTA OVERPACK

During the next test, the charged cylinder was loaded into the Anvil overpack. This unit resembled the BTA overpack in that it utilized plywood construction faced with a thermoplastic (figure 9). Approximately 1-inch-thick urethane foam was glued to the interior side of the plywood. Upon test initiation, the furnace temperature approached 400°F in approximately 15 minutes (figure 10). During the test, the temperature of the cylinder surface reached a maximum of 300°F at 90 minutes, at which point the test was terminated. A posttest inspection revealed melting of the exterior thermoplastic surface, exposing the plywood structure in several areas. In addition, the glue used to adhere the urethane foam to the plywood interior surface had melted into a black oily substance, allowing the foam to become displaced in several areas, especially the upper surface.

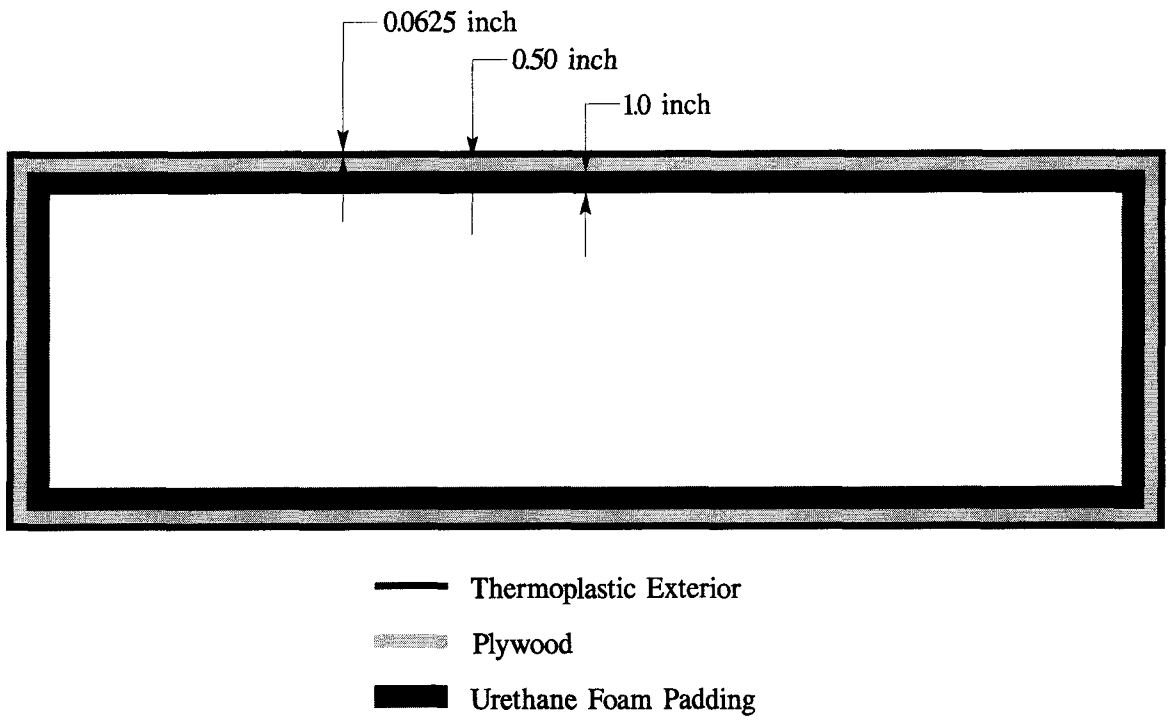

FIGURE 9. SCHEMATIC OF ANVIL OVERPACK CONSTRUCTION

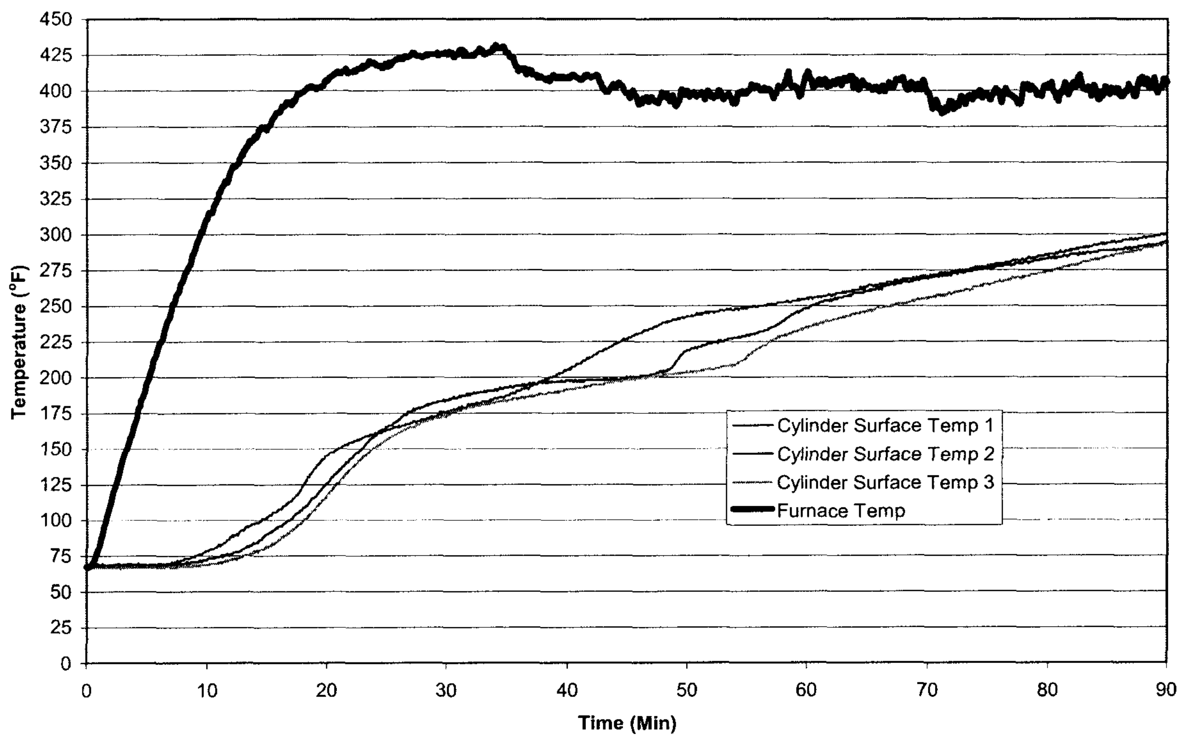

FIGURE 10. FURNACE TEST RESULTS USING 76.5-CUBIC-FOOT CYLINDER INSIDE ANVIL OVERPACK

In an effort to evaluate the potential increase in thermal protection offered by a modified system, additional tests were performed on overpacks specifically designed for this purpose. The overpacks were manufactured by Viking and contained an array of materials aimed at insulating a cylinder placed inside. During the first test, the empty 76.5-cubic-foot oxygen cylinder was placed in the overpack which was placed on several stacked bricks inside the furnace. A bulkhead compression fitting mounted to the overpack allowed for the passage of thermocouple wires for the purpose of measuring the cylinder surface temperature. The overpack exterior consisted of a heat-resistant thermoplastic known as Kydex. A 1-inch-thick fiberglass batt material was sandwiched between the exterior layer of Kydex and an additional layer of Kydex of the same thickness (figure 11). A layer of polyethylene foam was glued to the internal layer of Kydex to provide impact resistance. After test initiation, the furnace temperature reached 400°F in 10 minutes. The test was allowed to progress for approximately 60 minutes, at which point large quantities of smoke began to appear from the test furnace vents. The temperature of the cylinder surface never exceeded 90°F during the test (figure 12). A posttest inspection revealed the source of the smoke was from the two ends of the overpack which had come in contact with the furnace heating elements. The heated thermoplastic lost some of its structural integrity, allowing the ends to sag and eventually come in contact with the furnace surface. In addition, the latch mounts had pulled away from the overpack due to the rivets pulling through the heat-softened thermoplastic exterior, exposing the fiberglass insulation. The interior of the overpack was undamaged.

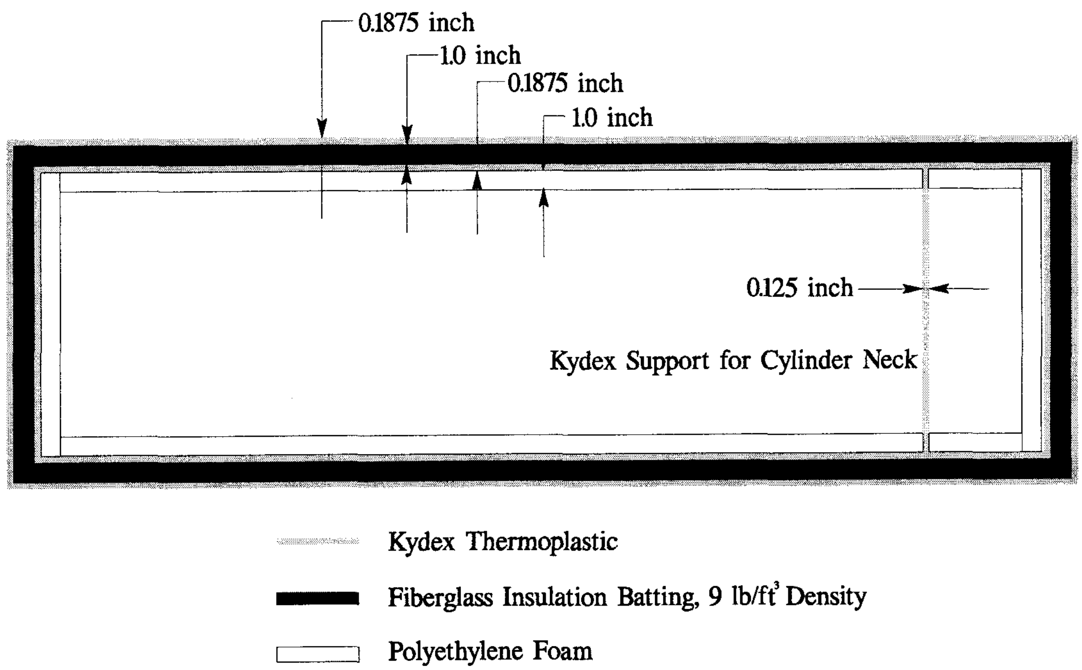

FIGURE 11. MODIFIED VIKING OVERPACK USING FIBERGLASS BATT INSULATION

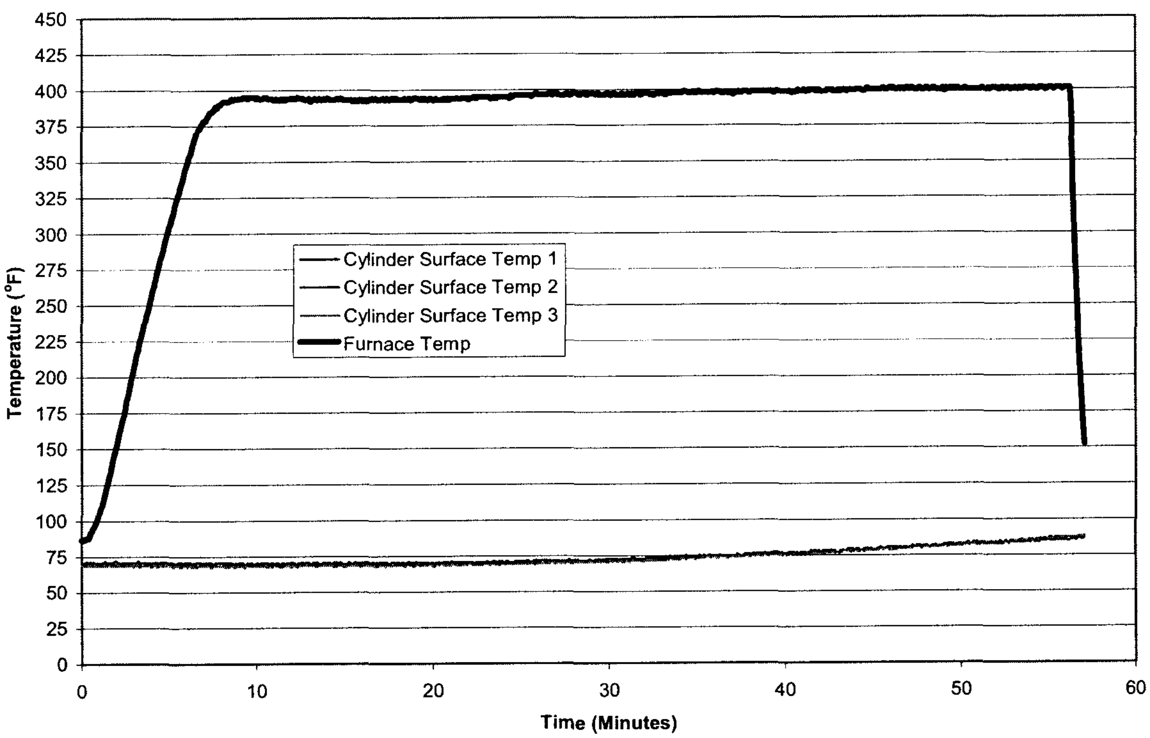

FIGURE 12. FURNACE TEST RESULTS USING 76.5-CUBIC-FOOT CYLINDER INSIDE FIBERGLASS INSULATION VIKING OVERPACK

A subsequent test was performed on an upgraded version of the thermally protected overpack. The new design utilized an aluminum-faced rigid insulating foam in place of the fiberglass batting (figure 13). External and internal layers of Kydex surrounded the rigid foam. After loading the charged cylinder into the new-design overpack, the furnace was activated and the temperature approached 400°F in approximately 15 minutes. During the test, the temperature of the cylinder surface reached a maximum of 210°F at 90 minutes, at which point the test was terminated. A posttest inspection revealed the external layer of Kydex had melted and burned in several locations, exposing the aluminum foil face of the rigid foam insulation panel which had remained intact. The inner layer of Kydex was slightly warped but had not changed color. Although the cylinder surface temperatures were kept relatively low, the cylinder and valve assembly had become slightly discolored as a result of combustion of the Kydex and possibly the rigid foam panel. Due to a malfunction with the data acquisition, the temperature versus time data obtained during the test could not be retrieved. However, these data were observed during the test and indicated a gradual increase of the cylinder surface temperature up to a maximum of 210°F at 90 minutes.

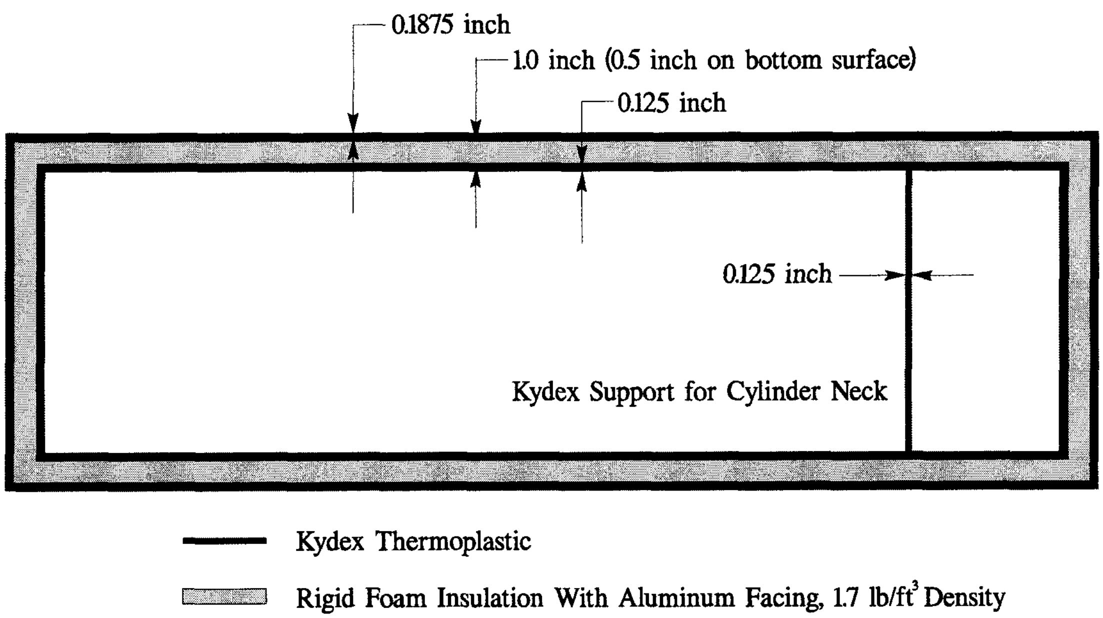

FIGURE 13. MODIFIED VIKING OVERPACK USING RIGID FOAM INSULATION

CONCLUSIONS

Past research has shown that temperatures can reach 400°F during suppression and control of fires in class C cargo compartments, which are equipped with detection and suppression systems. During initial furnace tests, it was revealed that a fairly insignificant amount of heat (300°F cylinder surface temperature) was capable of causing rupture disc activation in various sized unprotected oxygen cylinders. Upon rupture disc activation, the entire contents of the cylinder will discharge in short duration. Further tests conducted on currently available overpacks have shown that a significant delay in the activation of cylinder relief discs is possible. Two overpack designs provided between 60 and 90 minutes of protection. An overpack designed specifically for thermal protection was capable of maintaining very low cylinder temperatures (less than 100°F) for 60 minutes, suggesting extended periods of cylinder protection are achievable.

Oxygen cylinder overpacks designed for thermal protection could prevent the overpressurization of cylinders during a suppressed cargo fire and the potential increase in fire hazards associated with the release of oxygen. A new standard for overpack materials should reflect extended periods of elevated temperatures typical of a suppressed class C compartment fire. In addition, the overpack materials should be capable of withstanding open flames for a short duration, which could result when a cargo fire originates, prior to fire detection and activation of the suppression system.

Annex 3

The Response of Aircraft Oxygen Generators Exposed to Elevated Temperatures

280159

The Response of Aircraft Oxygen Generators Exposed to Elevated Temperatures

RSPA-04-17664-4

David Blake

November 2002

DOT/FAA/AR-TN02/

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7. Author(s)	8. Performing Organization Report No.
David Blake	DOT/FAA/AR-TN02/xx
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15. Supplementary Notes

16. Abstract

The purpose of this testing was to determine the temperatures that would cause self-activation of sodium chlorate oxygen generators. The data will be used to establish the degree of thermal protection that would be required to prevent the activation of chemical oxygen generators should they be exposed to heat from a cargo compartment fire involving other materials. The minimum temperature that caused the activation of one of the generators was 600°F. Due to uncertainties with other designs not tested and the physical properties of sodium chlorate, it is recommended that the generators not be exposed to temperatures above 400°F.

17. Key Words	18. Distribution Statement
Sodium chlorate, Oxygen generators, Elevated temperatures	This document is available to the public through the National Technical Information Service (NTIS), Springfield, Virginia 22161.

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EXECUTIVE SUMMARY

The purpose of this testing was to determine the temperatures that would cause self-activation of sodium chlorate oxygen generators. The data will be used to establish the degree of thermal protection that would be required to prevent the activation of chemical oxygen generators should they be exposed to heat from a cargo compartment fire involving other materials. Twenty-three tests were conducted inside a furnace with the generators subjected to various temperatures and exposure times. The minimum temperature that caused the activation of one of the generators was 600°F. A literature search revealed a range of temperatures between 482° and 572°F in which sodium chlorate will start to decompose and liberate oxygen. This project used generators from two different manufacturers that were readily available. Other generator manufacturers exist but their products were not tested. Due to uncertainties with other designs not tested and the physical properties of sodium chlorate, it is recommended that the generators not be exposed to temperatures above 400°F.

INTRODUCTION

The carrying of oxygen generators on passenger aircraft was banned following an in-flight cargo fire and subsequent crash of a ValuJet DC-9 near Miami, Florida, on May 11, 1996. The probable cause of the accident was determined to be the inadvertent activation of one or more oxygen generators in the forward cargo compartment that resulted in an uncontrollable fire [1]. The oxygen generators had been removed from other aircraft after exceeding the permitted service life and were being shipped back to the airline headquarters. The generators were improperly packaged and not declared as hazardous materials.

BACKGROUND.

Sodium chlorate oxygen generators are installed on many aircraft models to provide the oxygen source for emergency passenger breathing air. This air is required in the event of a fuselage depressurization while at altitude. The oxygen generators consist mainly of a sodium chlorate and iron powder mixture. Small quantities of other chemicals such as barium peroxide are also added to eliminate chlorine and control the reaction [2]. Most generators are equipped with a variety of mechanical spring-loaded mechanisms that strike a primer cap in one end of the generator. This produces sufficient heat to initiate the chemical reaction that liberates oxygen. A lanyard is typically attached between the passenger oxygen masks and the spring-loaded mechanism. When the passenger oxygen mask doors open, pulling the masks down will activate the generators. Some generators initiate the reaction electrically. The internal reaction temperature can be up to 1100°F. Insulation is installed around the sodium chlorate core to limit the temperature of the external steel case. Maximum surface temperatures measured with thermocouples welded to the side of the generator were approximately 400°F [3].

A literature search of the properties of sodium chlorate revealed that pure sodium chlorate will melt at 478°F and start to decompose and liberate oxygen at approximately 572°F [4]. Other literature lists a temperature of 482°F as the starting point of decomposition for sodium chlorate and iron powder mixtures [2].

The generators used in this testing had been in storage at the Federal Aviation Administration William J. Hughes Technical Center for several years. They had originally been donated to the Technical Center for previous testing after their removal from aircraft for exceeding their permitted service life. One of the reasons for specifying a maximum service life is that the sodium chlorate candle inside the generators can develop cracks over time. Should that occur, the chemical reaction could stop when it got to the crack and the generator would not produce oxygen for the entire time for which it was designed. Several hundred of the generators in storage had very recently been activated in order to dispose of them. Only a very small percentage of them failed to activate when the lanyard was pulled or to produce oxygen for approximately 15 minutes.

TEST SERIES.

Twenty-three tests were conducted in an electric box furnace. The multiple outlet fittings that feed the individual passenger oxygen masks were removed from all generators prior to testing. The main outlet of the generator was then attached to a copper tube that was routed outside of the furnace. A small strip of paper was placed over the outlet of this copper tube and used as an indication of the flow of oxygen from a generator activation. Figure 1 shows the test configuration.

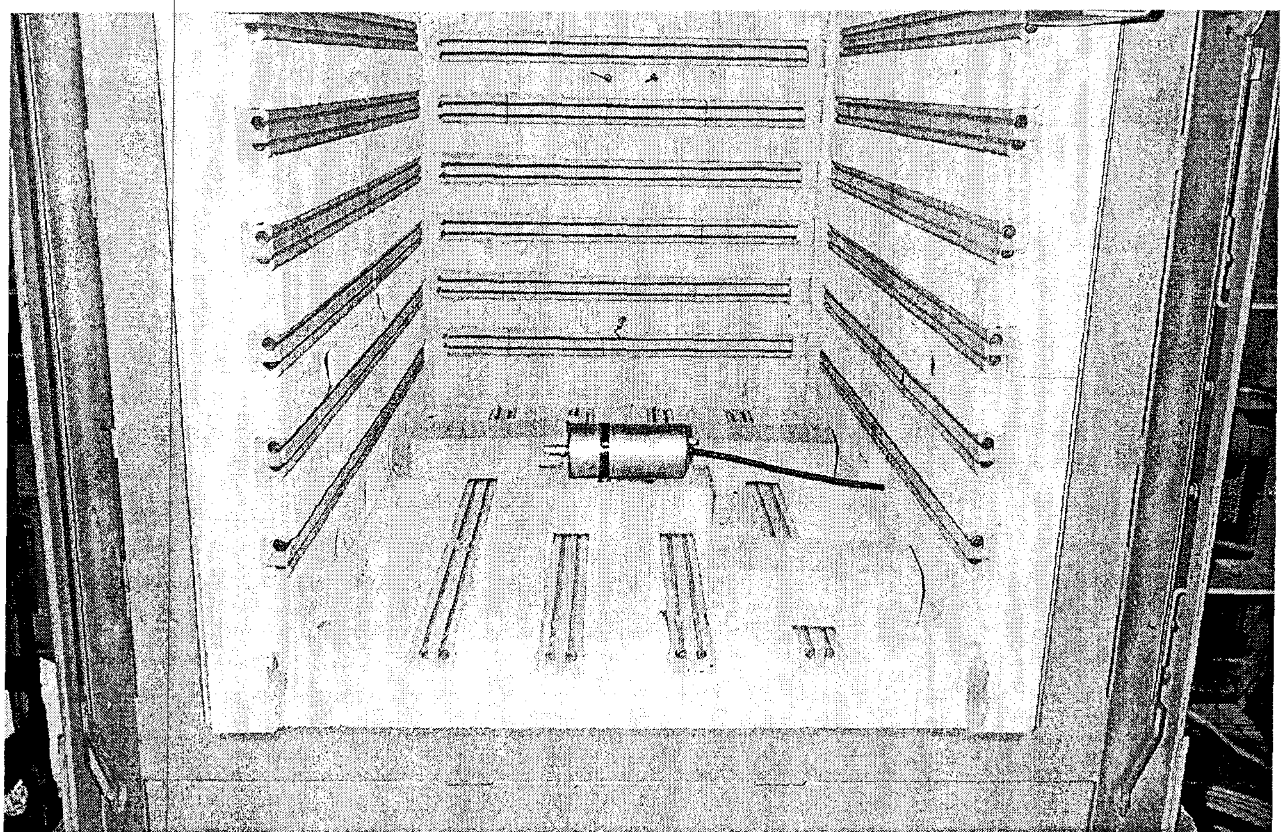

FIGURE 1. FURNACE AND OXYGEN GENERATOR

In 18 of the 23 tests, the furnace was preheated to the desired temperature and the generators were placed inside. In the remaining 5 tests the generators were placed in the furnace at ambient temperature, a set point of 800°F was selected and the furnace was then turned on. Following each test, the generators were allowed to cool to room temperature. After cooling, the lanyard was pulled on all the generators that did not activate in the furnace to determine if the generators were still capable of producing oxygen as designed. In all tests in which the generators activated, except for tests 15 and 18, the flow rate of oxygen was consistent with the flow rate that the generators are designed to produce in normal use. This is indicative of the reaction occurring as a result of the activation of the primer cap due to heat. The abnormal flow rates during tests 15 and 18 are indicative of the decomposition of the sodium chlorate/iron powder mixture at some other location within the generator. All of the generators that activated in the furnace were disassembled and the primer caps were examined. In all cases, the primer caps had activated. Figure 2 shows the outwardly bulged generator from test 18 next to a normal generator. Table 1 summarizes the results of the testing.

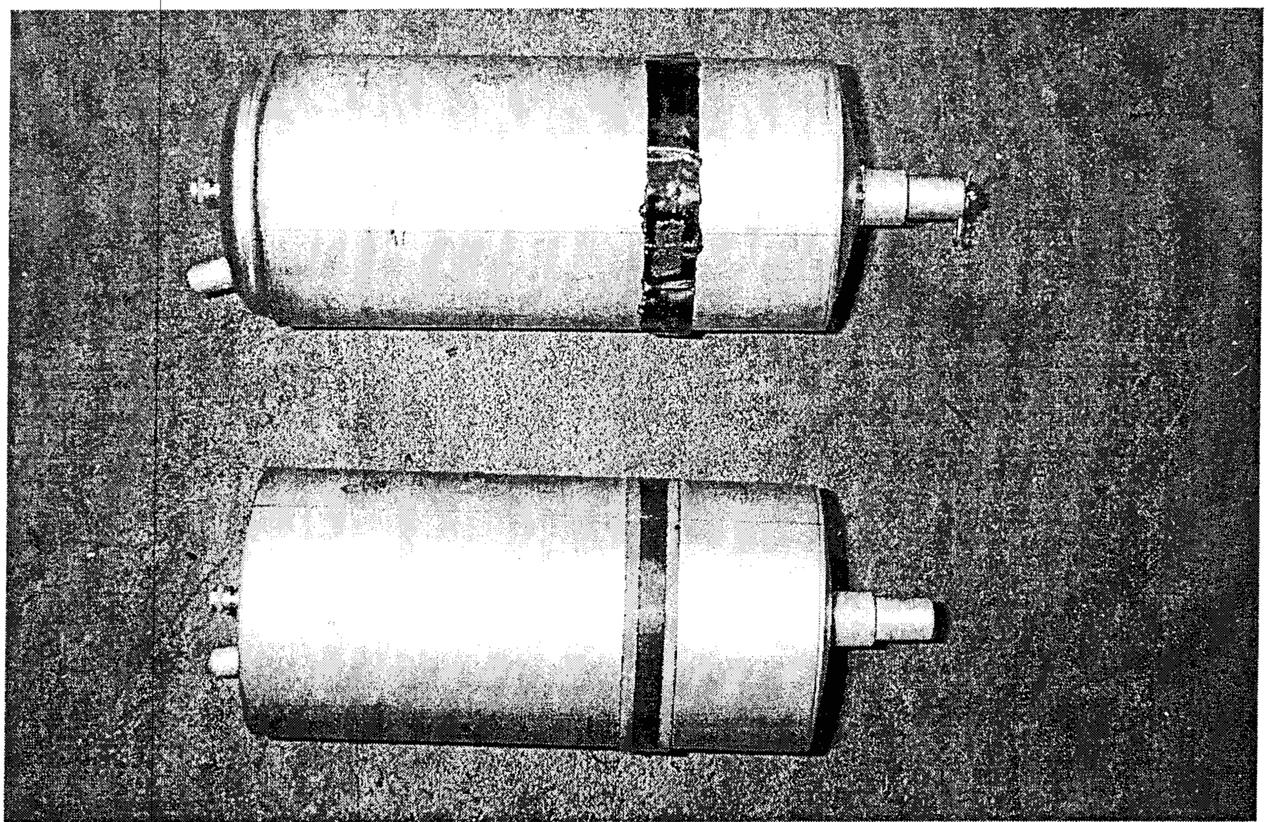

FIGURE 2. OUTWARDLY BULGED GENERATOR AND NORMAL GENERATOR

TABLE 1. SUMMARY OF TEST RESULTS

Test	Mfg	Furnace Temp (°F)	Exposure Time (minutes)	Activated in Furnace	Able to Initiate After Cooled
1	P-B	70-600	109	No	No
2	P-B	70-600	60	No	No
3	P-B	500	60	No	Yes
4	P-B	500	60	No	Yes
5	P-B	600	38	Yes	-
6	P-B	600	60	No	No
7	P-B	600	60	No	No
8	P-B	550	60	No	No
9	P-B	550	60	No	No
10	P-B	400	60	No	No
11	P-B	400	60	No	No
12	P-B	400	60	No	No
13	P-B	700	36	Yes	-
14	P-B	700	34	Yes	-
15	Scott	700	60	Yes[1]	-
16	Scott	700	60	No	No
17	P-B	70-800 (700 at activation)	82	Yes	-
18	P-B	70-800 (778 at activation)	65	Yes[2]	-
19	P-B	70-800 (771 at activation)	64	Yes	-
20	P-B	400	180	No	No
21	P-B	400	180	No	No
22	Scott	500	180	No	No
23	P-B	500	180	No	No

P-B = Puritan Bennet
Scott = Scott Aviation

1. Activated after 5 minutes but flow rate was much lower than normal.

2. Flow rate through normal outlet was much lower than normal. Oxygen also leaked out of primer cap end and generator body bulged outward due to internal pressure.

CONCLUSIONS

1. Exposure to furnace temperatures at or above 600°F was necessary to cause the self-activation of sodium chlorate oxygen generators.

2. Exposure to a furnace temperature of 500°F for 3 hours did not cause activation of the particular generator designs used in this test project.

3. Due to the uncertainty of the self-activation temperature of primer caps or electrically activated ignition squibs in other generator designs not tested in this project and the literature data stating that decomposition could occur as low as 482°F, it is recommended that generators not be exposed to ambient temperatures above 400°F.

REFERENCES

1. NTSB/AAR-97/06, "In-Flight Fire and Impact With Terrain ValuJet Airlines Flight 592, DC-9-32, N904VJ Everglades, near Miami, Florida, May 11, 1996."

2. Harding, R.M., "Oxygen Equipment and Pressure Clothing," Aviation Medicine, Ernsting, John and King, Peter, eds., Second Edition, 1988.

3. O'Connor, Thomas R., and Hagen, Eric L., "Activation of Oxygen Generators in Proximity to Combustible Materials," DOT/FAA/AR-TN99/9, May 1999.

4. Merck Index, "An Encyclopedia of Chemicals, Drugs, and Biologicals," Eleventh Edition, 1989.

Annex 4

REGULATORY EVALUATION

U.S. Department of Transportation

FEDERAL AVIATION ADMINISTRATION

REGULATORY EVALUATION,
REGULATORY FLEXIBILITY DETERMINATION, INTERNATIONAL TRADE IMPACT DETERMINATION, AND UNFUNDED MANDATES ASSESSMENT

HAZARDOUS MATERIALS: TRANSPORTATION OF OXIDIZING GASES ON AIRCRAFT

Final Rule
(49 CFR Parts 172, 175 and 178)

Scott M. Straub
Office of Aviation Policy and Plans
Operations Regulatory Analysis Branch, APO-310
August 2005, Revised December 2006

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Executive Summary Checklist

The Pipeline and Hazardous Materials Safety Administration (PHMSA) will amend the Hazardous Materials Regulations to require that cylinders of compressed oxygen, chemical oxygen generators and certain oxidizing gases be placed in a protective outer container that meets certain flame penetration and thermal resistance requirements when transported aboard an aircraft in other than the passenger cabin. PHMSA is also lowering the pressure relief device setting limit on cylinders of compressed oxygen, to limit the types of cylinders authorized to be transported aboard aircraft and to allow the transportation of other oxidizing gases aboard cargo and passenger aircraft with the same packaging. PHMSA and the Federal Aviation Administration (FAA) jointly developed this final rule.

Who is Potentially Affected by this Rulemaking

This final rule will affect entities that transport cylinders of compressed oxygen, certain oxidizing gases and chemical oxygen generators.

Our Cost Assumptions

PHMSA is using the following two assumptions to calculate costs for both oxygen cylinder and oxygen generator overpacks:

- The currently required container can be reused for 7-9 years (one eighth are replaced each year).
- After the mandatory compliance date (two years after the rule is issued), costs recur when containers may no longer be reused.
- All costs have been discounted to present value at 7% and are expressed in 2004 dollars.

Total Costs and Benefits of this Rulemaking

The total cost of the rule over 15 years is $37.8 million ($24.6 million discounted). Oxygen cylinders account for $10.8 million ($7.6

million discounted) and chemical oxygen generators account for $27.0 million ($16.9 million discounted).

The benefits of this rulemaking range from $30 million, if a cargo aircraft accident is averted, to $357 million, if a passenger aircraft accident is averted. Therefore, we conclude this rule will be cost beneficial.

Regulatory Flexibility Determination

The FAA conducted the required review of this final rule and determined that it will not have a significant economic impact. Therefore the FAA certifies that this rule will not have a significant economic impact on a substantial number of small entities. Therefore as the PHMSA Administrator, I certify that this rule will not have a significant economic impact on a substantial number of small entities.

International Trade Impact Assessment

The FAA has assessed the potential affect of this final rule and has determined that it will have only a domestic impact and therefore it will not affect any trade-sensitive activity.

Unfunded Mandates Assessment

This final rule does not contain such a mandate. The requirements of Title II do not apply.

I. Introduction and Background

The Pipeline and Hazardous Materials Safety Administration (PHMSA) will amend the Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180) to require that cylinders of compressed oxygen, chemical oxygen generators and certain oxidizing gases be placed in a protective outer container. The outer container must meet certain flame penetration and thermal resistance requirements when these items are transported aboard an aircraft, somewhere other than the passenger cabin. PHMSA will also lower the pressure relief device setting limit on cylinders of compressed oxygen. This action will also limit the types of cylinders authorized to be transported aboard aircraft and will allow the transportation of other oxidizing gases aboard cargo and passenger aircraft as long as they are packaged appropriately. PHMSA and the Federal Aviation Administration (FAA) jointly developed this final rule.

On May 11, 1996, ValuJet flight 592 crashed into an Everglades swamp shortly after takeoff from Miami International Airport, Florida. All 110 people (105 passengers, 3 flight attendants, and 2 pilots) onboard the aircraft died in the crash. Before the accident, the flight crew reported to air traffic control that they were experiencing smoke in the cabin and cockpit. The evidence indicates that five boxes containing as many as 144 chemical oxygen generators, most with unexpended oxidizer cores, and three aircraft wheel/tire assemblies had been loaded in the forward cargo compartment shortly before departure. This cargo was being shipped as company material. On August 19, 1997, the NTSB issued its aircraft accident report entitled "In-Flight Fire and Impact with Terrain; ValuJet Airlines Flight 592." The NTSB determined that one of the probable causes of the accident was a fire in the airplane's Class D cargo compartment that was caused by the actuation of one or more of the chemical oxygen generators. The chemical oxygen generators were improperly stored and carried as cargo.

On August 19, 1999, the Research and Special Programs Administration (RSPA), which is now known as PHMSA, published a final rule under Docket No. HM-224A (64 FR 45388) that imposed more stringent requirements on the transportation of cylinders of compressed oxygen and chemical oxygen generators by aircraft. These new requirements were designed to reduce the possibility that, if a fire occurred in a cargo compartment containing cylinders of compressed oxygen, or chemical oxygen generators, the oxygen might be released from those items and intensify the fire. If this sequence of events were to occur, then the fire might overcome the various cargo compartment devices designed to suppress or contain fires in the compartment.

As noted in the final rule in HM-224A the FAA conducted tests demonstrating that a fire in a cargo compartment can produce enough heat to cause an unprotected oxygen cylinder to release its contents. This would intensify the fire to such an extent that the fire could overcome the compartment's halon fire suppression system and cause severe damage to the aircraft. The FAA also found that oxygen cylinders release their contents at temperatures well below those temperatures that the aircraft cargo compartment liners and structures can withstand. However, FAA testing demonstrated that placing the oxygen cylinder in a protective outer container lengthens the time before a cylinder releases its contents. Based on these findings, HM-224A limited the number of oxygen cylinders (including passengers' medical oxygen) that may be carried as cargo in certain types of aircraft cargo compartments. HM-224A required each oxygen cylinder to be placed in an ATA specification 300 Category I shipping container developed by the Air Transport Association (ATA). The ATA Specification 300 Category I shipping container is a resilient, durable container that provides protection from shock and vibration. HM-224A also required that each cylinder of compressed oxygen be stowed horizontally on the compartment floor or as close as practicable to the floor. The effective date of the requirement adopted in HM-224A was March 1, 2000; voluntary compliance was authorized beginning October 22, 1999.

The FAA testing, discussed above, indicated that even more protection than that provided by the ATA specified shipping container was needed to improve the safety of carrying compressed oxygen. This extra protection could be provided by an improved overpack that provides thermal protection and satisfies a flame penetration criterion. In HM-224A PHMSA announced that it was considering amending the Hazardous Material Regulations to require the improved outer container for oxygen cylinders and later published a notice of proposed rulemaking on May 6, 2004. This final rule will require that a cylinder of compressed oxygen be placed in a flame-resistant and thermal-resistant outer container when transported in any cargo compartment of a passenger-carrying or cargo aircraft. Because of the added safety margin associated with these improved outer containers, this final rule will also remove the limits imposed in § 175.85 (i)(1) and (3) on the number of oxygen cylinders that may be transported in cargo compartments.

While developing the NPRM, PHMSA and FAA also reviewed the possible effects that heat from a cargo compartment fire would have on a package of properly prepared and transported chemical oxygen generators. The FAA determined that if exposed to the heat or flame associated with a cargo compartment fire, a properly prepared and transported oxygen chemical generator could release oxygen. Again, this would intensify the fire and overcome the compartment’s halon fire suppression system and cause severe damage to the aircraft. Therefore, this rule will require that chemical oxygen generators being transported aboard cargo-only aircraft, be placed in a protective outer container that meets the same flame penetration and thermal resistance requirements as for the compressed oxygen cylinders.

Finally, this final rule will allow the transportation of other oxidizing gases aboard cargo and passenger aircraft provided their container is placed in an approved outer container. These affected materials are covered under the shipping descriptions “Air, refrigerated liquid, (cryogenic liquid)”, “Carbon dioxide and oxygen mixtures, compressed”, “Nitrous oxide”, “Nitrogen triflouride, compressed”, “Compressed gas, oxidizing”, and “Liquefied gas, oxidizing.”

The regulations will require an outer container for an oxygen cylinder, chemical oxygen generator, or any other oxidizing gas listed above to meet the standards in Part III of Appendix F to 14 CFR Part 25, Test Method to determine Flame Penetration Resistance of Cargo Compartment Liners. To comply with the requirements of the flame penetration resistance test, a flat 16 by 24-inch test specimen must be constructed that represents the outer package design. At least three specimens of outer packaging materials and each design feature must be tested. Each specimen must simulate the oxygen cylinder outer packaging, including any design features, such as handles, latches, seams, hinges, etc. The failure of these design features would affect the capability of the outer packaging to prevent actuation of the oxygen cylinder pressure relief mechanisms or actuation of a chemical oxygen generator. Each specimen must be placed in the horizontal ceiling position of the test apparatus, and must prevent flame penetration for at least 5 minutes. The maximum allowable temperature at a point 4 inches above the test specimen, centered over the burner cone may not exceed 1,700ºF. Typically, the overpack closure mechanism, seam or hinges are tested independently in a longitudinal fashion, centered over the burner flame. See “Burnthrough Test Procedures for Cargo Liner Design Features”, DOT/FAA/CT-TN 88/33.

This final rule will require a cylinder of compressed oxygen remain below the temperature at which its pressure relief mechanism would activate when the container holding the cylinder is exposed to a mean temperature of 400ºF for three hours. This final rule will also require that a chemical oxygen generator remain below the temperature at which it would actuate when the container holding it is exposed to the same temperature test. The 400ºF temperature is the estimated mean temperature of a cargo compartment during a halon-suppressed fire[1]. Data collected during the FAA tests indicates that, on average, an oxygen cylinder's pressure relief mechanism will open when surface temperature of the cylinder reaches about 300ºF. To ensure an acceptable safety margin, the PHMSA is requiring a cylinder or chemical oxygen generator cannot reach an external temperature of 200ºF when the container which holds that cylinder or chemical oxygen generator is exposed to a 400ºF temperature for three hours.

Also, the regulation will lower the limit on pressure relief device (PRD) settings on cylinders containing compressed oxygen. This will ensure the cylinder does not burst at temperatures the cylinder might experience if exposed to heat while protected by the outer packaging. Specifically, this final rule will require oxygen cylinders be equipped with PRD's that have a set pressure equal to cylinder test pressure with tolerance of -10% to 0%. For oxygen transported in DOT 3HT specification cylinders, PHMSA will require the PRD have a rated burst pressure of 90% of the cylinder test pressure with a tolerance of –10% to +0%. Also, PHMSA will require the cylinders authorized for transport of compressed oxygen aboard aircraft be limited to DOT specifications 3A, 3AA, 3AL and 3HT, which are the most common cylinders in oxygen service.

During the development of the NPRM, PHMSA began to look at the total system of the cylinder within the improved overpack. PHMSA became aware of the need for limitations on the pressure relief device settings (PRD) for the cylinders used to transport oxygen by aircraft. If cylinders do not have the proper PRD settings, then an improved overpack will not have the desired result of keeping the gas in the cylinder in the event of a fire. PHMSA believes that industry is

[1] The FAA is currently evaluating other non-ozone depleting suppression agents that could eventually be used in cargo compartments. Some of the agents can maintain an adequate level of safety in the compartment, but the mean temperature may be slightly higher than 400ºF, which is the level found during typical halon-suppressed fires. If an alternate agent is used, the oven temperature level may need to be adjusted accordingly.

already using PRD's within the settings established in this final rule.

II. Response to Comments

Comment Summary (12, 14, 16, 18, 21, 23, 32): Several commenters stated that this rule will increase the cost of overpacks for both oxygen cylinders and chemical oxygen concentrators.

Several commenters stated the current costs of these containers range from $300 to $600 per container. Also, they estimated the cost per container will increase to within a range of about $1,500 to $13,000. One of the commenters also stated that it will cost approximately $10,000 to develop each package type. Many of the commenters stated they could not provide an accurate estimate of the effect of the new regulations on the price of these containers because they have been unable to find a company willing to offer these containers, or were unaware of any product would meet the new overpack standards. One commenter suggests that developing an overpack that can be reused will make this rulemaking successful.

One of these commenters stated that a producer has informally told them that they can produce a casing that will meet the new requirements, but none of them have been certified. They estimate that each case will cost between $450 and $800.

Response: We have obtained the costs of a reusable single cylinder overpack and a reusable multigenerator overpack from a manufacturer. This data was used to evaluate the costs of the final rule.

The FAA estimated the baseline cost per container to be $263 for small and medium containers, and $311 for large containers. We estimated the cost per new container would increase to about $425 for small and medium containers, and $477 for large containers. This estimated cost increase of $162 for small and medium containers, and $166 for large containers includes the research and development costs. We also estimated that the cost for oxygen chemical generators will increase by about $175. The estimated cost increase also includes research and development costs. We are aware of other manufacturers that are developing other products to meet the requirements of the rule, which may lower the costs of this final rule, without impacting the benefits.

Comment Summary (15): The commenter, an aircraft parts distributor, claims these changes will eliminate their role in the oxygen generator business. They claim they will be crowded out of the market as a result of the increased packaging costs, the inability to ship by air and the necessity of transporting shipping containers back to the manufacturer.

Response: The FAA disagrees; this rule will not eliminate the role of this small entity in the oxygen generator business since the incremental cost impact for all small entities affected by this rule is “de minimus”. This issue is discussed further in the regulatory flexibility determination in this document.

Comment Summary (19): This commenter states that the cost will be higher, but not prohibitive considering the safety limits of the package.

Response: The FAA agrees that the costs will be higher, but they will not be prohibitively higher.

Comment Summary (20): This commenter states that they are spending about $50,000 on packaging and other materials to meet shipping requirements of hazardous materials. The commenter estimates that the new requirements will increase this cost by about $450,000.

Response: We estimate the increase in costs of overpacks for oxygen cylinders to be 62% for small and medium containers, and 53% for large containers. We estimate the cost for oxygen chemical generators will increase by about 42%. These increases are much lower than the 800% increase suggested by the commenter.

Comment Summary (27): This commenter estimates that their costs will increase by about 50% as a result of the rule. The commenter also states that they cannot give a cost estimate until an overpack that meets the standards is manufactured.

Response: The FAA observes that the cost of overpacks for oxygen cylinders and oxygen chemical generators should increase by about 62% for small and medium containers and 53% for large containers, while the cost for oxygen chemical generators will increase by about 42%.

Comment Summary (31): ATA is not aware of any safety problems stemming from the transportation of oxygen cylinders. ATA member carriers have transported hundreds of thousands of compressed oxygen cylinders under the post-1996 rules. They have reviewed their records in connection with this NPRM, and none of their records report any problem or incident relating to the cylinders. Indeed, the closest parallel to the hypothetical catastrophic event that PHMSA envisions was the fire-related crash of a B-747 in TWA flight 800 in July 1996. It is ATA's understanding that the oxygen cylinders from that aircraft were recovered, intact and unreleased, from the wreckage. ATA suggests that PHMSA research the records regarding cases of other aircraft that have burned, regardless of the cause of the fire and including those that burned on the ground, to study the condition of any oxygen cylinders or generators that were in the cargo compartments.

Replacement of the packaging for all the cylinders that passenger carriers transport as cargo would be very costly without providing any demonstrable improvement in safety. Their cost per container ranges between $300 to $500 for their current fleet, which carried 7,268 oxygen cylinders as spares in their cargo holds. It is impossible to give an accurate estimate of the increased costs because they are unaware of a product that will meet the new standards. Without an increase in price, replacement packaging alone would cost their member carriers about $2.2 million to $3.6 million.

Response: The FAA disagrees that the rule will be very costly without providing any demonstrable improvement in safety. The FAA has determined that this final rule will not have a substantial impact on significant number of small entities and has given a detailed cost evaluation of a product that meets the new standard. The cost impact on their members would be about $3.1 million (7,268 x $425), which is included in the cost analysis below.

As table 1 suggests, there is a 95 percent probability that there will be one or more accidents because of fire in the cargo compartment and a low probability (0.05) that there will be no accidents due to fire in the cargo compartment.

Table 1. Probability Analysis -- Accidents due to fire in the cargo compartment (mean of 3) over the next 15 years

Number of Events	Probability of Event	Cumulative Probability of Event
0	0.05	0.05
1	0.15	0.20
2	0.22	0.42
3	0.22	0.65
4	0.17	0.82
5	0.1	0.92
6	0.05	0.97
7	0.02	0.99

Source: U.S. Department of Transportation, Federal Aviation Administration, Operations Regulatory Analysis Branch. June, 2005

Notes:

1) As noted in the benefits section, three accidents involving airplane cargo compartment fires occurred between 1986 and 2002.

2) We applied the Poisson probability distribution to this observed rate of accidents.

A fire in a cargo compartment could cause the release of oxygen from an oxygen generator or from a cylinder of compressed oxygen. If either device is present in the cargo compartment, during a fire in that compartment, it could cause a catastrophic fire onboard the aircraft. We estimated that if a cargo compartment fire becomes a catastrophic fire, the casualty cost could be $357 million (see benefits section for details).

We have reviewed the NTSB database for accidents and incidents where a fire in a cargo compartment caused the release of oxygen from an oxygen generator or from a cylinder of compressed oxygen and, no such accidents or incidents have occurred. However, 3 accidents and 10 incidents involving airplane cargo compartment fires have occurred between 1986 and 2002, which makes the release of oxygen from an oxygen generator or from a cylinder of compressed oxygen a likely scenario. Because we are taking a proactive approach to preventing accidents, we cannot accept the possibility that, in the event of a fire occurring in a cargo compartment containing cylinders of compressed oxygen, oxygen might be released intensifying the fire. Therefore, we believe that this rule is necessary.

III. Risks and Benefits

The purpose of this final rule is to reduce the risk of an airplane cargo compartment fire becoming a catastrophic fire because of the release of oxygen from a cylinder containing compressed oxygen or from a chemical oxygen generator. While the risk of this type of catastrophic fire is small, that risk cannot be ignored because items like chemical oxygen generators and cylinders containing compressed oxygen are carried in the cargo compartments of airplanes. The PHMSA has determined this final rule will generate benefits for system users by reducing that risk.

PHMSA has reviewed the National Transportation Safety Board’s (NTSB) database of historical aviation accidents and incidents and the FAA Accident/Incident Database for accidents or incidents caused by fire in the cargo compartment. Three accidents, two of which were cargo aircraft, and 10 incidents, all were passenger aircraft, involving airplane cargo compartment fires have occurred between 1986 and 2002, as shown in Table 2. This data shows that airplane cargo compartment fires occur about once a year.

Table 2. Accidents and incidents due to fire in the cargo compartment

Date	City & State	Event Type	Injuries				Aircraft Damage
			Fatal	Serious	Minor	None	
03/07/2002	Lincoln, NE	Incident				45	Minor
02/10/2001	Columbus, OH	Incident					Minor
11/08/1998	Atlanta, GA	Incident				4	Minor
07/07/1998	Rapid City, SD	Incident				2	Minor
09/05/1996	Newburgh, NY	Accident			2		Destroyed
05/11/1996	Miami, FL	Accident	110				Destroyed
08/11/1995	Nikolai, AK	Accident				1	Substantial
12/11/1992	Adak, AK	Incident				66	Minor
02/01/1991	Greensboro, NC	Incident				37	Minor
01/10/1990	Detroit, MI	Incident				2	Minor
02/03/1988	Nashville, TN	Incident			18	113	Minor
11/25/1986	Ontario, CA	Incident				124	Minor
08/10/1986	Chicago, IL	Incident				7	Destroyed

A fire in a cargo compartment could cause the release of oxygen from an oxygen generator or from a cylinder of compressed oxygen, if either device is in that cargo compartment. The release of oxygen could then cause a catastrophic fire onboard the aircraft. The cost of a catastrophic accident can be estimated in terms of lives lost and property damage.

According to the most recent forecast, the system average number of seats per aircraft is about 136, and the system average load factor is about 78%[2]. This equates to a passenger count of about 106 (136 x 78%). On a typical flight of 106 passengers, there would also be a flight crew of 2 pilots and 3 flight attendants, which totals 111 people onboard a typical aircraft. The fair market value of a passenger aircraft is estimated to be $13 million[3]. If a cargo

[2] U.S. Department of Transportation, Federal Aviation Administration, Office of Policy & Plans, FAA Aerospace Forecasts, Fiscal Years 2006 – 2017, Tables 6 and 9. The system load factors and number of passenger seats were used to address the possibility that oxygen canisters and chemical oxygen generators may be on international flights.
[3] Economic Values for FAA Investment and Regulatory Decisions, A Guide, Draft, December 31, 2004, Table 5-1.

compartment fire in a passenger aircraft becomes a catastrophic fire, the casualty cost is estimated to be $333 million (111 x $3 million). In addition, the cost of the plane, investigation, legal fees, property damage in a single catastrophic event can result in total costs approximating $357 million.

On a typical cargo flight there would be a flight crew of 2 pilots. The fair market value of a cargo aircraft is estimated to be $13 million[4]. If a compartment fire in a cargo aircraft becomes a catastrophic fire, the casualty cost is estimated to be $6 million (2 x $3 million). In addition, the cost of the plane, investigation, legal fees, property damage in a single catastrophic event can result in total costs approximating $30 million.

Hence, the benefits of this rulemaking range from $30 million, if a cargo aircraft accident is averted to $357 million, if a passenger aircraft accident is averted. This rulemaking is intended to prevent either outcome from occurring.

IV. Costs

The final rule will require that cylinders of compressed oxygen, other oxidizing gases and chemical oxygen generators when shipped on aircraft be packaged in containers that meet certain flame penetration and thermal resistance requirements. Although manufacturers maintain that it is feasible to construct a container meeting the flame penetration requirement, no container with this characteristic is currently commercially available.

Baseline Costs

The key factor in determining the cost impact was measuring the increase in costs over baseline costs. The baseline is defined as current practice, and takes into account the costs that would be incurred in the course of business without imposing the requirements of the final rule.

[4] Ibid.

PHMSA is using the following two assumptions to calculate baseline costs for both oxygen cylinder and oxygen generator overpacks:

- The currently required container can be reused for 7-9 years (one eighth are replaced each year).
- After the mandatory date (two years after the rule is issued), costs recur when the containers may no longer be reused.

Baseline costs are based on an estimate of the average price per container. For oxygen cylinder overpacks, PHMSA estimates the average price per small to mid sized container is $263, and $311 for large containers.[5] PHMSA estimates that the cost to the industry to comply with the current requirements by the mandatory date is estimated to be $7.9 million [(30,000 small to mid-sized containers x $263) + (100 large containers x $311)]. These numbers are based on expert PHMSA opinion and industry views. The total 15-year undiscounted baseline recurring replacement costs are estimated to be $14.9 million (or $9.7 million discounted). See Appendix A for details.

PHMSA estimates the average price per overpack, which can hold up to 6 chemical oxygen generators, costs about $420. PHMSA estimates there are 10,000 of these containers. Also, PHMSA estimates that airlines normally ship 3 chemical oxygen generators per container. The cost to the industry to comply with the current requirements by the mandatory date is estimated to be equal to be $4.2 million [(30,000 generators / 3 generators per overpack) x $420]. These numbers are based on expert PHMSA opinion and industry views. The total 15-year undiscounted baseline recurring replacement costs are estimated to be $7.9 million (or $5.1 million discounted). See Appendix B for details.

Costs of the Rule

Containers meeting the requirements of this rule will have to (1) withstand a flame penetration of 1,700°F for 5 minutes; and (2) prevent enclosed cylinders from exceeding a surface temperature of 200ºF when the containers are exposed to a mean temperature of 400ºF for 3 hours. PHMSA is using the following three assumptions to calculate the cost of the final rule over the 15-year period of analysis (these assumptions apply to both oxygen cylinder and oxygen generator overpacks):

- The mandatory year to comply with the requirement will be 2008.
- The currently required container would be reused for 7-9 years.
- After 2008, costs will recur when containers may no longer be reused.
- All costs have been discounted to present value at 7% and are expressed in 2004 dollars.

For oxygen cylinders, PHMSA estimates a $425[6] average cost per small to medium sized container and a $477 average cost per large container. Approximately 30,000 small to mid-sized containers and 100 large containers will be needed. The incremental cost of the rule for oxygen overpacks is calculated by first estimating a cost based on these numbers over the 15 years and then subtracting out baseline costs (Appendix A). The total 15-year undiscounted incremental cost of this final rule with respect to oxygen cylinders is estimated to be $10.8 million (or $7.6 million discounted).

For chemical oxygen generators the costs of the final rule are based on an estimate of the average price per container, shipping costs, and an estimate of the cost to the industry to comply with the requirement in the expected mandatory year, 2007, minus the cost of complying with the current overpack requirements.

However, in addition to the costs of the chemical oxygen generator overpacks, we also need to include a shipping cost. This is because of

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[5] Source: Viking Packing Specialist, August 2005.
[6] Source: Viking Packing Specialist, August 2005.

the current industry practice of shipping chemical oxygen generators in disposable overpacks from the factory to distribution points and then to its final destination. Under the final rule the overpacks, instead of simply being disposed of, will need to be returned to the factory or distributor.

PHMSA has estimated the industry will need about 10,000 containers to transport the 30,000 chemical oxygen generators by cargo aircraft (chemical oxygen generators are forbidden for transports aboard passenger aircraft as cargo). We have estimated that one-third of these containers will be used by the airline industry and the remaining two-thirds will be used by manufacturers and distributors of chemical oxygen generators. It is PHMSA’s belief the containers used by the manufacturers and distributors will be sent to outside companies and therefore, they will incur a "recovery fee" in order to get the containers back from their customers. We have estimated the cost of this recovery fee is $22 per return shipment and that each container will be shipped back 12 times each year. The total cost of this recovery fee is estimated at $1.8 million per year ($22 x 12 x 6,700). PHMSA has not included a shipping cost for the 3,300 airline industry containers because most if not all of the shipments using these containers would be to internal elements of the airline, which is considered current practice.

PHMSA estimates the average price per oxygen generator container that meets the new requirement to be $595 and there will be 10,000 containers necessary to be produced, to hold the 30,000 chemical oxygen generators. The PHMSA estimates that the cost to the industry to comply with the requirement for chemical oxygen generators in the mandatory year would be $7.7 million [((30,000 generators / 3 generators per overpack) x $595) + (6,700 x 12 x $22)]. After the initial expenditure, in addition to the annual recovery fee, there will be subsequent costs as the lifespan of the containers expires. The typical lifespan of a container is 8 years. For chemical oxygen generators the total 15-year undiscounted cost of this final rule is estimated to be $34.9 million (or $22.0 million discounted) (See Appendix B for details). After subtracting the baseline costs, $7.9 million ($5.1 million), the estimated incremental costs are $27.0 million ($16.9 million discounted).

Allowance of Oxydizing Gases

This final rule will also allow the transportation of other oxidizing gases aboard cargo and passenger aircraft. These affected materials are covered under the shipping descriptions “Air, refrigerated liquid, (cryogenic liquid)”, “Carbon dioxide and oxygen mixtures, compressed”, “Nitrous oxide”, “Nitrogen triflouride, compressed”, “Compressed gas, oxidizing”, and “Liquefied gas, oxidizing.” PHMSA has found that these gases are almost never shipped by airplane.

In the rare event that these oxidizers are shipped on an airplane, the oxidizer must be in an approved overpack. The shipping costs per container for these oxidizers are expected to be about the same for the oxygen cylinders and chemical oxygen generators, as discussed in the Appendix. The costs of these overpacks for shipping the oxidizing gases are expected to range between $425 and $500 per container.

The cost to the industry for shipping these oxidizing gases is likely to be small since most transporters should continue to ship the oxidizers via the other methods currently used in practice. The PHMSA concludes that any costs to society associated with allowing these oxidizing gases to be transported onboard an airplane are de minimus, and would not have a measurable effect on the cost-benefit ratio of this final rule.

V. Comparison of Costs and Benefits

The total cost of the rule over 15 years is $37.8 million ($24.6 million discounted). Oxygen cylinders account for $10.8 million ($7.6 million discounted) and chemical oxygen generators account for $27.0 million ($16.9 million discounted).

The estimated benefits of this rulemaking range from $30 million, if a cargo aircraft accident is averted to $357 million, if a passenger aircraft accident is averted. Therefore, we conclude this rule will be cost beneficial.

VI. Final Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 establishes "as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation." To achieve that principal, the Act requires agencies to solicit and consider flexible regulatory proposals and to explain the rational for their actions. The Act covers a wide-range of small entities, including small businesses, not-for-profit organizations and small governmental jurisdictions.

Agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. If the determination is that it will, the agency must prepare a regulatory flexibility analysis (RFA) as described in the Act.

However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the 1980 act provides that the head of the agency may so certify and an RFA is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

The Small Business Administration recommends that "small" represent the impacted entities with 1,500 or fewer employees. For this final rule, small entities are part 121 and part 135 air carriers with 1,500 or fewer employees that were approved to carry hazardous materials. The DOT identified 729 air carriers that meet this definition. PHMSA contacted several of these entities to estimate the number of containers that each small air carrier uses to transport oxygen cylinders aboard aircraft in other than the passenger cabin. All the entities that were contacted maintained that although they are approved to carry hazardous materials, they transport no oxygen cylinders in cargo compartments. From conversations with container manufacturers, PHMSA learned that roughly ten small air carriers transport compressed oxygen cylinders. PHMSA also believes each of the ten small air carriers will need roughly 5 compressed oxygen containers to comply with the final rule. We also estimate that each of ten small carriers will need roughly 5 chemical oxygen generator containers to comply with the final rule.

Table 3. Incremental Costs per Small Entity			
Cost per small entity assuming 5 containers	PV of Costs over 15 Years*	Capital recovery factor	Annualized Costs
Baseline Costs	$2,836	0.10979	$311
Proposed Costs	$6,946	0.10979	$763
Incremental Costs	$4,110	0.10979	$451
Source: U.S. Department of Transportation, Federal Aviation Administration, Operations Regulatory Analysis Branch. August, 2005.			
*From Appendix C.			

After calculating the prorated annualized costs per entity using the same assumptions that were used in the cost section, PHMSA determined that the incremental cost impact per small entity will be $451 (Table 3), which PHMSA considers is “de minimus” for a small business (See Appendix C). The baseline costs per small entity shown in Table 3 are generated from Appendix C by adding the baseline discounted costs of oxygen cylinders and chemical oxygen generator overpacks. Similarly, the costs in Table 3 are generated by adding discounted costs of the rule for oxygen cylinder and chemical oxygen generator overpacks. Annualized costs are calculated by applying a capital recovery factor to total incremental costs and measures the annual impact of the regulation.

Therefore the PHMSA certifies that this rule will not have a significant economic impact on a substantial number of small entities.

VII. International Trade Impact Determination

The Trade Agreements Act of 1979 (Public Law 96-39) prohibits Federal agencies from engaging in any standards or related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and where appropriate, that they be the basis for U.S. standards.

The final rule is not expected to affect trade opportunities for U.S. firms doing business overseas or for foreign firms doing business in the United States. Furthermore, the final rule is consistent with the terms of several trade agreements to which the United States is a signatory, such as the Trade Agreements Act of 1979 (19 U.S.C. 2501 et seq.), incorporating the Agreement on Trade in Civil Aircraft (31 U.S.T. 619) and the Agreement on Technical Barriers to Trade (Standards) (19 U.S.C. 2531). The final rule is also consistent with 49 U.S.C. 40105, formerly 1102 (a) of the Federal Aviation Act of 1958, as amended, which requires the PHMSA to exercise and perform its powers and duties consistently with any obligation assumed by the United States in any agreement that may be in force between the United States and any foreign country or countries.

VIII. Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (Public Law 104-4) requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of $100 million or more (adjusted annually for inflation with the base year 1995) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a “significant regulatory action.” The FAA currently uses an inflation-adjusted value of $128.1 million in lieu of $100 million.

This final rule does not contain such a mandate. The requirements of Title II do not apply.

APPENDIX A: COSTS OF THE FINAL RULE
COMPRESSED OXYGEN CYLINDERS

Baseline:

Table A1. Average Price per Container	
Models	Unit Price
Model 1	$225
Model 2	$250
Model 3	$260
Model 4	$269
Model 5	$269
Model 6	$280
Model 7	$290
Model 8	$302
Model 9	$320
Average price (Small & Medium. Includes 1 -7)	$263
Average price (Large, includes 8 & 9)	$311
Source: Viking Packing Specialist. August 2005.	

Table A2. Cost to the Industry to Comply with the Current Requirement.	
Small to mid-sized containers	
Number of Containers (a)	30,000
Average Price (b)	$263
Large containers	
Number of Containers (c)	100
Average Price (d)	$311
Total (a x b) + (c x d)	$7,929,671
Source for the Number of Containers: PHMSA, DOT. August, 2005.	

Table A3. Summary of Undiscounted and Discounted Baseline Costs.		
Years	Costs	Discounted Costs
2006	$991,209	$991,209
2007	$991,209	$926,364
2008	$991,209	$865,760
2009	$991,209	$809,122
2010	$991,209	$756,189
2011	$991,209	$706,718
2012	$991,209	$660,484
2013	$991,209	$617,275
2014	$991,209	$576,893
2015	$991,209	$539,152
2016	$991,209	$503,880
2017	$991,209	$470,916
2018	$991,209	$440,109
2019	$991,209	$411,316
2020	$991,209	$384,408
Total	$14,868,135	$9,659,795
Source: U.S. Department of Transportation, Federal Aviation Administration, Operations Regulatory Analysis Branch. August, 2005.		
Notes: 1) The required container can be reused for 7-9 years (one eighth are replaced each year).		

Final Rule: construct containers that meet certain flame penetration and resistance requirements.

Table A4. Cost to the Industry to Comply with the Requirement in the expected Mandatory year, 2008.	
Small to mid-sized containers	
Number of Containers (a)	30,000
Average Price (b)	$425
Large containers	
Number of Containers (c)	100
Average Price (d)	$477
Total (a x b) + (c x d)	$12,810,507
Source for the Number of Containers: PHMSA, DOT. August, 2005.	

Table A5. Summary of Undiscounted and Discounted Costs.		
Years	Costs	Discounted Costs
2006	-	-
2007	-	-
2008	$12,810,507	$11,189,193
2009	-	-
2010	-	-
2011	-	-
2012	-	-
2013	-	-
2014	-	-
2015	-	-
2016	$4,270,169	$2,170,737
2017	$4,270,169	$2,028,727
2018	$4,270,169	$1,896,006
2019	-	-
2020	-	-
Total	$25,621,014	$17,284,663
Source: U.S. Department of Transportation, Federal Aviation Administration, Operations Regulatory Analysis Branch. August, 2005.		

Incremental Costs

A6. Discounted Incremental Costs (Rule - Baseline)		
Years	Incremental Costs	Discounted Incremental Costs
2006-2020	$10,752,879	$7,624,868

APPENDIX B: COSTS OF THE FINAL RULE - OXYGEN GENERATORS

Baseline:

Table B1. Average Price per Container	
Models	Unit Price
Average price	$420
Source: Viking Packing Specialist. August 2005.	

Table B2. Cost to the Industry to Comply with the Requirement.	
Number of Generators (a)	30,000
Average Price (b)	$420
Total (a x b) / 3	$4,200,000
Source for the Number of Containers: PHMSA, DOT. August, 2005.	

Table B3. Summary of Undiscounted and Discounted Baseline Costs.		
Years	Costs	Discounted Costs
2006	$525,000	$525,000
2007	$525,000	$490,654
2008	$525,000	$458,555
2009	$525,000	$428,556
2010	$525,000	$400,520
2011	$525,000	$374,318
2012	$525,000	$349,830
2013	$525,000	$326,944
2014	$525,000	$305,555
2015	$525,000	$285,565
2016	$525,000	$266,883
2017	$525,000	$249,424
2018	$525,000	$233,106
2019	$525,000	$217,856
2020	$525,000	$203,604
Total	$7,875,000	$5,116,370
Source: U.S. Department of Transportation, Federal Aviation Administration, Operations Regulatory Analysis Branch. August, 2005.		
Notes: 1) The required container can be reused for 7-9 years (one eighth are replaced each year).		

Final Rule: construct containers that meet certain flame penetration and resistance requirements.

Table B4. Average Price per Container	
Average unit price	$595
Source: Viking Packing Specialist. August 2005.	

Table B5. Cost to the Industry to Comply with the Requirement in the expected Mandatory year, 2008.	
Number of Generators (a)	30,000
Average Price (b)	$595
Generators per overpack (c)	3
Acquisition cost of containers (D = (a x b) /c)	$5,950,000
Recovery fees (E = 6,700 x 12 x $22)	$1,768,800
Initial Cost (D + E)	$7,718,800
Number of years that the container cost will recur (f)	3
Recurrent costs (G = D / f + E)	$3,752,133
Source for the Number of Containers: PHMSA, DOT. August, 2005.	

Table B6. Summary of Undiscounted and Discounted Costs.		
Years	Costs	Discounted Costs
2006	-	-
2007	-	-
2008	$7,718,800	$6,741,899
2009	$1,768,800	$1,443,868
2010	$1,768,800	$1,349,409
2011	$1,768,800	$1,261,130
2012	$1,768,800	$1,178,626
2013	$1,768,800	$1,101,520
2014	$1,768,800	$1,029,458
2015	$3,752,133	$2,040,912
2016	$3,752,133	$1,907,394
2017	$3,752,133	$1,782,612
2018	$1,768,800	$785,368
2019	$1,768,800	$733,989
2020	$1,768,800	$685,971
Total	$34,894,400	$22,042,155
Source: U.S. Department of Transportation, Federal Aviation Administration, Operations Regulatory Analysis Branch. August, 2005.		

Incremental Costs

B7. Discounted Incremental Costs (Rule - Baseline)		
Years	Incremental Costs	Discounted Incremental Costs
2006-2020	$27,019,400	$16,925,785

APPENDIX C: FLEXIBILITY ANALYSIS

Oxygen Cylinders

Baseline:

Table C1. Average Price per Container	
Models	Unit Price
Model 1	$225
Model 2	$250
Model 3	$260
Model 4	$269
Model 5	$269
Model 6	$280
Model 7	$290
Model 8	$302
Model 9	$320
Average price (Small & Medium, includes 1 -7)	$263
Average price (Large, includes 8 & 9)	$311
Source: Viking Packing Specialist. August 2005.	

Table C2. Cost to the Industry to Comply with the Requirement.	
Small to mid-sized containers	
Number of Containers (a)	5
Average Price (b)	$263
Large containers	
Number of Containers (c)	1
Average Price (d)	$311
Total (a x b) + (c x d)	$1,627
Source for the Number of Containers: PHMSA, DOT. August, 2005.	

Table C3. Summary of Undiscounted and Discounted Baseline Costs.		
Years	Costs	Discounted Costs
2006	$203	$203
2007	$203	$190
2008	$203	$177
2009	$203	$166
2010	$203	$155
2011	$203	$145
2012	$203	$135
2013	$203	$126
2014	$203	$118
2015	$203	$110
2016	$203	$103
2017	$203	$96
2018	$203	$90
2019	$203	$84
2020	$203	$79
Total	$3,045	$1,977

Source: U.S. Department of Transportation, Federal Aviation Administration, Operations Regulatory Analysis Branch. August, 2005.

Notes:

1) The required container can be reused for 7-9 years (one eighth are replaced each year).

Final Rule: construct containers that meet certain flame penetration and resistance requirements.

Table C4. Cost to the Industry to Comply with the Requirement in the expected Mandatory year, 2008.	
Small to mid-sized containers	
Number of Containers (a)	5
Average Price (b)	$425
Large containers	
Number of Containers (c)	1
Average Price (d)	$477
Total (a x b) + (c x d)	$2,604
Source for the Number of Containers: PHMSA, DOT. August, 2005.	

Table C5. Summary of Undiscounted and Discounted Costs.		
Years	Costs	Discounted Costs
2006	-	-
2007	-	-
2008	$2,604	$2,274
2009	-	-
2010	-	-
2011	-	-
2012	-	-
2013	-	-
2014	-	-
2015	-	-
2016	$868	$441
2017	$868	$412
2018	$868	$385
2019	-	-
2020	-	-
Total	$5,207	$3,513
Source: U.S. Department of Transportation, Federal Aviation Administration, Operations Regulatory Analysis Branch. August, 2005.		

Incremental Costs

C6. Discounted Incremental Costs (Rule - Baseline)		
Years	Incremental Costs	Discounted Incremental Costs
2006-2020	$2,162	$1,536

Oxygen Generators

Baseline:

Table C7. Average Price per Container	
Models	Unit Price
Average price	$420
Source: Viking Packing Specialist. August 2005.	

Table C8. Cost to the Industry to Comply with the Requirement.	
Number of Containers (a)	5
Average Price (b)	$420
Total (a x b) / 3	$700
Source for the Number of Containers: PHMSA, DOT. August, 2005.	

Table C9. Summary of Undiscounted and Discounted Baseline Costs.		
Years	Costs	Discounted Costs
2006	$88	$88
2007	$88	$82
2008	$88	$77
2009	$88	$72
2010	$88	$67
2011	$88	$63
2012	$88	$59
2013	$88	$55
2014	$88	$51
2015	$88	$48
2016	$88	$45
2017	$88	$42
2018	$88	$39
2019	$88	$37
2020	$88	$34
Total	$1,320	$859
Source: U.S. Department of Transportation, Federal Aviation Administration, Operations Regulatory Analysis Branch. August, 2005.		
Notes: 1) The required container can be reused for 7-9 years (one eighth are replaced each year).		

Final Rule: construct containers that meet certain flame penetration and resistance requirements.

Table C10. Average Price per Container	
Average unit price	$595
Source: Viking Packing Specialist. August 2005.	

Table C11. Cost to the Industry to Comply with the Requirement in the expected Mandatory year, 2008.	
Number of Containers (a)	5
Average Price (b)	$595
Generators per overpack (c)	3
Acquisition cost of containers (D = (a x b) /c)	$992
Recovery fees (E = 1 x 12 x $22)	$264
Initial Cost (D + E)	$1,256
Number of years that the container cost will recur (f)	3
Recurrent costs (G = D / f + E)	$595
Source for the Number of Containers: PHMSA, DOT. August, 2005.	

Table C12. Summary of Undiscounted and Discounted Costs.		
Years	Costs	Discounted Costs
2006	-	-
2007	-	-
2008	$1,256	$1,097
2009	$264	$216
2010	$264	$201
2011	$264	$188
2012	$264	$176
2013	$264	$164
2014	$264	$154
2015	$595	$323
2016	$595	$302
2017	$595	$282
2018	$264	$117
2019	$264	$110
2020	$264	$102
Total	$5,415	$3,433
Source: U.S. Department of Transportation, Federal Aviation Administration, Operations Regulatory Analysis Branch. August, 2005.		

Incremental Costs

C13. Discounted Incremental Costs (Rule - Baseline)		
Years	Incremental Costs	Discounted Incremental Costs
2006-2020	$4,095	$2,574