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**14 CFR Part 121  
Protective Breathing Equipment; Final  
Rule**

## DEPARTMENT OF TRANSPORTATION

## Federal Aviation Administration

## 14 CFR Part 121

[Docket No. 24792; Amdt. No. 121-193]

## Protective Breathing Equipment

AGENCY: Federal Aviation Administration, DOT.

ACTION: Final rule.

**SUMMARY:** This final rule amends the regulations applicable to protective breathing equipment (PBE) by: (1) Incorporating the requirements of § 25.19 of the Federal Aviation Regulations into current § 121.337; (2) providing new standards for PBE for crewmembers who may be required to fight in-flight fires; (3) requiring the performance of an approved firefighting drill using PBE; (4) requiring that, when possible, additional PBE be located within 3 feet of each required hand fire extinguisher in passenger compartments; and (5) clarifying certain emergency drill requirements. This action was prompted by several in-flight fires and, in part, by a report on PBE by the National Transportation Safety Board.

EFFECTIVE DATE: July 6, 1987.

**FOR FURTHER INFORMATION CONTACT:** David E. Catey, Project Development Branch (AFS-240), Air Transportation Division, Office of Flight Standards, Federal Aviation Administration, 800 Independence Avenue SW., Washington, DC 20591; telephone: (202) 267-8096.

**SUPPLEMENTARY INFORMATION:****Background**

Protective breathing equipment (PBE) consists of a full face mask attached to an oxygen supply; a face mask, including smoke goggles, attached to an oxygen supply; or a smoke hood attached to an oxygen supply. Rules requiring operators conducting air carrier operations outside of the United States to have such equipment installed in their airplanes were originally included in § 41.24(c) of the Civil Air Regulations (CAR), which became effective on October 21, 1949. The basic requirement of these early standards was that the equipment be designed to prevent the person wearing the equipment from breathing noxious gases. Such standards were also a part of the type certification basis for older airplanes, and they still apply to those airplanes.

Subsequent amendments to the transport category airplane type certification requirements resulted in the

current PBE requirements set forth in § 25.1439 of the Federal Aviation Regulations (FAR). That rule specifies the airplane compartment configurations for which PBE is required and establishes performance standards for the equipment.

Under § 25.1439, PBE is required in an airplane if there are cargo compartments or isolated separate compartments, including upper and lower lobe galleys, which the flightcrew may enter during flight. Performance requirements in this rule specify that PBE must be designed to protect the flightcrew from smoke, carbon dioxide, and other harmful gases; that the PBE must also include suitable covering for eyes, nose, and mouth; and that a specified amount of oxygen must be supplied. These PBE standards for transport category airplanes were adopted in 1964 and amended in 1976. They do not apply to airplanes still in service that were type certificated prior to that time.

On July 11, 1973, a Boeing 707 (B-707) airplane made a forced landing short of the runway at Paris, France, as the result of a cabin fire started by a cigarette in a rear lavatory waste bin. Intense fire, smoke, and harmful gases spread throughout the airplane, with the result that only 11 of the 134 occupants survived. Investigation indicated that the use of upgraded PBE, meeting the revised standards contained in Technical Standard Order (TSO) C99, might have permitted the flight attendants using such upgraded equipment to extinguish the fire in flight and thus might have saved more lives.

On November 3, 1973, a fatal accident occurred in Boston, Massachusetts, involving a B-707 freighter airplane. Investigation of this accident prompted the National Transportation Safety Board (NTSB) to evaluate PBE used by a number of air carriers. The NTSB reported that smoke goggles used by several air carriers did not adequately protect crewmembers from smoke and that certain goggles in use appreciably restricted the wearer's vision. The NTSB recommended that all transport category airplanes, regardless of date of certification, be required to comply with current § 25.1439 and that all smoke goggles presently in use be inspected to ensure that they comply with § 25.1439.

On June 2, 1983, an in-flight fire occurred in the aft lavatory of a McDonnell-Douglas DC-9 airplane en route to Montreal, Canada. The crew was unable to control the fire and requested an emergency descent and air traffic control clearance to the nearest available airport. The crew successfully landed the airplane at Covington, Kentucky. Soon after passenger and

crewmember evacuation from the airplane began, dense smoke rapidly spread through the passenger compartment, apparently making it impossible for 23 of the 41 passengers on board to find their way to emergency exits. The Federal Aviation Administration's (FAA) analysis of this accident concludes that a number of those passengers who perished might have survived if certain cabin safety improvements under consideration at that time by this agency had been in effect. One of those improvements is the requirement contained in this rulemaking for additional PBE for use by crewmembers throughout the airplane. It is conceivable that, had the airplane been equipped with the additional PBE, its effective use by the flight attendants in fighting the fire might have delayed the spread of smoke in the cabin.

The result of this rule will be that the operating rule in Part 121 will impose additional PBE requirements that go beyond the airplane certification rules in § 25.1439. The principal additional requirement will be PBE for flight attendants, in addition to flight crewmembers, which will protect them while fighting on-board fires. These additional requirements are appropriate for Part 121 air carriers because they will provide the high level of safety that should be found in large air carrier aircraft operations. In addition, the Part 121 operating rule will provide refinements to the basic certification rules, such as specific inspection and training procedures.

On October 31, 1983, the NTSB issued two safety recommendations pertinent to this rulemaking. Safety Recommendation A-83-74 recommends that the FAA "require that protective breathing equipment, including smoke goggles, currently carried aboard transport category airplanes to comply with 14 CFR 25.1439 and 14 CFR 121.337 which do not meet the minimum performance standard prescribed in Technical Standard Order (TSO) C99 or equivalent be replaced with equipment which meets the standards." Safety Recommendation A-83-75 recommends that the FAA "amend 14 CFR 121.337 to prescribe a minimum number of portable protective breathing apparatus with full face masks which will be carried in the passenger compartment of transport category airplanes readily accessible to cabin attendants and flightdeck crew."

The current operating requirement (§ 121.337) for PBE used by Part 121 operators provides that the flightcrew be protected from smoke, carbon dioxide, and other harmful gases. The requirement for "protection" is actually

composed of several different criteria, of which the most significant is the amount of contamination that can be tolerated by the lungs without unduly impairing a flight crewmember's ability to function.

The FAA conducted a survey of reports concerning human physiological limitations resulting from 15-minute exposures to contaminants likely to be present in airplane fires. The results of this survey show that contaminant concentrations in the air of 5 percent for breathing and 10 percent for eye contact are the maximum acceptable levels for 15 minutes of exposure for flight crewmembers. These standards are currently incorporated in material referenced in TSO-C99.

In general, minimum performance standards for equipment established by the FAA are issued in the form of TSO's. Until recently, TSO's were included within the FAR (Part 37); they are now issued as nonregulatory material but continue to provide a basis for approval of materials, parts, and appliances.

TSO-C99 was first issued in June 1983. Prior to the issuance of TSO-C99, there were no specific standards for approval of PBE beyond those contained in the operating and certification rules. After issuing TSO-C99, the FAA tested a number of oxygen mask-smoke goggle combinations used in air carrier airplanes. These tests showed that many of these PBE units permitted contaminant concentration levels that exceeded the performance levels in TSO-C99.

The FAR now require all certificate holders to furnish approved PBE for their flight crewmembers' use. This equipment is generally used when a flight crewmember is in a sedentary state. This equipment is usually approved in accordance with TSO-C99 and Society of Automotive Engineers (SAE) Aerospace Standard (AS) 8031. This new rule will require that equipment to be used by crewmembers in other than a sedentary state must be PBE approved in accordance with new minimum performance standards contained in § 121.337. Guidance for approval will be available at FAA Field Offices by the effective date of the rule.

The FAA proposed that PBE be required in additional locations in airplanes operated under Part 121. Portable PBE located in passenger compartments would have to be easily accessible and conveniently located within 3 feet of each hand fire extinguisher required by § 121.309. An approved firefighting drill using PBE would have to be performed by all crewmembers while wearing PBE. In

addition, certain emergency drill requirements in Part 121 would be clarified.

These proposals were derived from experience gained from the accidents mentioned previously, where smoke and noxious gases may have impeded crewmembers when fighting cabin fires and, as previously noted, NTSB recommendations A-83-74 and A-83-75, which urge that a minimum number of PBE units be required aboard transport category airplanes and that PBE aboard those airplanes comply with §§ 25.1439 and 121.337 and TSO-C99.

As a result of various studies and recommendations, the FAA recently adopted rules that require the addition of reduced flammability requirements for seat cushions and high usage interior cabin materials, smoke detectors in lavatories, additional and improved hand fire extinguishers in airplanes operated under Part 121, and floor proximity lighting systems. These cabin safety improvements are in addition to the items in this amendment.

The FAA has carefully evaluated the cost and benefits of this amendment and has concluded that the lives that may be saved are in addition to any lives saved as a result of other cabin safety initiatives.

There are three major safety benefits to this PBE amendment. The first benefit is the direct prevention of injury or death of crewmembers as a result of smoke or harmful gases. The second benefit is a decreased likelihood of passenger injury or death because crewmembers will not be incapacitated by smoke or harmful gases and thus will be able to continue to perform their safety duties. Finally, the third benefit is the lessened chance of injury or death for both passengers and crewmembers as a result of the enhanced ability of crewmembers to actively combat potentially catastrophic in-flight fires. In contrast to the active cabin safety measures in this amendment, the benefits of related FAA cabin safety initiatives are those lives saved and injuries prevented by passive fire protection countermeasures in both in-flight and post-crash fires. Smoke detection devices, fire retardant materials, and improved passenger egress measures are passive in nature and not dependent on crewmember activation. The PBE amendment enhances the effectiveness of these passive fire protection initiatives by providing a complementary active countermeasure against the hazards of inflight fires. For this reason, the benefits attributed to this amendment represent an increase in the savings to the public above the cost

of lives and injuries already cited in other related FAA initiatives.

#### Comments on the Proposed Rule

During the 120-day comment period, the FAA received 32 comments in response to Notice of Proposed Rulemaking (NPRM) No. 85-17. The comments represent the views of individuals, airline employee labor organizations, U.S. airline organizations, oxygen mask manufacturers, and foreign airlines. Most comments agree with the need for improving regulations in the cabin safety area and commend the FAA for the rulemaking effort. Airline labor organizations, the NTSB, and numerous individuals favor even more stringent requirements than that proposed in the NPRM.

On January 3, 1986, the Air Transport Association (ATA) petitioned for a 60-day extension of the comment period. This request was denied by the FAA because the original comment period of 120 days was considered a reasonable length of time for any comments. The ATA submitted comments on the NPRM, dated February 10, 1986. Subsequently, an additional response was received from ATA, which was dated May 7, 1986. Although the last ATA comments received were beyond the comment period deadline, the FAA has considered them in developing this final rule. No other late-filed comments were received.

ATA stated that the incorporation of the PBE requirements of § 25.1439 into § 121.337 will have a significant impact on operators of airplanes certificated prior to the most recent changes to Part 25. These operators will be required to dispose of or modify PBE equipment that was properly certificated and deemed airworthy when the airplane was originally purchased. ATA says this is a departure from what it views as the standard FAA practice of imposing more stringent equipment standards only on airplanes certificated after the date of a new rule.

With the development of new technology equipment and the emphasis being placed upon upgrading cabin safety, upgrading of standards for PBE devices is warranted. Some existing equipment essentially meets the new standards, while other equipment can be modified to meet these new standards. In view of the clear safety improvements from the new standards, the FAA concludes that these changes should be implemented in accordance with the time constraints contained in the final rule.

The ATA and Regional Airlines Association (RAA) both state that

applying the new oxygen standards to portable PBE for flightcrew and cabin crew will increase the oxygen cylinder dimensions, which may create a space problem in the flightcrew compartment.

To meet this objection, § 121.337(b)(9)(iii) has been modified from the original proposal to allow the Administrator to authorize another location for portable PBE on the flight deck if space constraints prevent its storage in the flightcrew compartment. In such an event, the portable PBE for use by the flightcrew would have to be conveniently located so that it is readily accessible for use by the flightcrew in an emergency. Similarly, § 121.337(b)(9)(iv) allows PBE in passenger compartments to be located more than 3 feet from a hand fire extinguisher if special circumstances make it impractical to locate them as required. For example, space constraints may make it impossible to place PBE within 3 feet of the hand fire extinguishers at some locations on some airplanes. In this case, the Administrator may allow another location if an equivalent level of safety is maintained.

The NPRM proposed a 1-year compliance date for carriers to provide PBE in Part 121 operations. The ATA opposes the 1-year compliance period for several reasons. ATA says that PBE specifications are part of this rulemaking package. Therefore, until the package is finalized, equipment may not even be ordered. Because of this lack of adequate lead time, ATA states that it will be difficult for carriers to acquire new PBE for installation aboard airplanes and for use by crewmembers during the required training. ATA also maintains that demand for new PBE could outstrip manufacturers' inventories and production capacity. Finally, ATA says there will be administrative delays in establishing and approving training programs and that, after approval, it will take at least a year for all crewmembers to be trained. Several other commenters state that the 1-year compliance date would be insufficient and would cause additional compliance costs.

The FAA intends to give carriers a reasonable amount of time to comply with this rule for installation of PBE devices for both flight crewmembers and cabin crewmembers who may have to combat fires in the airplane. Equipment may need to be developed to meet the new approval standards to be established for an active (nonsedentary) crewmember. Once these standards have been established, the manufacturers state that they will be able to meet the expected demand.

Indeed, the Civil Aeromedical Institute (CAMI) has conducted tests that show that there is at least one currently available portable smoke hood device that would essentially provide the levels of protection for crewmembers combatting fires that the new rule requires. These tests used a work profile designed to replicate the activity of a crewmember combatting an in-flight fire. Thus, a carrier that wants to begin equipping its airplanes at once will be able to do so. Nevertheless, the FAA has decided that a 2-year compliance period for PBE for crewmembers combatting fires is appropriate. This longer period should allow ample time for development, manufacture, and distribution of adequate numbers of new equipment and time for required training.

Several commenters state that the economic impact could be substantial both for the PBE and for training personnel in the use of the PBE.

The FAA is aware that there may be some economic burden placed on Part 121 certificate holders; however, the safety benefits of the rule far outweigh the economic costs that may be incurred.

Two commenters indicate that the PBE should provide for hypoxia protection as well as protection from harmful gases and smoke.

The primary reason that the FAA has decided that the amendment should not include protection from the effects of hypoxia is that accident statistics do not show instances where smoke and/or fire in the airplane have occurred simultaneously with depressurization. Protection from the effects of depressurization is provided by the currently installed oxygen equipment, which will continue to provide supplemental oxygen to crewmembers, while PBE is intended to protect from the effects of smoke, carbon dioxide, and other harmful gases. Thus, PBE may supply any breathable atmosphere such as compressed air or oxygen.

Current § 121.337 only requires protection from the effects of smoke, carbon dioxide, and other harmful gases for required flight crewmembers on flight deck duty. It does not require protection against the physiological effects of depressurization. The FAA concludes that it is not necessary to require that the new requirements for PBE provide depressurization protection for either flight crewmembers or cabin crewmembers. This does not mean that they do not need some kind of breathing equipment that furnishes protection from depressurization. If a carrier chooses to furnish equipment that

protects against the effects of smoke, carbon dioxide, and other harmful gases, as well as an oxygen deficient environment (hypoxia) caused by depressurization, it may do so. Flight crewmembers must currently be protected from the effects of depressurization by full or partial masks that meet the standards prescribed in § 121.335. The FAA will not require that this equipment also meet the standards for PBE or that PBE meet these standards.

Two commenters state that PBE devices now in use are specifically tested only for use in a smoke-filled environment and that utilizing this equipment in a firefighting situation would subject this equipment to an unintended use. One of these commenters further states that they disagree with the implication that crewmembers are now, or should be, "firefighters." This commenter feels that crewmembers should never be led to believe that any existing or proposed equipment allows a crewmember to attack all fires. The commenter thinks that getting the airplane on the ground without delay should be the prime mission. In addition, this commenter criticizes the requirement for firefighting drills in the new training requirements. These drills themselves may present hazards to crewmembers that even professional firefighters would not undertake.

The FAA intent is that the equipment be used only as it was designed, but that it be utilized to the fullest extent of its capability. The equipment prescribed in the rule should be used to assist in locating any source of smoke and to aid in fighting an in-flight fire. Flight crewmembers should naturally make every effort to land the airplane as soon as possible. The efforts of the cabin crew in combatting or limiting an in-flight fire may very well provide the necessary time for the flightcrew to safely land the airplane.

Most of the commenters have definite recommendations regarding the equipment requirements of the NPRM. The NTSB issued Safety Recommendations A-83-75, which recommends that the FAA amend § 121.337 to prescribe a minimum number of portable protective breathing devices with full-face masks. The NTSB's comment in the docket continues to support this stand since it maintains that many partial masks with goggles fail to protect wearers adequately in a smoke-filled environment.

Numerous other commenters state that the full or partial face masks are not

practical for several reasons and that PBE hoods should be considered for use by cabin crewmembers.

The FAA agrees with the NTSB and other commenters that PBE for flight crewmembers should provide full protection from the effects of smoke, carbon dioxide, or other harmful gases while performing flight deck duties and while combatting a fire on the flight deck or elsewhere in the airplane. However, the FAA does not believe this protection may only be achieved using a full face mask. Properly designed combination face mask/goggle units, for example, may also provide the same level of protection, and manufacturers and carriers should be free to achieve the required level of protection using whatever technology will meet FAA approval criteria.

Similarly, hoods for portable PBE to be used by cabin crewmembers may be one means of providing protection for them while fighting fires. However, it need not be the only means. The PBE requirement is intended to ensure the necessary level of protection for crewmembers, not to mandate a particular PBE technology. Nevertheless, the FAA notes that hoods may offer advantages for cabin crewmembers who are fighting fires. For example some allow freedom of movement and use of the hands, since it may not be necessary to carry or position an oxygen bottle.

One commenter states that the proposed one PBE per required hand fire extinguisher is excessive in number and that for narrow body airplanes, one PBE in the front of the airplane and one PBE in the rear would be sufficient. The commenter states that a greater number should be required for wide-body airplanes, but the commenter was not specific about numbers. This same commenter further contends that the 3-foot maximum distance between a required hand fire extinguisher and PBE is without justification.

The FAA and the NTSB have recognized that in the past some airplane disasters that resulted from cabin fires might have been prevented with a rapid recognition of smoke/fire in the cabin and a rapid response to putting out the fire or limiting its spread. If a flight attendant is required to run to one end or the other of the airplane to get a PBE rather than going to the nearest required hand fire extinguisher for the PBE, valuable time may be lost. Therefore, in most cases, locating the PBE in the cabin within 3 feet of each required hand fire extinguisher is both reasonable and practical. The FAA does recognize that there are certain circumstances that will not practically allow the certificate holder to locate a

PBE within 3 feet of each required hand fire extinguisher and, therefore, the Administrator may authorize deviations from the requirement if special circumstances exist that make compliance impractical and the proposed deviation provides an equivalent level of safety.

Another commenter says that the requirement to allow interphone communication for each of two flight crewmember stations in the cockpit to at least one normal flight attendant station in each passenger compartment may create a problem, especially in an airplane that only requires one flight attendant. This scenario might require the lone flight attendant, or the only flight attendant using PBE and fighting a fire, to be hooked up to a cord for interphone use. This could lead to interphone cord entanglement or disconnection and would be unsatisfactory.

The purpose of this provision of the rule is to ensure a means of free exchange of information between flight deck personnel and cabin crewmembers during this type of emergency. In a situation where the only flight attendant on board is fighting a fire, it is not necessary for that flight attendant to be able to communicate with the flightcrew while actually fighting the fire. Rather there must be a provision for a flight attendant to communicate with the flight deck personnel by means of the intercom while wearing the PBE. This communication may be before and after the actual firefighting itself to keep the flight crewmembers informed regarding the emergency and to advise the flight crewmembers of the efficacy of firefighting actions or smoke elimination procedures so that the flightcrew can determine what course of action should be taken. If more than one cabin crewmember is available, at least one must be able to communicate using the interphone while wearing PBE with the flight deck personnel during the emergency. This flight attendant would be able to relay the information about the emergency to the flight deck personnel.

Two commenters state that "the duration of protection should be commensurate with the stated objectives and purposes for the mission completion." These commenters say that 30 minutes of protection is the bare minimum duration of protection because that is the least amount of time required to safely land and evacuate the airplane. In addition, these commenters say that when a flight is more than 30 minutes flying time from an adequate emergency landing field, the minimum protection

time should be the time required to reach such a field and evacuate.

The comments misperceive the purpose of the amendment. PBE is not intended to provide protection for the entire period required to land and evacuate an airplane in the event of an inflight fire. Rather it is designed to protect the crew long enough to allow them to take measures to combat the fire.

Several commenters indicate that the use of oxygen during an in-flight fire emergency borders on the catastrophic. One commenter states that military accident records are full of documentation of burns that were fueled by oxygen from the airplane breathing systems. However, the commenter making this assertion furnishes no supporting evidence. Commenters further indicate that the potential for oxygen leaks around the face masks is very high. Therefore, these commenters recommend the use of air instead of oxygen in PBE.

Hypoxia protection is already provided for under the current supplemental oxygen rules, and therefore it is unnecessary to require that the PBE duplicate these requirements. Therefore, any breathable atmosphere may be furnished for PBE. On the other hand, the FAA concludes that oxygen is an acceptable medium. It has been used, and still is used, over the past 50 years in civilian and military firefighting. The very few instances that have been reported where use of oxygen has resulted in injuries were where the oxygen hoses have burned through resulting in injuries to personnel. Crewmembers should be trained to maintain the proper distance from the fire to avoid injury while fighting a fire. By remaining the appropriate distance, the crewmember will reduce the chances of any oxygen that might conceivably leak from the PBE from fueling the fire or creating an explosion.

Several commenters oppose the number of proposed PBE and recommend that this requirement be reduced. On the other hand, seven commenters recommend that a PBE should be provided every crewmember and that it should be located at each cabin crewmember's seat.

The FAA has determined that one PBE device at each hand fire extinguisher location required by § 121.309 will provide an adequate level of coverage and will avoid any confusion in locating the equipment since it will be near a hand fire extinguisher. These locations will give the best distribution in the airplane and furnish easy access for the flight attendants should a problem arise

while they are performing their duties. The flight attendants are performing various duties throughout the cabin for a far longer period of time than they spend at their seats. The FAA has also determined that the restricted size of many areas aboard an airplane and the nature of emergencies restrict the number of flight attendants that can effectively fight a fire, and therefore it is not necessary for all flight attendants to be equipped with PBE.

Numerous commenters misinterpreted the term "for use in" to mean that a PBE needed to be located in each Class A, B and E cargo compartment. That phrase merely means that a PBE may be located nearby as long as it is conveniently located and easily accessible for use in these areas. The rule states that the PBE must be "in" an area when it requires a PBE to be physically located in that specific area.

One commenter states that the proposed wording for equipment preflight could inhibit development of more advanced equipment.

The FAA agrees and has changed the rule accordingly.

Two commenters object to the hands-on type of training in which flight attendants must fight a typical fire while wearing PBE. They say that this type of training does not accurately train for other types of fires, such as electrical fires. In addition, they cite potential hazards to flight attendants while undergoing such training and the difficulty of finding suitable locations for such training. Finally, they question the benefit of this one-time training in contrast to more frequent demonstrations. They believe that instruction using realistic training aids will better prepare flight attendants to cope with actual airplane fires.

The FAA does not agree with these commenters. Demonstrations and training aids, no matter how realistic, cannot provide the training benefits and confidence that actual firefighting experience will give to all crewmembers, including flight attendants. Although this requirement is a one-time exercise, it will provide a base of actual experience with combatting a fire that a crewmember can build upon in later recurrent training. Nothing in the rule prevents carriers from developing training curricula for initial and recurrent training that use training aids and instructors to supplement and reinforce the experience gained in the actual firefighting demonstrations. Any potential danger to flight attendant trainees can be eliminated with careful planning and supervision of the training. Indeed, this training requirement is

supported by flight attendant associations, who feel it should be a recurring rather than a one-time requirement. The cost and possible inconvenience of location of suitable training sites should be far outweighed by the vastly increased competence and confidence of crewmembers in fighting in-flight fires.

#### Section-by-Section Analysis

##### Section 121.337(a)

This section as proposed would have required certificate holders to furnish PBE meeting certain requirements in paragraph (b) of this section as well as the minimum performance standards of TSO-C99, Protective Breathing Equipment. TSO-C99 provides the current basic approval criteria for PBE to be used by flight crewmembers. A commenter on the proposal points out that the standards in TSO-C99 were designed to provide protection to these flight crewmembers who would be in a sedentary state while using the PBE. In contrast, the crewmembers who would be using the newly-required PBE to combat fire and smoke in the airplane would be quite active while using PBE. Consequently, their rates of oxygen consumption and carbon dioxide production would be significantly higher. Thus, equipment that meets TSO-C99 may not satisfy the demands of this higher workload.

The FAA agrees that the standards in TSO-C99 were not designed to accommodate nonsedentary crewmembers. Accordingly, the reference to TSO-C99 in paragraph (a) of the rule has been removed. Instead, the rule now requires that PBE be approved for use and that it meet specific equipment, breathing gas, and communication requirements set forth in paragraph (b) of the section.

When the issue of increased workload requirements of crewmembers combatting fire and smoke was identified, the FAA began to study the problem of appropriate performance levels for these crewmembers. A work profile was developed with input from airworthiness and flight standards staffs and CAMI. This work profile was based on expected work levels allowing a crewmember to proceed to a source of smoke or fire, don PBE, obtain a hand fire extinguisher, and fight the fire for a reasonable period of time. This work profile is believed to be representative of the exertion a crewmember would undergo while combatting an in-flight fire, although it is by no means the only possible or plausible scenario. For example, this scenario is less rigorous than that developed by the British Civil

Aeronautics Authority (CAA) for approval of PBE. The British scenario includes a portion simulating an evacuation. That portion is not appropriate for PBE to meet this amendment which does not cover the evacuation phase of an emergency.

Using this work profile, CAMI has tested one portable smoke hood which is currently available, the Scott Aviation Emergency Escape Breathing Device, which is approved under TSO-C99. CAMI's tests show this hood will essentially meet the requirements for protecting the crew from the effects of those items covered under paragraph (b)(1) of the amendment. Of course, this does not necessarily mean that any PBE device that is approved under TSO-C99 can also be approved for use by cabin crewmembers under this amendment. However, it does show that there is now PBE available that may be approved and that the technology to build approvable PBE is readily available.

Because TSO-C99 does not provide appropriate performance standards for approval of PBE to be used in fighting in-flight fires, the FAA is developing new approval criteria to be used in evaluating such PBE under the new rule. These criteria will be available from FAA Flight Standards district offices when this amendment becomes effective. After the effective date of the rule, there will be allowed a 2-year compliance period for furnishing portable PBE to be used in combatting in-flight fires and for providing the required crewmember training. In view of the ready availability of appropriate technology, this period should provide ample time for compliance and training. The language of section (a) has also been changed to allow any breathable gas to be used instead of requiring oxygen as proposed. This will allow greater flexibility for manufacturers and operators.

##### Section 121.337(b)(1)

The proposal specified that protection was required from the effects of smoke, carbon dioxide, or other harmful gases. The final rule adds the requirement to protect the wearer from an oxygen deficient environment except one caused by cabin depressurization. This additional requirement is no more than a refinement of the proposed language that will not add any additional burden on manufacturers or carriers. In addition, the change makes it clear that hypoxia caused by cabin depressurization is not within the range of hazards that PBE is required to deal with, although it may be used for this protection if a carrier chooses and if the

equipment also meets the standards in § 121.335.

*Section 121.337(b)(2)*

This section, which was not included in the notice, makes explicit the duty of a certificate holder to inspect PBE to ensure its continued suitability for its purpose. While this language was not included in the notice, it does no more than make explicit in the PBE rule itself the general requirement for inspection that applies to all items of equipment used aboard airplanes. In addition, the section also provides for inspection periods that may be different from those specified by the equipment manufacturer if the certificate holder can show that an equivalent level of safety is maintained. Thus, this added section is not envisioned to impose any additional requirements beyond the normal inspection requirements, and it provides for relief for a certificate holder who can justify different inspection periods.

*Section 121.337(b)(3)*

This section requires that the PBE eye protection must not impair the user's vision to the extent that the person would not be able to perform all crewmember duties. This section further requires that this equipment must allow for the use of eyeglasses without impairment of vision or the loss of protection against the effects of smoke, carbon dioxide, or other harmful gasses required by paragraph (b)(1) of this section. This last requirement for continued protection while wearing glasses was understood in the notice but is being clarified in the final rule.

*Section 121.337(b)(4)*

The final rule requires that the equipment must allow flight crewmembers to communicate using the airplane radios and to use the interphone to communicate with one another. The notice stated that the equipment must allow the flightcrew to use the radio and to communicate with each other while at their assigned duty stations. This could be construed to mean that the flightcrew must be able to use the radios and that they could communicate with one another visually or by signs. This was not the intent of the notice, and the amendment is changed to make clear that they must be able to communicate between them using the interphone. The notice required interphone communication for each of the two flight crewmember stations in the pilot compartment to at least one normal flight attendant station in each passenger compartment. This was misconstrued to mean that the

communication could be between two flight crewmembers to the flight attendant without the flight attendant being required to be able to reply to the flightcrew over the interphone. Therefore, the final rule is changed to make clear that the PBE must allow two-way crewmember interphone communication between each of two flight crewmember stations and at least one normal flight attendant station in each passenger compartment.

In addition, it should be noted that this communication capability between the flight deck and each passenger compartment requires only interphone capability to at least one flight attendant station. Some commenters misconstrue this section to require an interphone connection to the PBE itself and question whether such a hook-up would impede the firefighting effort. This section merely requires that the interphone equipment at the flight attendant station and the PBE must be compatible so that a crewmember may communicate with the flight deck from the station location while wearing PBE, not communicate continuously while wearing the PBE.

*Section 121.337(b)(5)*

This section amplifies and clarifies the interphone requirement in § 121.337(b)(4). It makes it clear that all PBE used by cabin crewmembers must allow the use of the interphone hook-up at at least one flight attendant station in each compartment. In other words, it is not permissible to have only one PBE that is capable of interphone communication; all must have that capability. This is in contrast to the requirement in paragraph (b)(4) that no more than one flight attendant station in each passenger compartment must have interphone equipment that is compatible with the PBE.

*Section 121.337(b)(6)*

This section merely allows, but does not require, that PBE may be used to satisfy the supplemental oxygen requirements of Part 121, provided it meets the requirements of § 121.335 as well as the requirements of § 121.337 for PBE.

*Section 121.337(b)(7)(i)*

This section contains the performance standards for PBE and has been simplified. The notice contained detailed standards for performance of PBE, including oxygen flow rates for various types of systems, which were the same for all crewmembers. The FAA has determined that these detailed standards are not appropriate for inclusion in the language of the rule

itself. Rather, the rule now includes only the basic performance standards: PBE must provide breathing gas to a crewmember for 15 minutes at a pressure altitude of 8,000 feet. This standard must be met both for flight crewmembers, who are generally sedentary while wearing PBE, and for cabin crewmembers who will be combating fires while wearing PBE. The higher workload of the crewmembers who are combating fires will require a greater supply of breathing gas to provide the required level and duration of protection. The more detailed standards proposed in the notice have been eliminated from this section of the rule. Such detailed standards are more appropriate for guidance material that will form the basis for approval testing of PBE. This detailed guidance will be available from the FAA as soon as the rule becomes effective.

*Sections 121.337(b)(7)(ii) and (iii)*

These sections require that the breathing gas system must not itself present any hazards and that there must be a means of determining the quantity of breathing gas available.

*Section 121.337(b)(7)(iv)*

This section was added to specifically allow the use of chemical oxygen generators as a means of meeting the PBE requirements. While the notice did not exclude the use of such devices, failure to mention them might have been considered to prohibit them. The standards to be applied are those already existing for transport category airplanes.

*Section 121.337(b)(8)*

This section is unchanged from the proposal.

*Section 121.337(b)(9)*

This section has been rewritten and reorganized for clarity. In addition, this section now requires portable PBE to be available for use by all crewmembers in fighting fires. The proposal restricted portable PBE to crewmembers other than flight crewmembers. The FAA has concluded that there is no reason for this restrictive language since, in some situations, the aid of a flight crewmember might be beneficial to firefighting efforts. No additional PBE will be required by this change.

*Sections 121.337(b)(9)(iii) and (iv)*

These sections require portable PBE to be located on the flight deck and in each passenger compartment, respectively, and have been changed to reflect several comments. These comments

express concern that space or other limitations might make compliance with these PBE placement requirements impossible. To accommodate this possibility, these two sections now allow the Administrator to allow PBE to be placed elsewhere if special circumstances, such as space constraints, make compliance impractical and an equivalent level of safety can be achieved.

*Section 121.337(b)(9)(ii)*

This section has been changed to be consistent with the PBE requirements for the passenger compartment and with current policy with respect to the hand fire extinguisher requirements of § 121.309(c)(2). The amendment will require one PBE for each hand fire extinguisher actually installed in an upper or lower lobe galley, where the galley encompasses the entire lobe. If a galley does not encompass the entire lobe, current policy allows a hand fire extinguisher to be conveniently located outside the galley for use in the galley. Section 121.337(b)(9)(iv) would require PBE within 3 feet of this extinguisher unless the Administrator allows it to be placed elsewhere.

*Section 121.337(e)(1)*

This section has been changed slightly to require that PBE at each flight crewmember duty station be checked for proper functioning before each flight, rather than only before each flight crewmember's first flight of the day. This will provide an extra assurance that this PBE will be fully functioning if needed and should impose little extra work on flight crewmembers.

*Section 121.337(e)(2)*

This section has also been changed slightly to allow a certificate holder to designate a particular crewmember to check the PBE not located at flight crewmember duty stations. The proposal would have required each responsible crewmember to check PBE before his or her first flight of the day in the airplane. The revised language will simplify carrier procedures by allowing a designated crewmember to check PBE while other crewmembers perform other preflight duties.

*Section 121.337(f)*

This section provides a compliance period of 2 years for certificate holders to furnish portable PBE for crewmembers who must fight in-flight fires. This period reflects the fact that new approval standards will be required to provide adequate protection and training to these crewmembers. As the technology to meet these standards is

already available, a 2-year period should be more than adequate.

*Section 121.417(d)*

This section has been changed to lengthen the training compliance date to 2 years rather than 1 year as proposed. The firefighting drill referred to in this section must be performed using the portable PBE intended for fighting in-flight fires. Certificate holders are not required to have the equipment on board the airplane until 2 years after the effective date of the amendment. Thus, this change conforms the training compliance date to that period.

**Economic Evaluation**

This document summarizes the final industry cost impact and benefit assessment of a regulation to amend Part 121 of the FAR to upgrade the level of protection for the traveling public against the hazards of in-flight fires. The final rule incorporates the requirements of § 25.1439 into current § 121.337, adopts new standards for PBE for crewmembers who may fight a fire in the airplane while in flight and requires that crewmembers perform an approved firefighting drill while using PBE. The final rule also requires that additional PBE be located within 3 feet of each required hand fire extinguisher in passenger compartments when possible and clarifies certain emergency drill requirements.

This rule is a result of recommendations of the NTSB, which found during an accident investigation that PBE (smoke goggles) used by several air carriers did not adequately protect the flightcrew and that some smoke goggles restricted the user's vision. The action to increase crewmembers' firefighting training was prompted by the FAA's awareness of several fatal inflight fires in airplanes of U.S. manufacture operated by foreign carriers and by the alarming number of cabin fire and smoke-in-the-cabin incidents recorded in recent years.

The assumptions used in the preparation of economic impact estimates of the changes to §§ 121.337 and 121.417 have been developed by the FAA. Cost factors were obtained from manufacturers, air carriers, and industry trade associations. Information for analysis of benefits was obtained from the safety records of the NTSB and the FAA. The revisions to the PBE provisions and standards of § 121.337 and the current crewmember emergency training requirements of § 121.417 stem from the FAA's growing awareness of the hazards of in-flight fires.

In NPRM No. 85-17, the FAA invited public comments concerning the

technical and operational considerations and economic impact assumptions as these apply to the additional time, labor hours, materials, and facilities that would be required for compliance. Comments on the proposal were submitted by domestic and foreign air carriers, manufacturers, and operator trade associations. The majority of the comments recommend minor technical modifications and editorial clarification. A number of commenters state that the economic impact could be substantial both for the PBE and for training personnel in the use of PBE. Several commenters, however, point out that PBE meeting the performance standards of TSO-C99 would protect sedentary flight crewmembers but would be inadequate to satisfy the workload requirements of crewmembers actively fighting a fire. The FAA has evaluated the public comments and made final determination regarding their impact.

With the exception of cockpit PBE that meets the standards of TSO-C99, the FAA finds that the proposals determined to have an economic impact at the NPRM stage of rulemaking will also have an economic impact if the rule is adopted.

The amendment to § 121.337 would have an economic impact on all active and future production airplanes operating under Part 121 because of the cost of acquisition, installation, and maintenance of portable breathable gas PBE that would meet the new equipment requirements and the new standards that will be available at the time this rule is in effect for all crewmembers who may have to fight a fire. The cost of this requirement is \$14.193 million in 1985 dollars for the 10-year period of 1988 to 1997 and \$10.789 million at a present worth discount rate of 10 percent over the same period.

The amendment of the crewmember emergency training requirements of § 121.417 would affect the current 146 Part 121 certificate holders. These operators would be required to incur additional cost to equip and train the present and future crewmembers in the Part 121 fleet. The estimated cost of compliance with the new firefighting training requirements is \$63.079 million in 1985 dollars and \$50.332 million at a discount rate of 10 percent for the 10-year period of 1988 to 1997.

Thus, the maximum estimated cost of compliance of the amendments to increase protection against the hazards of inflight fires is \$61.120 million in 1985 dollars for the period 1988 to 1997 at a present worth discount rate of 10 percent over the same 10-year period.

The basic benefit that results from this rule is the savings for the general public in lower exposure to accidents and death caused by otherwise survivable in-flight fires. Quantification of these benefits was made difficult by the relatively limited number of in-flight cabin fire accidents. There have been no major cabin fire accidents in U.S. air carrier passenger operations. During the 10-year period of 1974 to 1983 reviewed in this evaluation, there have been only three major in-flight fires in worldwide operations in which the countermeasures adopted in this rule might have been effective in averting an accident. When such accidents have occurred, however, the results have been catastrophic. To allow for the uncertainty inherent in predicting future accidents when historical data is limited, a risk analysis has been performed. The risk analysis generates a probability distribution of the potential benefits that may be realized from accidents avoided as a result of the amendments.

A comparison of the probability distribution of potential benefits and estimated costs of each amendment is summarized in Tables 1 and 2. Averages of the possible benefit and benefit/cost ratio outcomes, weighted by the probability of each outcome, are also indicated as the expected benefit/cost ratio for each amendment. All values have been discounted at the 10 percent discount rate prescribed by the Office of Management and Budget over the 10-year period of this analysis. As indicated in Tables 1 and 2, the expected benefit/cost ratios for the PBE and the firefighting training rules are 3.2 and 1.4, respectively. The combined total cost of the PBE and firefighting training rules is \$61.1 million and the expected benefits equal \$100.3 million, resulting in a total expected benefit/cost ratio of 1.7.

#### Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 requires a review of rules to assess their impact on small business. This amendment will have a significant economic impact on a substantial number of small entities. However, the FAA finds that there are no viable alternatives for small air carriers to adopt that would reduce the cost of compliance yet achieve the level of protection sought by this rulemaking.

#### Trade Impact Assessment

The FAA has determined that these regulations will not have an impact on international trade.

TABLE 1.—PROBABILITY DISTRIBUTION OF BENEFIT/COST RATIOS FOR PROTECTIVE BREATHING EQUIPMENT (PBE)

Benefit (dollar million)	Benefit/cost ratio	Probability that the protective breathing equipment proposal will equal or exceed the benefit/cost ratio shown at left (in percent)
0.....	0	100
10.8 (breakeven).....	1.0	83
15.4.....	1.4	75
29.5.....	2.7	50
46.8.....	4.3	25
140.4.....	13.0	0

Expected Benefit/Cost Ratio = 3.2 (based on expected benefit of \$35.1 million).

Cost of Protective Breathing Equipment for 1988-1997, \$10.8 million.

TABLE 2.—PROBABILITY DISTRIBUTION OF BENEFIT/COST RATIOS FOR FIRE FIGHTING EQUIPMENT (PBE)

Benefit (dollar million)	Benefit/cost ratio	Probability that the fire fighting training requirement will equal or exceed the benefit/cost ratio shown at left (in percent)
0.....	0	0
38.0.....	.75	75
50.3 (breakeven).....	1.0	64
63.7.....	1.2	50
91.0.....	1.8	25
214.6.....	4.2	0

Expected Benefit/Cost Ratio = 1.4 (based on expected benefit of \$68.1 million).

Cost of Fire Fighting Training for 1988-1997, \$50.3 million.

#### Conclusion

Under the terms of the RFA, the FAA has reviewed these amendments to determine what impact they may have on small entities. The amendments will have a significant economic impact on a substantial number of small entities. The FAA has evaluated several alternatives and has chosen the only alternative that would accomplish the objective.

These amendments will not result in an annual effect on the economy of \$100 million or more, or a major increase in costs for consumers; industry; or Federal, State, or local government agencies. Accordingly, it has been determined that these are not major amendments under Executive Order 12291. In addition, the amendments will have little or no impact on trade opportunities for U.S. firms doing business overseas or for foreign firms doing business in the United States.

Since the amendments concern a matter on which there is a substantial

public interest, the FAA has determined that this action is significant under Department of Transportation Regulatory Policies and Procedures (44 FR 11034; February 26, 1979).

A regulatory evaluation of the amendments, including a Regulatory Flexibility Analysis, has been placed in the regulatory docket. A copy may be obtained by contacting the person identified under "FOR FURTHER INFORMATION CONTACT."

#### List of Subjects in 14 CFR Part 121

Aviation safety, Safety, Air carriers, Air transportation, Aircraft, Airplanes, Airworthiness directives and standards, Transportation, Common carriers.

#### Adoption of the Amendment

Accordingly, Part 121 of the Federal Aviation Regulations (14 CFR Part 121) is amended as follows:

#### PART 121—CERTIFICATION AND OPERATIONS: DOMESTIC FLAG AND SUPPLEMENTAL AIR CARRIERS AND COMMERCIAL OPERATORS OF LARGE AIRCRAFT

1. The authority citation for Part 121 is revised to read as set forth below, and the authority citations following all sections in Part 121 are removed:

Authority: 49 U.S.C. 1354(a), 1355, 1356, 1357, 1401, 1421-1430, 1472, 1485, and 1502; 49 U.S.C. 106(g) [Revised, Pub. L. 97-449, January 12, 1983].

2. By revising § 121.337 to read as follows:

#### § 121.337 Protective breathing equipment.

(a) The certificate holder shall furnish approved protective breathing equipment (PBE) meeting the equipment, breathing gas, and communication requirements contained in paragraph (b) of this section.

(b) *Pressurized cabin airplanes.* Except as provided in paragraph (f) of this section, no person may operate a transport category airplane unless protective breathing equipment meeting the requirements of this section is provided as follows:

(1) *General.* The equipment must protect the flightcrew from the effects of smoke, carbon dioxide or other harmful gases or an oxygen deficient environment caused by other than an airplane depressurization while on flight deck duty and must protect crewmembers from the above effects while combatting fires on board the airplane.

(2) The equipment must be inspected regularly in accordance with inspection guidelines and the inspection periods

established by the equipment manufacturer to ensure its condition for continued serviceability and immediate readiness to perform its intended emergency purposes. The inspection periods may be changed upon a showing by the certificate holder that the changes would provide an equivalent level of safety.

(3) That part of the equipment protecting the eyes must not impair the wearer's vision to the extent that a crewmember's duties cannot be accomplished and must allow corrective glasses to be worn without impairment of vision or loss of the protection required by paragraph (b)(1) of this section.

(4) The equipment, while in use, must allow the flightcrew to communicate using the airplane radio equipment and to communicate by interphone with each other while at their assigned duty stations. The equipment, while in use, must also allow crewmember interphone communications between each of two flight crewmember stations in the pilot compartment and at least one normal flight attendant station in each passenger compartment.

(5) The equipment, while in use, must allow any crewmember to use the airplane interphone system at any of the flight attendant stations referred to in paragraph (b)(4) of this section.

(6) The equipment may also be used to meet the supplemental oxygen requirements of this part provided it meets the oxygen equipment standards of § 121.335 of this part.

(7) Protective breathing gas duration and supply system equipment requirements are as follows:

(i) The equipment must supply breathing gas for 15 minutes at a pressure altitude of 8,000 feet for the following:

(A) Flight crewmembers while performing flight deck duties; and

(B) Crewmembers while combatting an in-flight fire.

(ii) The breathing gas system must be free from hazards in itself, in its method of operation, and in its effect upon other components.

(iii) For breathing gas systems other than chemical oxygen generators, there must be a means to allow the crew to readily determine, during flight, the quantity of breathing gas available in each source of supply.

(iv) For each chemical oxygen generator, the supply system equipment must meet the requirements of § 25.1450 (b) and (c) of this chapter.

(8) Protective breathing equipment with a fixed or portable breathing gas supply meeting the requirements of this section must be conveniently located on

the flight deck and be easily accessible for immediate use by each required flight crewmember at his or her assigned duty station.

(9) Protective breathing equipment with a portable breathing gas supply meeting the requirements of this section must be easily accessible and conveniently located for immediate use by crewmembers in combatting fires as follows:

(i) One for use in each Class A, B, and E cargo compartment (as defined in § 25.857 of this chapter) that is accessible to crewmembers in the compartment during flight.

(ii) One for each hand fire extinguisher located in each upper and lower lobe galley, where the galley encompasses the entire upper or lower lobe compartment space.

(iii) One on the flight deck, except that the Administrator may authorize another location for this PBE if special circumstances exist that make compliance impractical and the proposed deviation would provide an equivalent level of safety.

(iv) In each passenger compartment, one located within 3 feet of each hand fire extinguisher required by § 121.309 of this part, except that the Administrator may authorize a deviation allowing locations of PBE more than 3 feet from required hand fire extinguisher locations if special circumstances exist that make compliance impractical and the proposed deviation provides an equivalent level of safety.

(c) *Nonpressurized cabin airplanes.* The requirements of paragraphs (a) and (b) of this section apply to nonpressurized cabin airplanes if the Administrator finds that it is possible to obtain a dangerous concentration of smoke or carbon dioxide or other harmful gases in the flight deck area in any attitude of flight that might occur when the airplane is flown in accordance with either normal or emergency procedures.

(d) *Nonpressurized cabin airplanes with a built-in carbon dioxide hand fire extinguisher system in a fuselage compartment.* Each certificate holder operating a nonpressurized cabin airplane that has a built-in carbon dioxide hand fire extinguisher system in a fuselage compartment shall provide protective breathing equipment meeting the requirements of paragraphs (a) and (b) of this section for the flight crewmembers except where—

(1) Not more than 5 pounds of carbon dioxide would be discharged into any compartment in accordance with established fire control procedures; or

(2) The carbon dioxide concentration at each flight crewmember station has

been determined in accordance with § 25.1197 of this chapter and has been found to be less than 3 percent by volume (corrected to standard sea level conditions).

(e) *Equipment preflight.* (1) Before each flight, each item of PBE at flight crewmember duty stations must be checked by the flight crewmember who will use the equipment to ensure that the equipment—

(i) For other than chemical oxygen generator systems, is functioning, is serviceable, fits properly (unless a universal-fit type), and is connected to supply terminals and that the breathing gas supply and pressure are adequate for use; and

(ii) For chemical oxygen generator systems, is serviceable and fits properly (unless a universal-fit type).

(2) Each item of PBE located at other than a flight crewmember duty station must be checked by a designated crewmember to ensure that each is properly stowed and serviceable, and, for other than chemical oxygen generator systems, the breathing gas supply is fully charged. Each certificate holder, in its operations manual, must designate at least one crewmember to perform those checks before he or she takes off in that airplane for his or her first flight of the day

(f) Notwithstanding the provisions of paragraphs (a) and (b) of this section, the final compliance date for furnishing portable PBE for use in combatting in-flight fires aboard airplanes shall be July 6, 1989.

3. By amending § 121.417 by revising paragraph (c), by redesignating paragraph (d) as (e), and by adding new paragraphs (d) and (f), to read as follows:

**§ 121.417 Crewmember emergency training.**

\* \* \* \* \*

(c) Each crewmember must accomplish the following emergency training during the specified training periods, using those items of installed emergency equipment for each type of airplane in which he or she is to serve (Alternate recurrent training required by § 121.433(c) of this part may be accomplished by approved pictorial presentation or demonstration):

(1) One-time emergency drill requirements to be accomplished during initial training. Each crewmember must perform—

(i) At least one approved firefighting drill using at least one type of installed hand fire extinguisher, appropriate for the type of fire to be fought, while using the type of installed PBE for combatting

fires aboard airplanes required by § 121.337 of this part; and

(ii) An emergency evacuation drill with each person egressing the airplane or approved training device using at least one type of installed emergency evacuation slide. The crewmember may either observe the airplane exits being opened in the emergency mode and the associated exit slide/raft pack being deployed and inflated, or perform the tasks resulting in the accomplishment of these actions.

(2) Additional emergency drill requirements to be accomplished during initial training and once each 24 calendar months during recurrent training. Each crewmember must—

(i) Perform the following emergency drills and operate the following equipment:

(A) Each type of emergency exit in the normal and emergency modes, including the actions and forces required in the deployment of the emergency evacuation slides;

(B) Each type of installed hand fire extinguisher;

(C) Each type of emergency oxygen system to include protective breathing equipment;

(D) Donning, use, and inflation of individual flotation means, if applicable; and

(E) Ditching, if applicable, including but not limited to, as appropriate:

(1) Cockpit preparation and procedures;

(2) Crew coordination;

(3) Passenger briefing and cabin preparation;

(4) Donning and inflation of life preservers;

(5) Use of life-lines; and

(6) Boarding of passengers and crew into raft or a slide/raft pack.

(ii) Observe the following drills:

(A) Removal from the airplane (or training device) and inflation of each type of life raft, if applicable;

(B) Transfer of each type of slide/raft pack from one door to another;

(C) Deployment, inflation, and detachment from the airplane (or training device) of each type of slide/raft pack; and

(D) Emergency evacuation including the use of a slide.

(d) After July 6, 1989, no crewmember may serve in operations under this part unless that crewmember has performed the firefighting drill prescribed by paragraph (c)(1)(i) of this section.

\* \* \* \* \*

(f) For the purposes of this section, "perform" means accomplishing a prescribed emergency drill using established procedures that stress the skill of those persons involved in the drill, and "observe" means to watch without participating actively in the drill.

Issued in Washington, DC, on May 28, 1987.

Donald D. Engen,

Administrator.

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