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**30 CFR Parts 7 and 75
Refuge Alternatives for Underground Coal
Mines; Proposed Rule**

DEPARTMENT OF LABOR

Mine Safety and Health Administration

30 CFR Parts 7 and 75

RIN 1219-AB58

Refuge Alternatives for Underground Coal Mines

AGENCY: Mine Safety and Health Administration, Labor.

ACTION: Proposed rule; notice of public hearings and close of comment period.

SUMMARY: The Mine Safety and Health Administration (MSHA) is proposing requirements for refuge alternatives in underground coal mines and the training of miners in their use. The proposed rule also includes requirements for testing and approval of refuge alternatives. The proposal would implement section 13 of the Mine Improvement and New Emergency Response (MINER) Act of 2006. Consistent with the MINER Act, it includes MSHA's response to the National Institute for Occupational Safety and Health Report on Refuge Alternatives.

DATES: All comments must be received by midnight Eastern Standard Time on August 18, 2008. MSHA will hold 4 public hearings on July 29, July 31, August 5, and August 7, 2008. Details about the public hearings are in the **SUPPLEMENTARY INFORMATION** section of this document.

ADDRESSES: Comments must be clearly identified with "RIN 1219-AB58" and may be sent by any of the following methods:

- (1) *Federal e-Rulemaking Portal:* <http://www.regulations.gov>. Follow the instructions for submitting comments.
- (2) *Electronic mail:* zzMSHA-comments@dol.gov. Include "RIN 1219-AB58" in the subject line of the message.
- (3) *Facsimile:* 202-693-9441. Include "RIN 1219-AB58" in the subject line of the message.
- (4) *Regular Mail:* MSHA, Office of Standards, Regulations, and Variances,

1100 Wilson Boulevard, Room 2350, Arlington, Virginia 22209-3939.
 (5) *Hand Delivery or Courier:* MSHA, Office of Standards, Regulations, and Variances, 1100 Wilson Boulevard, Room 2350, Arlington, Virginia. Sign in at the receptionist's desk on the 21st floor.

Comments can be accessed electronically at <http://www.msha.gov> under the *Rules and Regs* link. MSHA will post all comments on the Internet without change, including any personal information provided. Comments may also be reviewed at the Office of Standards, Regulations, and Variances, 1100 Wilson Boulevard, Room 2350, Arlington, Virginia. Sign in at the receptionist's desk on the 21st floor.

MSHA maintains a list that enables subscribers to receive e-mail notification when rulemaking documents are published in the **Federal Register**. To subscribe, go to <http://www.msha.gov/subscriptions/subscribe.aspx>.

Information Collection Requirements: Comments concerning the information collection requirements of this proposed rule must be clearly identified with "RIN 1219-AB58" and sent to both the Office of Management and Budget (OMB) and MSHA. Comments to OMB may be sent by mail addressed to the Office of Information and Regulatory Affairs, Office of Management and Budget, New Executive Office Building, 725 17th Street, NW., Washington, DC 20503, Attn: Desk Officer for MSHA. Comments to MSHA may be transmitted either electronically to zzMSHA-Comments@dol.gov, by facsimile to (202) 693-9441, or by regular mail, hand delivery, or courier to MSHA, Office of Standards, Regulations, and Variances, 1100 Wilson Blvd., Room 2350, Arlington, Virginia 22209-3939.

FOR FURTHER INFORMATION CONTACT: Patricia W. Silvey at silvey.patricia@dol.gov (E-mail), 202-693-9440 (Voice), or 202-693-9441 (Fax).

SUPPLEMENTARY INFORMATION: The outline of this proposal is as follows:
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 - H. Executive Order 13211: Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use
 - I. Executive Order 13272: Proper Consideration of Small Entities in Agency Rulemaking

Public Hearings

MSHA will hold four public hearings on the proposed rule. These public hearings will begin at 9 a.m. and end after the last speaker speaks, and in any event not later than 5 p.m., on the following dates at the locations indicated:

Date	Location	Contact information
July 29, 2008	Radisson Hotel Salt Lake City Downtown, 215 West South Temple, Salt Lake City, UT 84101.	(801) 933-8022.
July 31, 2008	Marriott Charleston Town Center, 200 Lee Street East, Charleston, WV 25301	(304) 345-6500.
August 5, 2008	Hilton Suites Lexington Green, 245 Lexington Green Circle, Lexington, KY 40503	(859) 271-4000.
August 7, 2008	Sheraton Birmingham, 2101 Richard Arrington Jr. Blvd., Birmingham, AL 35203 ...	(205) 324-5000.

The hearings will begin with an opening statement from MSHA, followed by an opportunity for members

of the public to make oral presentations. Requests to speak at a hearing should be made at least 5 days prior to the hearing

date. Requests to speak may be made by telephone (202-693-9440), facsimile (202-693-9441), or mail (MSHA, Office

of Standards, Regulations, and Variances, 1100 Wilson Boulevard, Room 2350, Arlington, Virginia 22209-3939).

Any unallocated time at the end of each hearing will be made available to persons making same-day requests to speak. Any unallocated time at the end of each hearing will be made available to persons making same-day requests to speak. Speakers will speak in the order that they sign in at the hearing. At the discretion of the presiding official, the time allocated to each speaker for their presentation may be limited. Speakers and other attendees may also present information to the MSHA panel for inclusion in the rulemaking record.

The hearings will be conducted in an informal manner. Formal rules of evidence and cross examination will not apply. The hearing panel may ask questions of speakers. Speakers and other attendees may present written information to the MSHA panel for inclusion in the rulemaking record. MSHA will accept post-hearing written comments and data for the record from any interested party, including those not presenting oral statements, until the close of the comment period. MSHA will make transcripts of the hearings, post them on MSHA's Web site <http://www.msha.gov>, and include them in the rulemaking record.

I. Introduction

This proposed rule would implement section 13 of the Mine Improvement and New Emergency Response (MINER) Act of 2006. It would require that operators include refuge alternatives in the *Emergency Response Plan* required by section 2 of the MINER Act. MSHA's objective, consistent with the MINER Act, is to improve the safety of mines and mining. Toward that end, the proposal would improve mine operators' preparedness for mine emergencies and require refuge alternatives underground to protect persons trapped when a life-threatening event occurs that makes escape impossible. Refuge alternatives can also be used to assist miners in escaping from the mine. MSHA developed this proposed rule based on Agency data and experience, NIOSH recommendations, research on available and developing technology, and regulations of several states. The proposed rule includes—

- New requirements for testing and approval of refuge alternatives and components of refuge alternatives;
- Requirements for the availability and maintenance of refuge alternatives and communication facilities for refuge alternatives; and

- Requirements for miners to be trained in the location, use, maintenance, and transportation of refuge alternatives.

A. Rulemaking Background

Section 2 of the MINER Act requires underground coal mine operators to develop and adopt a written *Emergency Response Plan* (ERP), which must be approved by MSHA. The ERP provides for the evacuation of all individuals endangered by an emergency and the maintenance of individuals trapped underground. All ERPs must provide for emergency supplies of breathable air for individuals trapped underground sufficient to maintain them for a sustained period of time.

MSHA issued Program Policy Letter (PPL) No. P06-V-10 (October 24, 2006) to implement section 2 of the MINER Act. The PPL provides guidance to mine operators for developing ERPs and to MSHA District Managers in approving ERPs. MSHA issued Program Information Bulletin (PIB) No. P07-03 (February 8, 2007) to provide additional guidance to be used in conjunction with the PPL. The PIB represents the quantity of breathable air that would be sufficient to maintain persons for a sustained period of time.

Section 13 of the MINER Act directs NIOSH to conduct research on refuge alternatives and submit a report on the results of the research to the Secretary of Labor, among others. Section 13 also directs the Secretary of Labor to—

* * * provide a response to the Committee on Health, Education, Labor, and Pensions of the Senate and the Committee on Education and the Workforce of the House of Representatives containing a description of the actions, if any, that the Secretary intends to take based upon the report, including proposed regulatory changes and the reasons for such actions.

MSHA has reviewed NIOSH's report and determined that refuge alternatives are practical and will increase the chance for survival for persons trapped in underground coal mines, when integrated into the mine's comprehensive escape and rescue plans.

B. Discussion of the Hazard

MSHA reviewed a number of underground coal mine accident reports in the development of this proposed rule. The Agency discusses the following accidents, which reflect typical emergency conditions, hazards, and issues in underground coal mines.

On March 9, 1976, an explosion occurred at the Scotia Mine in Kentucky. Fifteen miners died from the explosion. Of these fifteen miners, six

were found behind a partially built protective structure.

On December 19, 1984, a fire occurred at the Wilberg Mine in Utah. Twenty-eight miners were working on the section when the fire occurred. The intake airway and adjacent belt entry were impassable due to gas and smoke. One miner survived by using an SCSR and crawling on his stomach through the smoke-filled mine. The remaining twenty-seven miners who survived the fire, died while attempting to evacuate the mine.

On July 24, 2002, a nonfatal entrapment accident caused by a water inundation occurred at Quecreek #1 Mine, Black Wolf Coal Company, Inc., located at Quecreek, Somerset County, Pennsylvania. Nine miners had attempted to escape, but were blocked by water. The miners were trapped for over 3 days before all were rescued.

On January 2, 2006, an explosion in which 12 miners were trapped occurred at the Sago Mine, located near Tallmansville, West Virginia. The explosion killed one miner instantly and destroyed seals and filled portions of the mine with toxic levels of carbon monoxide. The victims' attempts to evacuate were unsuccessful and they barricaded themselves on the section. Unfortunately, the barricade was constructed in an area with high concentrations of carbon monoxide. Eleven miners died before they could be rescued and one was rescued although severely injured.

On January 19, 2006, a fire occurred at the belt take-up storage unit of the Aracoma Alma Mine #1, located near Logan, West Virginia, resulting in the deaths of two miners. Miners in the affected area began an evacuation and, after traveling some distance out of the mine, encountered smoke and donned their self-contained self-rescue (SCSRs) devices. The two miners who died had become separated from their crew while attempting to escape.

On May 20, 2006, an explosion occurred at the Kentucky Darby, LLC, Darby Mine No. 1, located near Holmes Mill, Kentucky. The forces from the explosion killed two miners. Four other miners attempted to evacuate and encountered thick smoke. At this point they donned their SCSRs and attempted to continue their evacuation. The miners eventually became separated and three died from carbon monoxide poisoning.

Based on the MINER Act, MSHA data and experience, and the NIOSH report, MSHA is proposing regulations that address the approval and use of refuge alternatives in underground coal mines.

II. Section-By-Section Analysis

A. Part 7 Approval

The proposal includes new requirements for approval of refuge alternatives for underground coal mines. The proposal also includes approval of components of refuge alternatives. Under the proposal, manufacturers could apply for approval of a pre-fabricated self-contained refuge alternative or for approval of a refuge alternative component.

MSHA is proposing the approval requirements in part 7 to allow refuge alternatives or components to be tested by applicants or third-parties. MSHA has a 20-year history of administering this program, which has reduced product testing costs and improved approval efficiency. Under the proposal, the applicant, usually the manufacturer, would have to provide the required information and demonstrate that the refuge alternative or component meets the technical requirements and test criteria. Based upon an evaluation of this information, MSHA would issue an approval.

The proposal would: Provide alternatives for satisfying the requirements; provide performance-based approval criteria; and promote innovative new technology. The proposal addresses requirements for a pre-fabricated self-contained refuge alternative and components for a refuge alternative:

- Structural, which would create an isolated atmosphere and contain the other integrated components.
- Pre-fabricated self-contained rescue alternative.
- Breathable air, which would include the means to supply safe concentrations of oxygen and dilute harmful gases.
- Air-monitoring, which would provide occupants of the refuge alternative with devices to measure the concentrations of oxygen, carbon dioxide, carbon monoxide, methane, and other harmful gases.
- Harmful gas removal, which would provide for removal of harmful gases from the refuge alternative.

The refuge alternative would have to include provisions for sanitation, food, water, and first-aid. These items would have to be approved in the ERP.

The proposed requirements would assure that the refuge alternative could be used safely and effectively in underground coal mines and that the components could be used safely with each other.

All of the existing general provisions of subpart A of part 7 would apply to refuge alternatives. Existing § 7.8

addresses post-approval product audit and requires that, on request the approval-holder make a product available to MSHA for audit at no cost to MSHA, but no more than once a year except for cause. In addition, under existing § 7.8, an audit would be conducted at a mutually agreeable site and time. MSHA anticipates that in appropriate instances, the Agency would travel to the manufacturer's site particularly for pre-fabricated self-contained refuge alternatives and components. For refuge alternatives that are not pre-fabricated, i.e. constructed in place or materials pre-positioned, the structure would be approved by the District Manager in the Emergency Response Plan. Consistent with this requirement, the approval-holder must provide a refuge alternative or component to MSHA for audit.

Section 7.501 Purpose and Scope

This proposal would state that the purpose of approved refuge alternatives is to provide a life-sustaining environment for miners trapped underground when escape is impossible. The proposal would also define the scope as applying to underground coal mines. Under the proposal, refuge alternatives could also be used to facilitate escape by sustaining trapped miners until they receive communications regarding escape options or until rescuers arrive. MSHA considers refuge alternatives as a last resort to protect persons who are unable to escape from an underground coal mine in the event of an emergency. In its report on refuge alternatives, NIOSH recognized that the "potential for refuge alternatives to save lives will only be realized to the extent that mine operators develop comprehensive escape and rescue plans that incorporate refuge alternatives."

Refuge alternatives that states have approved and those that MSHA has accepted in approved ERPs would meet the requirements of this proposed rule. When mine operators replace these refuge alternatives or components, the new refuge alternatives or components must meet the requirements of the proposed rule. Based on preliminary discussions with manufacturers, MSHA used the estimated service life of the pre-fabricated self-contained refuge alternative. This would allow refuge alternatives to be used until replaced or 10 years maximum. This would allow refuge components to be used until replaced or 5 years maximum. MSHA solicits comments on the estimated service life of the pre-fabricated self-contained units. Comments should be

specific, including alternatives, rationale, and supporting data.

Section 7.502 Definitions

The proposed rule includes several definitions to assist applicants in preparing applications for approval. Because refuge alternatives represent a relatively new technology for underground coal mines, the terminology may not be widely used. MSHA intends that these definitions would facilitate the mining community's understanding of the proposal.

Apparent temperature.

MSHA proposes to define *apparent temperature* as the combined effects of air movement, heat, and humidity on the human body. When no air movement is present, the apparent temperature equals the heat index. As heat and humidity increase, the amount of evaporation of sweat from the body decreases. The international scientific community generally recognizes a maximum safe apparent temperature of 95° Fahrenheit (F) in confined survival environments,¹ such as a refuge alternative. Body heat is the primary heat source in a refuge alternative and the humidity will likely be high in such a sealed environment. The carbon dioxide absorption process also generates heat and humidity. There is currently no permissible air conditioning equipment, which will overcome this problem in underground coal mines.

Breathable oxygen.

MSHA proposes to define *breathable oxygen* as oxygen that is at least 99 percent pure with no harmful contaminants. Acceptable breathable oxygen is frequently supplied from a compressed gas cylinder as U.S. Pharmacopoeia medical oxygen or as aviator breathing oxygen. This definition is consistent with the attachment to MSHA's PIB P07-03: "Methods for Providing Breathable Air." MSHA solicits comments on the proposed definition. Comments should be specific, including alternatives, rationale, and supporting data.

Flash fire.

MSHA proposes to define *flash fire* as a fire that rapidly spreads through a diffuse fuel, such as airborne coal dust or methane, without producing damaging pressure. Flash fire may occur in an environment, such as an underground coal mine, where fuel and air become mixed in adequate concentrations to combust. In an underground coal mine, a flash fire can be a rapidly moving flame front from a

¹ 1 R.G. Steadman (1979).

combustion explosion. In its report, NIOSH recommended that the fire resistance for refuge alternatives be 300 °F for 3 seconds. They based this recommendation on NFPA-2113, but advised that additional investigation is warranted. A flash fire is defined by the National Fire Protection Association (NFPA 2113) as:

A fire that spreads rapidly through a diffuse fuel, such as dust, gas, or vapors of an ignitable liquid, without the production of damaging pressure.

NFPA 2113 also includes a longer explanation of flash fire in the Annex A.3.3.16. This explanation addresses flame temperatures for diffused fuel flash fires ranging from 1000° to 1900 °F.

Noncombustible material.

MSHA proposes to define *noncombustible material* as material that will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat.

Overpressure.

MSHA proposes to define *overpressure* as the pressure above the background atmospheric pressure. For example, air pressure in a car tire is measured with a pressure gauge as 30 psi, which is an overpressure. The absolute pressure of the air inside the tire is 44.7 psi which is 14.7 psi or one atmosphere higher. Explosion pressures are normally expressed as an overpressure beyond standard atmospheric pressure.

Refuge alternative.

MSHA proposes to define *refuge alternative* as a protected, secure space with an isolated atmosphere and integrated components that create a life-sustaining environment for persons trapped in an underground coal mine.

The proposed rule addresses refuge alternatives that consist of a protective structure, an airlock, an interior space, and components that provide for breathable air, air monitoring, and harmful gas removal. The refuge alternative would also include provisions for sanitation, lighting, communications, food and water, and first aid.

Section 7.503 Application Requirements

Proposed paragraph (a) would require that an application include information to assure that MSHA can determine if a refuge alternative or component meets the technical requirements for approval, functions as intended, and is safe for use in an underground coal mine.

Paragraph (a)(1) would require the application to contain the refuge alternative or component's make and model number, if applicable. This

provision would assist MSHA in identifying specific units or parts from different companies.

Paragraph (a)(2) would require that the application list the refuge alternative or component's parts, including the MSHA approval number for electric-powered equipment; each component's or part's in-mine shelf life, service life, and recommended replacement schedule; and the materials used in each component or part with their MSHA approval number or a statement that the materials are noncombustible. This proposed provision would assure that materials are safe for use in an underground coal mine. The hazardous nature of an underground coal mine requires that sources of ignition be eliminated. MSHA may have approved some equipment as intrinsically safe or permissible that may be used in a refuge alternative component. The confined space of an underground coal mine necessitates that materials be designed so that they will not contribute to a fire or give off harmful gases when exposed to heat.

Paragraph (a)(3) would require the application to specify the capacity and duration (the number of persons it is designed to maintain and for how long) of the refuge alternative or component on a per-person per-day basis. For example, the application would need to include the specific number of persons and a specific length of time that the refuge alternative or component could support. The application also would need to contain this same information for food, water, lighting, sanitation, and any other materials that must be provided to assure proper use of the refuge alternative or component. This information is necessary so that MSHA can appropriately evaluate the performance of the refuge alternative or component and determine if it meets the requirement that it sustain persons for 96 hours.

Paragraph (a)(4) would require the application to specify the length, width, and height of space required for storage of each component. MSHA needs this information for components approved separately to assure that the refuge alternative will have enough usable space for occupants when all components are stored.

Paragraph (b) would require that the application include additional information for the refuge alternative. This specific information is necessary for the applicant or third party to perform an adequate evaluation of the refuge alternative and for MSHA to approve the refuge alternative or component.

Paragraph (b)(1) would require the application to describe the breathable air component, including drawings, air-supply sources, piping, regulators, and controls. This information is necessary for the applicant to demonstrate that all systems are included and in their proper location, to assure proper functioning of this component.

Paragraph (b)(2) would require the application to specify the maximum volume of the refuge alternative, excluding the airlock; the dimensions of usable space provided for each person; and the interior dimensions of the airlock. This information is necessary to demonstrate that there is adequate usable space when all systems and components are shown in their respective place.

Paragraph (b)(3) would require the application to specify the maximum allowable positive pressures of the refuge alternative and airlock and describe the means used to limit or control the positive pressure in the refuge alternative and airlock. Information on the refuge alternative and airlock is essential for MSHA to determine whether the atmospheric pressure in the refuge alternative will maintain good air as miners enter and pass through the airlock. The information will be used to demonstrate that the pressure will be adequate for the intended purpose but not excessive, which could create adverse physiological effects for the miners.

Paragraph (b)(4) would require that the application specify the maximum allowable apparent temperature of the interior space of the refuge alternative and airlock and describe the means used to control the apparent temperature in the refuge alternative and airlock. This information provides a basis to determine whether the refuge alternative will protect miners from heat stress. Data show that apparent temperatures greater than 80 °F are generally associated with some discomfort. Medical evidence reveals that values approaching or exceeding 105 °F would be life-threatening, resulting in severe heat exhaustion or possible heatstroke if exposure is prolonged or physical activity high. The degree of heat stress would vary with age, health, and body characteristics.

Paragraph (b)(5) would require that each application include drawings that show the features of each component and contain sufficient information to document that each component meets the technical requirements of this subpart. Drawings of each component would illustrate the internal configuration of the refuge alternative. Under the proposal, this information

would include the dimensions and layout of the refuge alternative components, controls, and materials necessary for proper operation. This information is necessary for the applicant or third party to make an appropriate and informed evaluation and of the unit to provide a basis for MSHA approval of the refuge alternative or component.

Paragraph (b)(6) would require that the application include essential information or instructions, such as a training manual that contains sufficient detail to train personnel to transport, operate, and maintain the refuge alternative or component. MSHA recognizes that, as a general practice, manufacturers provide users with information necessary for safe and effective use of their products. Under the proposal, the applicant would be required to develop a training manual for each refuge alternative or component.

Paragraph (b)(7) would require a summary of the procedures for constructing and activating refuge alternatives. MSHA recognizes that, as a general practice, manufacturers provide users with information necessary for safe and effective use of their products. This summary information would include all of the steps and procedures to construct and activate a refuge alternative. This information would be used in evaluating the approval and for instruction in the construction and activation of refuge alternatives.

Paragraph (b)(8) would require a summary of the procedures related to using refuge alternatives. This summary information would include steps and procedures for using the refuge alternative during a substantial period of time. This information would be used in evaluating the approval and for instruction in using the refuge alternatives.

Paragraph (b)(9) would require that the application contain the results of inspections, evaluations, calculations, and tests conducted under this subpart. MSHA would use this information to evaluate the effectiveness and compatibility of refuge alternative components. For example, the application would contain the calculation of the rate oxygen is delivered on a per person basis and the results of tests, including calculations, of the carbon dioxide removal (scrubbing) to demonstrate that the refuge alternative will maintain a safe atmosphere for 96 hours.

Paragraph (c) would require that the application for the air-monitoring component include additional information. This information is

necessary for the applicant or third party to make an effective evaluation of the component to provide a basis for MSHA approval of the air-monitoring component.

Paragraph (c)(1) would require that the application specify the types of sensors, their operating ranges, the gases measured, and any environmental limitations including the cross-sensitivity of each detector or device to other gases. This information on the air-monitoring component is essential for MSHA to determine that persons inside the refuge alternative will be aware of the concentrations of carbon dioxide, carbon monoxide, and methane, inside and outside the refuge alternative, including the airlock. In addition, this will assure that oxygen concentrations can be monitored simultaneously.

Paragraph (c)(2) would require that the application include the method for operation of each device so that it functions as necessary to test gas concentrations over a 96 hour period. This information will assist MSHA's evaluation of whether the air-monitoring component can sustain persons for 96 hours. The Agency recognizes that different types and combinations of instruments from several manufacturers may be used in an air-monitoring component. MSHA needs to assure that the different components are available and will provide reliable monitoring of breathable air as necessary over the 96-hour period. MSHA believes that a properly designed system would control gas concentrations inside the refuge alternative. The intent of this provision is that detectors would be used to periodically check gas concentrations in the refuge alternative and provide miners with this information.

Paragraph (c)(3) would require that the application include procedures for monitoring and maintaining breathable air in the airlock, before and after purging. Under the proposal, breathable air must be provided in the airlock at all times. However, when miners enter the airlock following an emergency, it will be necessary to monitor and purge the air to remove any contaminants and minimize contamination inside the refuge alternative as miners pass through the airlock into the interior space.

Paragraph (c)(4) would require that the application include instructions for determining the quality of the atmosphere in the airlock and interior of the refuge alternative and a means to maintain breathable air in the airlock. The quality of air inside the refuge alternative is vital to sustain trapped miners. The procedures for using the

air-monitoring component are essential for MSHA to determine whether the component provides adequate means for trapped miners to verify the quality of the air inside and outside the refuge alternative.

Paragraph (d) would require that the application specify the volume of breathable air available for removing harmful gas, both at start-up and while persons enter or exit through the airlock; and the maximum volume of each gas that the component is designed to remove on a per-miner per-day basis. Information on harmful gas removal is essential for MSHA to determine the ability of the refuge alternative to sustain occupants for 96 hours. The purpose of this component is primarily to remove carbon dioxide exhaled by the occupants. MSHA also intends that this component be capable of removing toxic and irritant gases, fumes, mists, and dusts that may enter the refuge alternative through the airlock.

Paragraph (e) would require that the applicant certify that each component is constructed of suitable materials, is of good quality workmanship, is based on sound engineering principles, is safe for its intended use, and is designed to be compatible with other components in the refuge alternative, within the limitations specified in the approval. This information is needed to assure that the application, test results, and construction quality are complete and accurate.

Section 7.504 Refuge Alternatives and Components; General Requirements

Proposed § 7.504 provides general safety and health requirements for refuge alternatives and components.

Paragraph (a)(1) would require refuge alternatives and components to be intrinsically safe for use in an underground coal mine and designed with fire and explosion-proof features for use with an oxygen supply component. This requirement would assure that the refuge alternative or component does not contribute to a secondary fire or explosion.

Paragraph (a)(2) would require that a refuge alternative or component not produce noise levels in excess of 85 dBA in the structure's interior. Noise above this level can be irritating and interferes with communication. Exposure to noise at or above the 85 dBA level could adversely affect hearing. Based on MSHA's knowledge, noise controls such as dampening material are available to control noise levels.

Paragraph (a)(3) would require that the refuge alternative or component not liberate harmful or irritating gases or

particulates into the structure's interior or airlock. Some materials off-gas when heated. Vapors, aerosols or particulates should not be released into the refuge alternative. The proposed rule would require that materials used in a refuge alternative or component be tested and evaluated to determine that nonmetallic materials do not release irritating odors or toxic gases when subjected to a flash fire test. The application would have to include the results of the tests and evaluation.

Paragraph (a)(4) would require that the refuge alternative or component be designed to be moved safely with devices such as tow bars. MSHA recognizes that refuge alternatives could be a hazard to miners during transport if not properly designed and if miners are not adequately trained. Based on MSHA's experience, inadequate rigging and towing devices could cause accidents to miners. The refuge alternative should be designed with proper connections and devices to eliminate or reduce the use of chains, ropes, and slings. In addition, miners would need training on how to move a refuge alternative to avoid injury.

Paragraph (a)(5) would require that the refuge alternative and components be designed to withstand damage during transport and handling. The proposed rule would require that designs incorporate bumpers, guarding, skids, packing and securing devices, and rigging components. Additionally the components and supplies must be configured, arranged, and stored to minimize shifting, movement, or damage during handling and routine transport. Training would incorporate precautions to prevent damage to the refuge alternatives and components while storing, handling, and transporting the equipment.

Paragraph (b) would require that the apparent inside temperature be controlled to prevent heat stroke. The miners will produce heat within the confined space of the refuge alternative. The chemicals used to remove carbon dioxide also generate heat. Over time, the heat build-up could produce heat stroke. NIOSH stated that—

Apparent temperature is a measure of heat stress, but other indices or standards could be used, such as the wet bulb globe temperature. Regardless of the index selected, the numerical value must be assigned to prevent heat stroke.

Paragraph (b)(1) would require that, when used in accordance with the manufacturer's instructions and defined limitations, the apparent temperature in the fully occupied refuge alternative not exceed 95° Fahrenheit. The apparent

temperature is a measure of relative discomfort due to the combined effect of heat and humidity. The concept of apparent temperature was developed by R.G. Steadman (1979) and is based on physiological studies of evaporative skin cooling for various combinations of ambient temperature and humidity. At higher dew-points, the apparent temperature exceeds the actual temperature and measures the increased physiological heat stress and discomfort associated with higher than comfortable humidity.

The likelihood of adverse effects from heat may vary with a person's age, health, and body characteristics; however, apparent temperatures greater than 80 °F are generally associated with some discomfort. Temperatures in excess of 105 °F are considered life-threatening, with severe heat exhaustion or heatstroke possible after prolonged exposure or significant physical activity. There is a general consensus among researchers that the apparent temperature within a confined space occupied by humans should not exceed 95 °F.²

MSHA recognizes that body heat and heat generated by chemical reactions (i.e., CO₂ scrubbing chemicals) are inherent heat-producing sources within a refuge alternative. Ambient temperature in a refuge alternative also is affected by the mine temperature compounded by high humidity in the sealed environment. High humidity reduces a body's ability to regulate temperature by sweating, which could result in a dangerously elevated internal body temperature.

Paragraph (b)(2) would require that calculations or tests be conducted to determine the maximum apparent temperature in the refuge alternative when used at maximum occupancy and in conjunction with required components calculations or test results. In addition, the proposed rule would require that an application include test results and calculations to demonstrate that the apparent temperature within the refuge alternative would not exceed 95 °F when used in conjunction with required components and fully occupied.

MSHA requests specific comments on the apparent temperature and mitigation of heat stress and heat stroke. Comments should address the generation of heat and the methods for measuring heat stress on persons occupying the refuge alternative. Comments should be specific including alternatives,

rationale, safety benefits to miners, technological and economic feasibility, and supporting data.

Paragraph (c) would require that refuge alternatives include a number of auxiliary requirements to enhance the safety and survival of persons in a refuge alternative. These requirements would include a means for communicating with persons outside, lighting, and first aid, and provisions for food, water, and sanitation.

Paragraph (c)(1) would require that refuge alternatives accommodate communications. Paragraphs (c)(1)(i) and (ii) would require that refuge alternative accommodate a telephone or an equivalent two-way communication facility that can be used from inside the refuge alternative, or a two-way wireless system when it is approved in the operator's Emergency Response Plan (ERP). Manufacturers would need to provide suitable ports, connections, jacks, and fittings for communication equipment, and ports and connections would need to be designed for electrical permissibility and maintaining air quality (gas tight cable entries) within the refuge alternative.

MSHA requests comments on including a requirement that refuge alternatives be designed with a means to signal rescuers on the surface. This would assure that rescuers on the surface could be contacted if the communications systems become inoperable. This signal would be similar to what miners had done in the past by hammering on the roof, ribs, or floor to create sounds that can be detected by seismic devices located on the surface. A signaling device would need to be configured to produce a sound on the roof, ribs, or floor while maintaining the isolated atmosphere. Comments should be specific, including alternatives, rationale, safety benefits to miners, technological and economic feasibility, and supporting data.

MSHA requests comments on including a requirement that the manufacturer design refuge alternatives with a means to signal underground rescuers with a homing device. This would assure that rescuers could detect the trapped miners within the mine. Comments should be specific, including alternatives, rationale, safety benefits to miners, technological and economic feasibility, and supporting data.

Paragraph (c)(2) would require that refuge alternatives include lighting sufficient to perform tasks. Lighting that generates significant heat, or requires continual manual power for light generation, would be unacceptable. Light is essential to allow persons to read instructions, warnings, and gauges;

² U.S. Department of Defense, National Aviation and Space Administration, Canadian, Australian, and the United Kingdom.

operate gas monitoring detectors; and perform other activities related to the operation of the refuge alternatives. MSHA recommends a minimum of 1 foot candle of lighting be provided per miner per day.³ The manufacturer or approval holder would have to measure the number of foot candles provided per miner per day and report this information in the refuge alternative's manual.

MSHA requests comments on the types, sources, and magnitude of lighting needed for the proper functioning of a refuge alternative and the needs of the occupants. Comments should be specific, including alternatives, rationale, safety benefits to miners, technological and economic feasibility, and supporting data.

Paragraph (c)(3) would require that refuge alternatives include a means to effectively contain human waste and minimize objectionable odors. Information regarding the sanitation would assure that the manufacturer or approval holder has included an adequate means for containing waste.

The proposed provisions on sanitation would encompass containment and disposal of waste. This provision would also require a means for operation and use, and a means, such as a plastic bag and closed receptacle, to contain the waste to prevent objectionable odors from being detected within the interior space. Provisions should include individually packaged sanitation supplies, including toilet paper and hand sanitizer. The manufacturer or approval holder would have to measure the length, width, and height of the container housing the sanitation component and report this information, together with operating instructions, in the refuge alternative's manual.

Paragraph (c)(4) would require that refuge alternatives include first aid supplies to treat injuries. The provision would assure that a sufficient quantity of first aid supplies are available for injured miners.

Paragraph (c)(5) would require that refuge alternatives be stocked with materials, parts, and tools for repairs of components. This requirement would assure that refuge alternative manufacturers provide a repair kit with necessary materials and appropriate tools to perform repairs. This should include adequate tools, metal repair materials, fiber material, adhesives, sealants, tapes, and general hardware (i.e., screws, bolts, rivets, wire, zippers

and clips). Powered tools must be intrinsically safe and permissible.

Paragraph (d) would require that containers used for storage of refuge alternative components be airtight, waterproof, and rodent-proof; easy to open and close without the use of tools; and conspicuously marked with an expiration date and instructions for use of the component. This requirement would assure that the containers' contents are useable when needed. Some contents should be individually packaged and stored in containers. For example, food and water should be provided in individual, disposable packages and stored in a container.

Section 7.505 Structural Components

Proposed § 7.505 Addresses the Structural Components Required for Refuge Alternatives

Paragraph (a)(1) would require that refuge alternatives provide a minimum of 15 square feet of usable floor space and a minimum of 60 cubic feet of usable volume per person. MSHA believes that these proposed minimums are necessary to provide adequate room for miners using the refuge alternative. Usable space or volume means space or volume without stored items. The space and volume requirements are exclusive of the airlock space and volume. NIOSH design parameters recommended 15 square feet and 85 cubic feet per miner. NIOSH stated that these recommendations were not to be considered absolute.

Under this proposed provision, a space of 6 feet of length and 2.5 feet of width would amount to 15 square feet. If the same area has a height of 4 feet, the miner would be provided with 60 cubic feet of space. For mines with lower heights, the 60 cubic feet of space may need to be attained by increasing the length or floor area.

MSHA solicits comments on these minimum space and volume requirements. Comments should be specific, including alternatives, rationale, safety benefits to miners, technological and economic feasibility, and supporting data.

The area cannot be determined solely by the number of miners that would be using the refuge alternative. Miners would need some free space to operate components, drink, eat, and use the sanitation facilities—and tend to injuries. Additional space may be needed for suspended curtains, as part of a passive system CO₂ removal system. Also larger volumes seem to be more effective at dissipating heat.

Paragraph (a)(2) would require that refuge alternatives include storage space

for securing and protecting the components during transport and that permits ready access to components for inspection, maintenance, and activation.

The proposed rule is intended to provide adequate storage space in addition to the usable space required for persons occupying the unit. The storage space is required for the supplies in containers. The containers need to be secured to prevent movement during transport. The supplies should be located to provide usable space for miners and to be accessible for inspection while the refuge alternative is stored. The components should be positioned to allow for visual checks for availability, readiness and shelf life dates.

Paragraph (a)(3) would require that refuge alternatives include an airlock that creates a barrier to isolate the interior space from the mine atmosphere, except for a refuge alternative capable of maintaining adequate positive pressure. The intent of this provision is to provide breathable air to miners entering the refuge alternative if the mine atmosphere is contaminated. The miners would need to go into the refuge alternative through an airlock supplied with breathable air. The airlock would minimize the amount of contaminated mine air that could enter the interior space of the refuge alternative. The airlock would need to have positive pressure to prevent the contaminated atmosphere from entering the airlock when the outside door is opened. Conversely when the inside door of the airlock is opened, the air inside the airlock should not readily enter the interior space of the refuge alternative. Pressures need to be different between the interior space, airlock space and mine atmosphere. Pressures need to be incrementally higher in the interior space as compared to the airlock and the airlock pressure needs to be higher than the mine atmosphere. Miners will pass through the airlock via airtight doors into the interior space.

The proposed rule includes an exception for an airlock if the refuge alternative is capable of maintaining adequate positive pressure. The positive pressure would prevent outside air from contaminating the refuge alternative, therefore an airlock would not be necessary.

Paragraph (a)(3)(i) would require that the airlock be designed to be used multiple times to accommodate the structure's maximum occupancy. This provision would assure access for the number of persons for which the refuge alternative is designed.

³ MIL-STD-1472F, Lighting for bomb shelters, NOTICE 1,05 December 2003.

Paragraph (a)(3)(ii) would require that the airlock be configured to accommodate a stretcher without compromising the airlock's function. Following a mine accident, miners that would use the refuge alternative may be injured and transported on a stretcher. The airlock would need to be an adequate length to accommodate the stretcher (with injured miner) in the airlock with the outside door closed (to allow the interior door to be opened for access to the interior space).

Paragraph (a)(4) would require that refuge alternatives be designed and constructed to withstand 15 pounds per square inch (psi) overpressure for 0.2 seconds prior to activation. Proposed paragraph (a)(5) would require that refuge alternatives be designed and constructed to withstand exposure to a flash fire of 300 °Fahrenheit for 3 seconds prior to activation.

Paragraphs (a)(4) and (a)(5) would assure that the refuge alternative would be able to withstand an initial explosion and fire. These provisions would also assure that the components are not damaged and are able to function as intended.

Paragraph (a)(6) would require that refuge alternatives be constructed with materials that are noncombustible or MSHA-approved flame-resistant. MSHA tests for flame resistance of brattice cloth under 30 CFR 7.27 could be used to determine the flame resistance of noncombustible materials in refuge alternatives. Materials under this provision could include, but would not be limited to inflatable stoppings, inflatable shelters, and any materials providing a barrier used to protect the inside atmosphere from the hazardous outside atmosphere. Materials are generally tested for noncombustibility under ASTM E 136 "Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C" (2004), although a similar ISO test, "ISO 1182:2002" also exists.

Paragraph (a)(7) would require that refuge alternatives be constructed from reinforced material that has sufficient durability to withstand routine handling and resist puncture and tearing during activation and use. Refuge alternatives need to be capable of withstanding the harsh mining environment and require materials to withstand abrasion, tears and punctures during handling and activation. This especially applies to inflatable-type stoppings and tent refuge alternatives. These materials must be made to isolate areas without compromising the interior atmosphere of the refuge alternative.

Paragraph (a)(8) would require that refuge alternatives be guarded or

reinforced to prevent damage that would hinder activation, entry, or use. This paragraph would assure the refuge alternative design incorporates protective features to protect the integrity of the barrier and operation of doors, inflatable extensions of the refuge alternative, or any other functions necessary to use the refuge alternative.

Paragraph (a)(9) would require that refuge alternatives be designed to permit measurement of outside gas concentrations without exiting the structure or allowing entry of the outside atmosphere. Miners would need to conduct gas monitoring of the atmosphere outside of the isolated interior space to monitor harmful gas levels outside the refuge alternative when there is a lack of communication with rescuers and the occupants are considering whether evacuation is a viable option. To assure the safety of the miners, the design should incorporate methods or equipment that can monitor outside of the interior space without contamination.

Proposed § 7.505(b) would address tests for the structural components required for refuge alternatives.

Paragraph (b)(1) would require that tests be conducted to determine or demonstrate that the refuge alternative can be constructed, activated and used as intended. Under this provision, trained persons would need to be able to fully activate the structure, without the use of tools, within 10 minutes of reaching the refuge alternative.

This provision would assure that miners can use the refuge alternative upon reaching it. Following an accident, the first actions of the miners are to attempt to evacuate wearing SCSRs. In a worst-case scenario, only one SCSR may be available to provide 60 minutes of breathable air. The first 30 minutes would enable the miner to attempt to evacuate and return to the refuge alternative if escape is impossible. If the miner cannot escape, and returns to a refuge alternative, the miner would have 10 minutes to establish a barrier between the interior and exterior atmospheres. The remaining 20 minutes of breathable air provided by the SCSR will allow refuge alternative purging to establish a breathable air atmosphere. It is expected that the testing under this paragraph would be conducted using simulated real-life situations and conditions, such as smoke, heat, humidity and darkness using SCSRs.

Paragraph (b)(2) would test that an overpressure of 15 psi applied to the pre-activated refuge alternative structure for 0.2 seconds would not allow gases to pass through the barrier separating the interior and exterior atmospheres.

Paragraph (b)(3) would test that a flash fire of 300° Fahrenheit for 3 seconds would not allow gases to pass from the outside to the inside of the structure.

Paragraphs (b)(2) and (b)(3) would assure that the refuge alternative is tested to verify that it will withstand an initial explosion and fire. It would also assure the structure and components are intact following a fire or explosion. The testing should demonstrate that the integrity of the barrier and operation of doors is maintained.

MSHA tests for flame resistance of brattice cloth at 30 CFR 7.27 could be used to determine the flame resistance of noncombustible materials in refuge alternatives. Materials under this provision could include, but would not be limited to inflatable stoppings, inflatable shelters, and any materials providing a barrier used to protect the inside atmosphere from the hazardous outside atmosphere. Materials are generally tested for noncombustibility using ASTM E 136 "Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C" (2004), although a similar ISO test, "ISO 1182:2002" also exists.

Paragraph (b)(4) would test that the expected overpressure forces do not prevent the stored components from operating. Paragraph (b)(5) would test that a flash fire does not prevent the stored components from operating. Paragraphs (b)(4) and (b)(5) would assure that refuge alternatives are tested to demonstrate that they will withstand an initial explosion and fire. Additionally, the test should assure that an isolated atmosphere is provided for the miners and the components are not damaged and are able to function as intended.

Paragraph (b)(6) would require testing to demonstrate that each structure resists puncture and tearing when tested in accordance with ASTM D2582-07 "Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting." This provision will test the capability of material used to construct the refuge alternative. The material must withstand the harsh mining environment and abrasion, tears, and punctures during handling, transportation and activation. This especially applies to inflatable-type stoppings and tent refuge alternatives. These materials must be made to maintain barriers without compromising the atmosphere established on the interior of the refuge alternative.

Paragraph (b)(7) would require that each reasonably anticipated repair can be completed within 10 minutes of opening the storage space for repair

materials and tools. The inflatable-type refuge alternative has the potential to be ripped, torn or develop a leak. The refuge alternative must maintain an isolated atmosphere at all times. If a leak or tear occurs, the miners should be able to repair it with little delay or their safety could be jeopardized. The test would demonstrate that a miner would be able to make a repair, such as mending a tear or resealing the fabric, within 10 minutes of opening the storage space.

Paragraph (b)(8) would require that nonmetallic materials used to construct the refuge alternative, not release harmful gases or noticeable odors before or after the flash fire test. The test would determine the identity and concentrations of gases released. This provision would require a test of the material used to construct the refuge alternative to assure that the materials do not emit noticeable odors that may sicken the miners occupying the refuge alternative. The testing should include provisions and instruments for detecting any released gases. Materials (i.e., paints, plastics, fiber, etc.) used in the manufacturing of the refuge alternative should not release harmful fumes, vapors, or gases.

Proposed § 7.505(c) addresses refuge alternatives that use pressurized air to activate the structure or maintain its shape.

Paragraph (c)(1) would require a pressure regulator or other means to prevent over-pressurization of structures that use pressurized air to activate the structure or maintain its shape. Over-pressurization of the interior space or airlock space would be detrimental to the safety of the miners. The regulator should be designed to assure that proper relief of overpressure can be accomplished.

Paragraph (c)(2) would require inclusion of a means to repair and repressurize the structure in case of failure of the structure or loss of air pressure. If the inflatable-type structure is damaged or leaks, it will need repair and additional compressed air to establish the pressure and volume of air that was lost.

Proposed § 7.505(d)(1) would require that refuge alternatives be designed such that pre-shift examination of the components critical for activation can be conducted without entering the structure. Paragraph (d)(2) would require that a refuge alternative be designed to provide a means to indicate unauthorized entry or tampering. Paragraphs (d)(1) and (d)(2) would assure that the refuge alternative is designed to allow for all necessary inspections. The gauges and controls for

critical components, such as compressed air and oxygen, should be easy to observe to determine the readiness of those components.

Section 7.506 Breathable Air Components

Paragraph (a) would require that breathable air be supplied by compressed air cylinders, compressed breathable-oxygen cylinders, fans installed on the surface or compressors installed on the surface. Only uncontaminated breathable air is allowed to be supplied to the refuge alternative.

Maintaining breathable air inside the refuge alternative is vital to sustain persons trapped underground. Currently MSHA will accept compressed air cylinders and compressed breathable-oxygen cylinders as a means to supply breathable air in underground coal mines. MSHA will also accept fans or compressors installed on the surface as a means to supply breathable air in these mines. The proposed rule addresses MSHA's need to evaluate whether breathable air components will meet the requirement for sustaining persons for 96 hours in a refuge alternative. Provisions regarding the proper use of approved breathable air components are important for MSHA to use in determining that a component will provide adequate air inside the refuge alternative.

The Agency recognizes that different types and combinations of breathable air components from several manufacturers may be used to provide breathable air for refuge alternatives. MSHA needs to assure that these components and combination of components are reliable and ready to use for maintaining persons as necessary over the 96-hour period.

Paragraph (b) would require that mechanisms be provided and procedures be followed within the refuge alternative such that (1) breathable air sustain each person for 96 hours; (2) the oxygen concentration be maintained at levels between 18.5 and 23 percent; and (3) the average carbon dioxide concentration be maintained at 1.0 percent or less, with excursions not to exceed 2.5 percent.

Paragraph (b)(1) addresses MSHA's need to evaluate the effectiveness and compatibility of the breathable air components to assure that the supply of breathable air is sufficient to sustain persons occupying the refuge alternative for 96 hours. In MSHA's February 8, 2007, Program Information Bulletin No. P07-03, (PIB P07-03), MSHA addressed that the Agency considered 96 hours to be necessary. MSHA concluded that a

96-hour supply was warranted, and accordingly, the Agency is proposing 96 hours as a time that breathable air would need to be provided. MSHA solicits comments on the proposed 96-hour supply of breathable air. Comments should be specific, including alternatives, rationale, safety benefits to miners, technological and economic feasibility, and supporting data.

In arriving at this 96-hour minimum, MSHA reviewed recent and historical data on entrapments. While it is clear that refuge alternatives can save the lives of trapped persons, it was not clear how long refuge alternatives should be capable of sustaining miners. The depth of the mine, the geology of the overburden, and the terrain above the mine significantly affects rescue activities.

Paragraph (b)(2) would require that mechanisms be provided and procedures be followed within the refuge alternative such that the oxygen concentration be maintained at levels between 18.5 and 23 percent. In this subpart, MSHA is defining breathable oxygen as oxygen that is at least 99 percent pure with no harmful contaminants. Acceptable breathable oxygen is frequently supplied from a compressed gas cylinder as U.S. Pharmacopoeia medical oxygen or as aviator breathing oxygen. In addition, consistent with NIOSH's recommendation, the Agency proposes that breathable air contain an oxygen concentration between 18.5 and 23 percent.

Paragraph (b)(3) would require that the average carbon dioxide concentration be maintained at 1.0 percent or less, with excursions not to exceed 2.5 percent. In this subpart, MSHA proposes that breathable air contain no harmful quantities of asphyxiant, irritant, or toxic gases, fumes, mists, or dusts. This is consistent with NIOSH's recommendation. The provision proposes that the carbon dioxide concentration not exceed a 1.0 percent time weighted average over the rated duration of the refuge alternative with excursions not to exceed 2.5 percent.

MSHA is assuming that breathing rates for miners who have reached refuge alternatives would consist of activity levels of $\frac{1}{5}$ at rest and $\frac{1}{5}$ moderate activity. Therefore, using the respiratory quotient, which is the ratio of CO₂ that expelled to O₂ consumed, the average carbon dioxide generation is 1.08 cubic feet per hour per person. These breathing rates were based upon the U.S. Bureau of Mines Foster Miller Report of 1983, "Development of

Guidelines for Rescue Chambers," Volume I (Foster Miller report).

The Agency recognizes that in an enclosed space, miners may die from the effects of CO₂ rather than the effects of O₂ deficiency. In PIB P07-03, MSHA demonstrated the rate at which a person would overexpose from carbon dioxide if carbon dioxide were not removed from the environment. MSHA used air supply calculations and activity levels based upon information provided in the Foster Miller report. The Agency used a hypothetical sealed enclosed space with a volume of 1,800 cubic feet (20 feet long, 18 feet wide and 5 feet high) that contained one person. The initial air quality was assumed to be 19.5% O₂, and 0.03% CO₂, and the breathing rate ($\frac{4}{5}$ at rest and $\frac{1}{5}$ moderate activity) for oxygen inhaled is 0.022 cubic feet per minute per person.

For this example, MSHA found that one miner could be maintained 49.5 hours in an enclosed space with 1,800 cubic feet and initial air quality of 19.5% O₂, and 0.03% CO₂. This equates to 1.65 minutes per cubic foot of enclosed space (volume). Correspondingly, 10 miners could be maintained in a 1,800 cubic foot space for 4.95 hours before the CO₂ concentration reached the defined unacceptable level. In addition, 10 miners in the above defined 1,800 cubic feet volume would reach 10% CO₂ and resulting unconsciousness in approximately 16.6 hours. Unacceptable level for CO₂ would be 3% based on Peele Mining Engineers' Handbook and current MSHA Short Term Exposure Limits.

Paragraph (c) would require that breathable air supplied by compressed air from cylinders, fans, or compressors provide a minimum flow rate of 12.5 cubic feet per minute of breathable air for each miner. MSHA proposes to use 12.5 cubic feet per minute of breathable air as a required volume for each miner based on the amount of air needed for respiration and dilution of CO₂ and other harmful gases. In addition, the 12.5 cubic feet per minute flow rate would assure positive pressure to prevent contamination from the mine atmosphere. A maximum positive relief valve would need to be located in the refuge alternative. MSHA requests comments regarding the flow rate. Comments should be specific including alternatives, rationale, safety benefits to miners, technological and economic feasibility, and supporting data.

MSHA considered the enclosed space as similar to a loose-hood respirator using supplied air. Flair Corporation Bulletin 270 revision H (4-01) indicates that OSHA requires a supply air of 6 to

15 cfm (360 to 900 cfm) for supplied air hoods (continuous flow supplied air respirators) to purge accumulated carbon dioxide. The 12.5 cfm per person fell within this range. Engineering handbooks recommend ventilation rates in the range 10-15 cfm of fresh air per person for offices with 12.5 cfm per person being the midpoint of this range. MSHA believes that these quantities are conservative. However, they are design parameters for a life support system, which demands a more cautious approach. In addition, compressor wear reduces performance and the system will become less efficient with age.

The Agency considers that the use of compressed air cylinders as the sole means of providing breathable air may be impractical and encourages mine operators to consider other options. As MSHA pointed out in PIB P07-03, a fan or equivalent method should be used to force fresh air into the hole with enough positive pressure to overcome total mine pressure to deliver sufficient quantities of breathable air. Compressor air intakes should be installed and maintained to assure that only clean, uncontaminated air enters the compressors. Mines should assure compressors have the capacity to deliver the required volume of air at the point of expected usage.

Paragraph (c)(1) would require that compressed air from cylinders, fans or compressors provide a minimum flow rate of 12.5 cubic feet per minute of breathable air for each miner. Fans or compressors would be required to (i) be equipped with a carbon monoxide detector located at the surface that automatically provides a visual and audible alarm if carbon monoxide in supplied air exceeds 10 ppm; (ii) provide in-line air-purifying sorbent beds and filters or other equivalent means to assure the breathing air quality and prevent condensation; (iii) include maintenance instructions that provide specifications for periodic replacement or refurbishment of sorbent beds and filters or alternate means; (iv) provide an automatic means to assure that the maximum allowable positive pressure is not exceeded in the refuge alternative; (v) include warnings to assure that only uncontaminated breathable air is supplied to the refuge alternative; (vi) include air lines to supply breathable air from the fan or compressor to the refuge alternative; and (vii) assure that harmful or explosive gases, water, and other materials cannot enter the breathable air. In addition, the proposal would require that air lines be capable of preventing or removing water accumulation, and be designed and protected to prevent damage during normal mining operations, a flash fire of

300° F for 3 seconds, a pressure wave of 15 psi overpressure for 0.2 seconds, and ground failure.

In PIB P07-03, MSHA provided a number of recommendations regarding hazards stemming from the use of compressors to provide breathable air underground. The Agency also acknowledges that these recommendations would apply to the use of fans used for the same purpose. As such, MSHA recommended that compressor air intakes should be installed to assure that only clean, uncontaminated air enters the compressors. Care should be exercised when using compressors in the vicinity of other equipment having gas or diesel engines. Gas engines emit carbon monoxide (toxic fumes) and diesel engines emit sulfur dioxide (noxious fumes) and nitrogen oxides. Compressors requiring oil can generate carbon monoxide (CO) internally which can be supplied inadvertently to miners. Oil-type compressors could be used; however, the air quality must be sampled and/or controlled using CO filtration. Oil-less compressors do not generate carbon monoxide; thus, no CO filtering is required.

Paragraph (c)(1)(i) would require carbon monoxide detectors for compressors or fans at the surface that automatically provide a visual and audible alarm if carbon monoxide in supplied air exceeds 10 ppm because compressors powered by gas engines emit carbon monoxide. Through the use of detectors at the surface, this provision is intended to assure that harmful levels of carbon monoxide would not be transferred into the refuge alternative from this equipment. MSHA is proposing to use the same early warning level for carbon monoxide in compressor supplied breathable air as established by OSHA, which will maintain uniformity in requirements for the use of such specialized equipment. MSHA believes warning operators when the CO level exceeds 10 ppm will help maintain safe breathable air in the refuge alternative. MSHA solicits comments on this provision including alternatives.

Paragraph (c)(1)(ii) would require in-line air-purifying sorbent beds and filters or other equivalent means to assure the breathing air quality and prevent condensation. Sorbent beds and filters would help assure that the air quality is maintained and condensation is prevented.

Paragraph (c)(1)(iii) would require maintenance instructions that provide specifications for periodic replacement or refurbishment of sorbent beds and filters or alternate means. Proper

maintenance and periodic replacement of sorbent beds and filters would help assure that the air quality is maintained and condensation is prevented.

Paragraph (c)(1)(iv) would require that fans or compressors provide positive pressure and an automatic means to assure that the pressure is relieved in the refuge alternative at 0.25 psi above mine atmospheric pressure. MSHA believes that positive pressure to exceed total mine pressure will prevent contamination and allow sufficient quantities of breathable air. The pressure should be adequate for the intended purpose, but not excessive where it creates adverse physiological effects for the miners. An automatic means, such as a relief valve set at 0.25 psi, should be provided to assure that the refuge alternative is not over-pressurized if breathable air is being supplied through a borehole or other means. The Foster Miller report specifies a minimum of 5 inches of water gage overpressure in the refuge alternative which is equivalent to approximately 0.18 psi. Currently, most manufactured refuge alternatives have relief valves set at 0.25 psi. Having too much pressure differential would make opening doors difficult for miners entering the refuge alternative. MSHA requests comments on the proposed setting for pressure relief and whether a higher pressure relief should be required. Comments should be specific including alternatives, rationale, safety benefits to miners, technological and economic feasibility, and supporting data.

Paragraph (c)(1)(v) would require warnings to assure that only uncontaminated breathable air is supplied to the refuge alternative. This provision is intended to assure that only clean, uncontaminated air enters the compressors. Care should be exercised when using compressors or fans in the vicinity of other equipment having gas or diesel engines.

Paragraph (c)(1)(vi) would require that fans or compressors supplying breathable air underground include air lines to supply the air to the refuge alternative, that (A) air lines be capable of preventing or removing water accumulation, and that (B) air lines be designed and protected to prevent damage during normal mining operations, a flash fire of 300 °F for 3 seconds, a pressure wave of 15 psi overpressure for 0.2 seconds, and ground failure.

Proposed paragraph (c)(1)(vi)(A) is intended to prevent accumulation of water, which could affect the quantity and quality of breathable air provided underground. Moisture-laden air should

not be pumped into the area where miners are trapped. If this moisture is not removed water could accumulate in the refuge alternative. All air supply systems must provide a means of preventing and removing the accumulation of water. MSHA anticipates air dryers with drain valves will be used. Air lines or pipes that are pre-installed must also be capped to prevent the entry of rain or moisture-laden air. If horizontal runs of air lines or pipes are used, they must be provided with a means to automatically drain any water accumulation.

Proposed paragraph (c)(1)(vi)(B) is intended to provide protection for lines that come from boreholes or air lines from the surface that are extended underground to a refuge alternative. This protection could consist of burying pipes by trenching deep enough to protect the pipes from mine traffic, explosions, ground movement or equipment damage.

Paragraph (c)(1)(vii) would assure that harmful or explosive gases, water, and other materials cannot enter the breathable air. When connecting equipment to boreholes that enter the mine, precautions must be taken to prevent explosive or harmful gases from entering the equipment supplying the breathable air. Harmful gases could contaminate filters or other components or collect in the equipment and affect the quality of the air being supplied to the trapped miners.

Paragraph (c)(2) would require redundant fans or compressors and power sources to permit prompt reactivation of equipment in the event of failure. It is crucial to maintain a continuous supply of breathable air to persons trapped underground and MSHA believes that redundant systems would assure that the supply is maintained in the event of failure of one of these systems.

Paragraph (d) would require that compressed, breathable oxygen (1) include instructions for activation and operation; (2) provide oxygen at a minimum flow rate of 1.32 cubic feet per hour per miner; (3) include a means to readily regulate the pressure and volume of the compressed oxygen; (4) include an independent regulator as a backup in case of failure; and (5) be used only with regulators, piping, and other equipment that is certified and maintained to prevent ignition or combustion.

Paragraph (d)(1) would require that compressed, breathable oxygen include instructions for activation and operation. This information will assure that mine operators have the proper information to correctly perform the

tasks involving activating compressed oxygen cylinders. MSHA believes that failure to properly perform these tasks may imperil the lives of the miners within the refuge alternative.

Instructions could include such items as checking for loose connections, leaking gas sounds, damage to hoses along their lengths or at their fittings, and broken gauges. The instructions would also help to assure that tanks are secured and pressure regulators are properly set and that wrenches and pliers will be in proper working order. Safe Use of Oxygen and Oxygen Systems: Guidelines for Oxygen System Design, Materials Selection, Operations, Storage, and Transportation, ASTM Stock No.: MNL 36.

Paragraph (d)(2) would require that compressed, breathable oxygen provides oxygen at a minimum flow rate of 1.32 cubic feet per hour per miner. MSHA is assuming that breathing rates for miners who are using a refuge alternative would reflect activity levels of $\frac{4}{5}$ at rest and $\frac{1}{5}$ moderate activity. Oxygen consumption at this assumed breathing rate would be 1.32 cubic feet per hour per person (0.022 cubic feet per minute per person). These oxygen consumption rates were based upon the U.S. Bureau of Mines Foster Miller Report of 1983, "Development of Guidelines for Rescue Chambers," Volume I.

Paragraph (d)(3) would require that compressed, breathable oxygen provide a means to readily regulate the pressure and volume of the compressed oxygen. Regulating is necessary to assure that oxygen levels remain within the recommended values. In addition, all oxygen valves should be opened slowly to prevent the oxygen from heating.

Paragraph (d)(4) would require that compressed, breathable oxygen include an independent regulator as a backup in case of failure. It is crucial to maintain a continuous supply of breathable air to persons trapped underground. MSHA believes that redundant regulators would assure that the miners are maintained in the event of failure of one of these regulators. MSHA expects redundant oxygen control valves and regulators will be provided to assure continual availability of breathable oxygen. This provision is meant to assure that pre-connected valves and regulators are available. This will assure that miners will always have breathable air available in case of component failures.

Paragraph (d)(5) would require that compressed, breathable oxygen be used only with regulators, piping, and other equipment that is certified and maintained to prevent ignition or combustion. Components such as

pipings, couplings, valves and regulators used to supply air to the refuge alternative must be maintained in operable condition and in accordance with manufacturer's recommendations. These components will likely be stored by the mine operator until needed for training or rescue operations. Improper storage of these components can lead to their corrosion or their contamination. Compressed oxygen components must not be used with previously used compressed air system components due to the fire and explosion hazards resulting from pure oxygen coming into contact with oil and grease that is inherent with used compressed air systems.

Paragraph (e) would require that carbon dioxide removal components (1) include instructions for activation and operation; (2) be used with breathable air cylinders or oxygen cylinders; (3) remove carbon dioxide at a rate of 1.08 cubic feet per hour per miner; (4) be contained to prevent contact with the chemicals and the release of airborne particles; (5) be provided and packaged with all necessary means to expedite use, such as hangers, racks, and clips; and (6) be stored in containers that are conspicuously marked with instructions for disposal of used chemicals.

Paragraph (e)(1) would require that carbon dioxide removal components include instruction for activation and operation. MSHA needs this information to assure that mine operators have the proper information to correctly perform tasks involving activating carbon dioxide removal components. Carbon dioxide is a natural asphyxiant produced through human respiration. To prevent the accumulation of harmful concentrations of carbon dioxide, scrubbing systems have been developed to chemically absorb the carbon dioxide. When entering a refuge alternative, miners would have to perform tasks to activate the carbon dioxide removal components. The miners would have to purge the atmosphere (in some cases), turn on the breathable air and maintain a viable atmosphere. Depending on the type of CO₂ removal system, instructions could include activation scheduling and proper handling of these materials. MSHA believes that failure to properly perform these tasks may imperil the lives of the miners within the refuge alternative.

Paragraph (e)(2) would require that carbon dioxide removal components be used with breathable air cylinders or oxygen cylinders. MSHA needs to assure that carbon dioxide removal components are compatible with the

overall system for providing breathable air.

Paragraph (e)(3) would require that carbon dioxide removal components remove carbon dioxide at a rate of 1.08 cubic feet per hour per miner. MSHA is assuming that breathing rates for miners who have reached refuge alternatives would reflect activity levels of $\frac{4}{5}$ at rest and $\frac{1}{5}$ moderate activity. Therefore, using the respiratory quotient, which is the ratio of CO₂ expelled to O₂ consumed, the average carbon dioxide generation is 1.08 cubic feet per hour per person. These breathing rates were based upon the Foster Miller report.

Paragraph (e)(4) would require that carbon dioxide removal components be contained to prevent contact with the chemicals and the release of airborne particles. Commonly used CO₂ removal systems include lithium hydroxide or soda lime curtains or soda lime cartridges. These systems will require proper handling and may involve using personal protective equipment. The NIOSH report stated that the scrubbing material must not become airborne or otherwise cause respiratory distress or other acute reaction.

Paragraph (e)(5) would require that carbon dioxide removal components be provided and packaged with all necessary means to expedite use. Depending on the type of CO₂ removal component, items such as hangers, racks, and clips may be required to activate and use this component.

Paragraph (e)(6) would require that carbon dioxide removal components be stored in containers that are conspicuously marked with instructions for disposal of used chemicals. Manufacturers would need to provide instructions for disposal of used chemicals.

Paragraph (f) would require the carbon dioxide removal component be tested and evaluated to demonstrate that it can maintain average carbon dioxide concentration at 1.0 percent or less, with excursions not to exceed 2.5 percent under the following conditions: (1) at 55 °F (±4 °F), 1 atmosphere (±0.5 percent), and 50 percent (±0.5 percent) relative humidity; (2) at 55 °F (±4 °F), 1 atmosphere (±0.5 percent), and 100 percent (±0.5 percent) relative humidity; (3) at 90 °F (±4 °F), 1 atmosphere (±0.5 percent), and 50 percent (±0.5 percent) relative humidity; (4) at 82 °F (±4 °F), 1 atmosphere (±0.5 percent), and 100 percent (±0.5 percent) relative humidity.

The Agency is proposing testing and evaluating of the CO₂ removal component to assure that the concentration not exceed a 1.0 percent time-weighted average over the rated duration of the refuge alternative with

excursions not to exceed 2.5 percent. The provisions in proposed paragraph (f) are consistent with NIOSH's recommendation.

MSHA recognizes that some CO₂ scrubbing components may not perform as well as others and that the most commonly used CO₂ scrubbing chemicals performed their function within an acceptable range of the conditions found in underground mines. The testing procedure that would be required under proposed paragraphs (f)(1) through (4) are representative of extreme conditions that CO₂ scrubbing components may be exposed to in different underground mines. The increased temperature and humidity ranges between these provisions reflect increases that would result from occupancy of a refuge alternative, although MSHA assumes that some body heat and moisture generation will be dissipated by contact with the refuge alternative or mine roof, ribs, and floor.

Therefore, it is important to evaluate these CO₂ scrubbing components and determine the differences in levels of effectiveness with currently available components. This will enable mine operators to make more informed choices in selecting scrubbing components to be used in their particular mining operation.

Paragraph (g) would require that respirators or breathing apparatus used with a breathable air component (1) be NIOSH-approved with a means of flow and pressure regulation; (2) be equipped with fittings that connect only to a breathable air compressed line; (3) allow for communication, and the provision of food, and water while preventing the entry of any outside atmosphere; and (4) be capable of being worn for up to 96 hours. The proposed rule addresses the need to have provisions to assure the safe use of respirators or breathing apparatus.

Paragraph (g)(1) would require that respirators or breathing apparatus used for a breathable air component have a NIOSH approval with a means of flow and pressure regulation.

Paragraph (g)(2) would require that respirators or breathing apparatus be equipped with fittings that connect only to a breathable air compressed line. This provision would prevent respirators from being connected to piping that is not designed for breathing apparatus or to gas sources that are not capable of sustaining life. Compressed air regulating valves and supply hoses are generally shipped with quick-connect industrial interchange safety fittings/couplings that prevent accidental separation of the hoses. The proposed rule would require that these fittings be

incompatible with outlets for non-respirable air or other gas systems so that asphyxiating substances are not introduced into breathing air lines. This provision is also comparable to the Occupational Safety and Health Administration respiratory protection standard 29 CFR 1910.134(i)(8), which states that—

[t]he employer shall ensure that breathing air couplings are incompatible with outlets for nonrespirable worksite air or other gas systems. No asphyxiating substance shall be introduced into breathing air lines.

Paragraph (g)(3) would require that respirators or breathing apparatus used with breathable air components allow for communication, and the provision of food and water while at the same time preventing the entry of any outside atmosphere. MSHA is proposing this requirement because communications with and between persons in refuge alternatives to convey and share information are vital to mine rescue efforts. The knowledge of where persons are in refuge alternatives, their condition and the conditions in the mine may make the difference between life and death in a post-accident crisis. In addition, being able to consume food and water is critical for the 96-hour confinement. MSHA believes that the proposed requirements could be met with full-faced respirators or breathing apparatus that have ports for the use of liquids, such as those used by commercial divers.

Paragraph (g)(4) would require that respirators or breathing apparatus used with breathable air components be capable of being worn for up to 96 hours. The refuge alternative standard would require that breathable air be provided in the refuge alternative at all times. Among the concerns addressed by this provision are that if respirators or apparatus are required to be worn for extended periods of time, the respirators or breathing apparatus would need to be of such a type or configuration that it would not become dislodged when sleeping or when activities are performed.

Paragraph (h) would require that an applicant prepare and submit a risk analysis to assure that the breathable air component will not cause an ignition. The proposed provision requires that an analysis be conducted to evaluate the potential fire and ignition risks of the equipment and components.

Paragraph (h)(1) would require that the risk analysis specifically address oxygen fire hazards and fire hazards from chemicals used for removal of carbon dioxide. This provision addresses MSHA's specific concern that

the use of oxygen presents inherent potential fire hazards. The provision also focuses on assuring that fire hazards from chemicals used for removal of carbon dioxide are addressed by manufacturers of refuge alternative components.

Paragraph (h)(2) would require that the risk analysis identify the means used to prevent any ignition source. This provision addresses the need to assure that refuge alternative manufacturers analyze inherent potential fire hazards and, if any potential exists, that the mitigation plan includes the means to prevent ignition of breathable air component equipment or materials.

Paragraph (i) would require that the breathable air component shall include a fire extinguisher that (1) is compatible with the chemicals used for removal of carbon dioxide; and (2) uses a non-toxic extinguishing agent that does not produce a hazardous by-product when heated or activated. This paragraph addresses the need to assure that refuge alternative manufacturers analyze inherent potential fire hazards and develop means to prevent the ignition of breathable air component equipment or materials. The proposed requirements in paragraphs (h)(1) and (2) would help assure that the fire extinguisher used in a refuge alternative or component does not contribute to a secondary fire or explosion. The provisions would assist MSHA in determining that materials used in the fire extinguisher are safe for use in an underground mine and do not give off harmful gases when exposed to heat.

Section 7.507 Air-Monitoring Components

Proposed § 7.507(a) would include requirements for an air-monitoring component that provides persons inside the refuge alternative with the ability to determine the concentrations of carbon dioxide, carbon monoxide, oxygen, and methane, inside and outside the structure, including the airlock. This proposal would assure that breathable air is properly monitored and that air-monitoring equipment is properly inspected, tested, maintained, and stored so that it is fully charged and available for immediate use.

The monitoring of these gases is critical to the survival of miners occupying a refuge alternative. The proposal includes the recommended values provided in the NIOSH report for oxygen, carbon monoxide, and carbon dioxide. NIOSH recommended values and gas concentration ranges that would assure that the quality of breathable air is maintained. The ability to monitor the

atmosphere outside the refuge alternative would assist miners inside the refuge alternative in making crucial decisions in the event of a mine emergency. Additionally, methane would be monitored to negate the possibility of oxygen deficiency or the potential for explosion.

Paragraph (b) would require that refuge alternatives designed for use in mines with a history of harmful gases, other than carbon monoxide, carbon dioxide, and methane be equipped to measure those harmful gas concentrations. Some mines have a history of liberating harmful gases such as hydrogen sulfide, volatile hydrocarbons, or sulfur dioxide. Miners would need to be prepared for potential liberating of these harmful gases and have appropriate monitoring equipment readily available.

Paragraph (c) would require that the air-monitoring component be inspected or tested and the test results are included in the application. This provision will assure that all types of monitors or detectors that are included in the refuge alternative will be tested for the conditions for which they are intended. Performance testing will assure the components will operate for which the air monitoring is intended as well as meet the intrinsic safety requirements. Additionally, visual inspection, calibration, and performance test reports will need to be included in the application to verify performance.

Paragraph (d) would require that all air-monitoring components be approved as permissible by MSHA and the MSHA approval number be specified in the application. MSHA will only accept MSHA approved permissible components to assure an explosion hazard does not exist in an explosive atmosphere and the components will serve the purpose for which they are intended. MSHA would allow third party testing of the components for air monitoring. Approval information will assure the components are performance-tested for safe usage in the refuge alternative.

Paragraph (e) would require that air-monitoring components meet the following: (1) The total measurement error, including the cross-sensitivity to other gases, shall not exceed ± 10 percent of the reading, except as specified in the approval, and (2) the measurement error limits not exceed after startup, after 8 hours of continuous operation, after 96 hours of storage, and after exposure to atmospheres with a carbon monoxide concentration of 999 ppm (full scale), a carbon dioxide concentration of 3 percent, and full-scale concentrations of other gases.

Paragraph (e)(1) would assure that the instruments are tested to specific ranges. MSHA has referenced gas analyzer specifications from 30 CFR part 7 Diesel Engine approvals detailed in § 7.86(b)(10), which specifies that the gas analyzer error including cross-sensitivity to other gases is 5%. MSHA recommends using gas analyzers that account for cross sensitivity, such as sensitivity to hydrogen or hydrocarbons which would result in false indication of actual carbon monoxide, and adjust readings accordingly.

The $\pm 5\%$ error specification in § 7.86(b)(10) refers to the instrument error specification. The $\pm 10\%$ total measurement error specification above refers to the combined effects of environment and accessories on the measurement itself under normal conditions, and was arrived at through uncertainty evaluation of gas measurement instruments used at MSHA's Approval and Certification Center. Measurements taken when environmental conditions are not within the instruments' specified acceptable limits, or when the instrument is in need of calibration, can result in the measurement value falling outside the $\pm 10\%$ limit. Measurements that fall outside of the $\pm 10\%$ limit are not in compliance. The applicant needs to determine what environmental or calibration issues exist and resolve them to keep the combined instrument and measurement error within $\pm 10\%$.

Paragraph (e)(2) would require testing to demonstrate that the gas monitors or detectors will afford miners the capability to determine accurate gas concentrations throughout the duration of refuge occupancy and at different parameters such as startup, after 8 hours of continuous operation, during storage when continuously exposed to the maximum recommended gas concentrations, and at other concentrations much higher than the recommended maximum values. This requirement takes into account the effects high gas concentration levels may have on these measurements over extended periods of time. A consensus standard for instruments, ANSI/ISA-92.02.01, Part I-1998 Performance Requirements for Carbon Monoxide Detection Instruments (50-1000 ppm full scale), specifies carbon monoxide instrument range limits of 1000 ppm, 2000 ppm overload, and the standard specifies these instruments be able to withstand a carbon monoxide shock loading of 4000 ppm.

Paragraph (e)(3) would require that calibration gas values be traceable to the National Institute for Standards and Testing (NIST) "Standard Reference

Materials" (SRMs). This procedure will assure proper calibration of the air-monitoring equipment. These standards are recognized and accepted by industry. This provision is based upon existing § 7.86(b)(16), which references NIST SRMs.

Paragraph (e)(4) would require that the analytical accuracy of the calibration gas values be within 2.0 percent of NIST gas standards. This provision is based upon existing § 7.86(b)(16), which also references analytical accuracy of calibration gases within 2 percent of NIST gas standards.

Paragraph (e)(5) would require that the analytical accuracy of the span gas values be within 2.0 percent of NIST gas standards. This provision is based upon existing § 7.86(b)(17) which also references analytical accuracy of span gases within 2 percent of NIST gas standards.

Paragraph (e)(6) would require the detectors be capable of being kept fully charged and ready for immediate use. MSHA needs to assure that the detectors are reliable and ready to use for maintaining persons as necessary over the 96-hour period.

Section 7.508 Harmful Gas Removal Components

This section addresses removing harmful gases to assure that breathable air is maintained for persons occupying refuge alternatives during the 96-hour period.

Paragraph (a)(1) would require purging or other effective methods be provided for the airlock to dilute the carbon monoxide concentration to 25 ppm or less and the methane concentration to 1.5 percent or less as persons enter, within 20 minutes of miners activating the refuge alternative. The NIOSH recommended value of maximum concentration of carbon monoxide is 25 ppm. This provision is intended to address evacuating contaminated air by forcing the contaminated air out of the refuge alternative environment. Airlocks are intended to speed up the process of ingress and egress, because this is a smaller volume as compared to the interior space to purge. MSHA believes that following the miners' attempt to escape and time required for constructing and activating the refuge alternative, the SCSRs would allow 20 minutes for purging the airlock to establish a breathable air atmosphere.

In addition, purge air should be provided from compressed air cylinders. The allowable carbon monoxide contamination level is the NIOSH recommended value contained in the NIOSH report. The methane

concentration action level in 30 CFR 75.323(b)(2)(i) of less than 1.5 percent is the limit established for persons to be allowed to occupy an area.

Paragraph (a)(2) would require that chemical scrubbing or other effective methods be provided to maintain the average carbon dioxide concentration in the occupied structure at 1.0 percent or less with excursions not to exceed 2.5 percent. The provision addresses the harmful effects of carbon dioxide, a natural asphyxiant produced through human respiration. To prevent the accumulation of harmful concentrations of carbon dioxide, scrubbing systems have been developed to chemically absorb the carbon dioxide. Carbon dioxide scrubbing systems are described as active or passive. Passive systems rely solely on natural air currents for the air to react with the chemical bed. Passive systems chemicals are usually packaged in curtains that are suspended in the refuge chamber environment. Active systems were designed to increase efficiency of CO₂ scrubbing systems. This is accomplished by forcing the air through the chemical bed by fans or compressed air. The recommended average carbon dioxide concentration came from the NIOSH report.

Paragraph (b)(1) would require that chemicals used in harmful gas removal be contained such that when stored or used they cannot come in contact with persons. Because these harmful gas removal chemicals are caustic, they would need to be contained. One way of packaging these chemicals is in curtains or cartridges that are isolated so that contact with or exposure to the chemicals is prevented. MSHA does not condone the use of uncontained materials because of the caustic nature of these materials. Chemicals must be activated without compromising the packaging materials and exposing miners to chemical hazards.

Paragraph (b)(2) would require that each chemical used for removal of harmful gas be provided together with all materials, parts, or equipment necessary for its use. This requirement is proposed to expedite activation of the scrubbing system to reduce start-up time and make the system easy to use for the miner. The intent is to make the system as uncomplicated as possible, and to reduce harmful gases as soon as possible while ensuring everything necessary is provided. The harmful gas removal system should be designed on a per-miner incremental basis to make the system easily understood by miners.

Paragraph (b)(3) would require that each chemical used for removal of harmful gas be stored in an approved

container that is conspicuously marked with the manufacturer's instructions for disposal of used chemicals. The intent of this provision is to provide for appropriate containment during shipping and pre-activation storage. Approved containers would be considered those appropriate for pre-activation transport and storage in the mine environment as determined by generally accepted chemical industry practice. Disposal instructions are also to be provided to assure miners are not exposed or otherwise injured while handling chemicals. Activation instructions should also be provided on the container.

Paragraph (c) would require that each harmful gas removal component be inspected or tested to determine its ability to remove harmful gases. The functionality and efficiency of the gas removal components need to be verified.

Paragraph (c)(1) would require that the component be tested in a refuge alternative structure that is representative of the configuration and maximum volume from which the component is designed to remove harmful gases. The intent is to obtain data that is directly representative of how the components will perform in actual use. Data from small-scale tests or prototype testing would require interpretation along with making assumptions which introduces the potential for the measured performance not being representative of full-scale performance.

Paragraph (c)(1)(i) would require that the test include three sampling points located vertically along the centerlines of the length and width of the structure and equally spaced over the horizontal centerline of the height of the structure. There are to be a total of three sampling points equally spaced along the center length of the structure on the longitudinal (horizontal) centerline and located so as to provide an accurate representation of the gas concentration found in the middle of the structure as opposed to the ends, corners, top, sides, or bottom.

Paragraph (c)(1)(ii) would require that the structure be sealed airtight. The structure is to be airtight to prevent unintended atmosphere contaminants from entering into the structure and altering/interfering with the internal test atmosphere.

Paragraph (c)(1)(iii) would require that the operating gas sampling instruments be placed inside the structure and continuously exposed to the test atmosphere.

Paragraph (c)(1)(iv) would require that the sampling instruments

simultaneously measure the gas concentrations at the three sampling points. Gas sampling instruments must operate continuously at the three sampling points while measuring the gaseous concentration inside of the structure. The intent of simultaneously sampling is to determine the interior atmosphere at different locations at a given point in time, to eliminate any sampling variability introduced by sequential sampling, and to determine if a homogenous atmosphere is maintained throughout the refuge alternative.

Paragraph (c)(2) would require when testing the component's ability to remove carbon monoxide, the structure be filled with a test gas of either purified synthetic air or purified nitrogen that contains 400 ppm carbon monoxide. Refuge alternatives should be configured to ensure the air contained therein is normally isolated from the mine atmosphere which would negate the need to purge a refuge after an event. However, the concept of an airlock to provide a transition area into a breathable air zone, by its very nature, would possibly become contaminated after an event. In recognizing this, airlocks need the capability to remove contaminants or otherwise operated to ensure that contaminated mine atmosphere is prevented from migrating through the airlock into the breathable air refuge. The 400 ppm was selected based on safety considerations (ACGIH 400 ppm CO STEL limit) while also being able to determine multiple gas concentration level reductions of the gas purification/de-contamination system for the entire ingress/egress process at maximum occupancy.

Paragraph (c)(2)(i) would require that after a stable concentration of 400 ppm, ± 5 percent, carbon monoxide has been obtained for 5 minutes at all three sampling points, a timer be started and the structure shall be purged or CO otherwise removed. A uniform homogeneous atmosphere inside of the chamber containing a concentration of 400 ppm must be consistent for 5 minutes. After this is achieved, a timer will be started and the structure purged or CO otherwise removed to an acceptable concentration.

Paragraph (c)(2)(ii) would require that carbon monoxide concentration readings from each of the three sampling devices be recorded every 2 minutes. The intent is to have enough data points to have a valid test.

Paragraph (c)(2)(iii) would require that the time from the start of harmful gas removal until the readings of the three sampling instruments all indicate a carbon monoxide concentration of 25

ppm or less shall be recorded. The purpose for recording the time is to assure the time to remove the toxic gas and activate the refuge alternative is less than the time to deplete the life of the SCSR. All of the rated number of occupants need to be located safely inside the refuge alternative prior to depleting their SCSR air capacity.

Paragraph (d) would allow that alternate performance tests may be conducted if the tests provide the same level of assurance of the harmful gas removal component's capability as the tests specified in paragraph (c) of this section. Alternate tests shall be specified in the approval application. The intent of this statement is as a general protection clause. The applicant can perform other tests to assure the ability of these systems to remove harmful gases if the applicant can demonstrate that the same degree of protection is provided as the refuge alternative requirements. Alternate tests may be used if they are submitted to MSHA for approval and there is assurance that the capacity to remove harmful gas is adequate.

Section 7.509 Approval Markings

Paragraph (a) would require that each approved refuge alternative or component be identified by a legible, permanent approval marking that is securely and conspicuously attached to the component or its container. This requirement is necessary to assure that only approved materials and components are used in the refuge alternatives. The marking would be placed such that the marking will not be subject to damage or removal.

Paragraph (b) would require that each approval marking include the refuge alternative's and component's MSHA approval number and expiration date. This requirement is necessary to assure that only approved materials and components are used in the refuge alternatives.

Paragraph (c) would require that each refuge alternative structure provide a conspicuous means for indicating an out-of-service status, including the reason it is out of service. This requirement would assure the materials are able to be inspected and removed and replaced when needed.

Paragraph (d) would require that each airlock be conspicuously marked with the recommended maximum number of persons that can use it at one time. This requirement would assure the airlock is used as intended to allow safe passage of persons through the airlock and to prevent the contamination of the interior space atmosphere.

Section 7.510 New Technology

This proposed section would allow MSHA to approve a refuge alternative or a component that incorporates new knowledge or technology, if the applicant demonstrates that the refuge alternative or component provides no less protection than those meeting the requirements of this subpart. Recent innovative uses of commercially available technology to enhance mine safety have shown that, while the drawbacks are significant, credible scientific research supports the use of refuge alternatives. Refuge alternatives are technologically feasible in that they use commercially available technology and they can reasonably be integrated into mining operations considering specific physical characteristics of a mine. MSHA recognizes that using the refuge alternatives in low coal mines could be problematic. The Agency further recognizes that certain types of refuge alternatives may not be feasible in low coal mines. MSHA solicits comment from the public on the use of refuge alternatives in low coal mines. Please be specific in your response, including alternatives, rationale, safety benefits to miners, technological and economic feasibility, and data to support your comment.

B. Part 75 Safety Standards

Section 75.221 Roof Control Plan Information

Paragraph § 75.221(a)(12) would require that the operator describe the roof and rib support necessary for the refuge alternative in the roof control plan. Roof and rib falls could damage a refuge alternative and compromise its integrity. Humidity resulting from fires, vibrations, shock, and thermal effects are often associated with catastrophic events that may require the use of additional roof support for areas housing refuge alternatives. Due to the vital role of refuge alternatives in the event of an emergency, mine operators must plan for their location and assure that they are adequately protected from possible roof and rib falls. MSHA encourages the mine operator to prepare locations for refuge alternatives in advance. The additional steps to protect these units from roof and rib falls must be described in the roof control plan.

Section 75.313 Main Mine Fan Stoppage With Persons Underground

Paragraph 75.313(f) would require the use of intrinsically safe electrical components in a refuge alternative during fan stoppages underground. Mine explosions, mine fires, and coal bumps and bounces may compromise

the mine ventilation system resulting in a mine fan stoppage. A refuge alternative that is normally located in intake air may be exposed to a potentially explosive mixture of methane in the aftermath of a mine emergency. Like existing § 75.313(e), only intrinsically safe electrical components may be operated in a refuge alternative during fan stoppages.

Section 75.360 Preshift Examination

Paragraph 75.360(d) would require the person conducting the preshift examination to check the refuge alternative for damage, the integrity of the tamper-evident seal and the mechanisms required to activate the refuge alternative, and the ready availability of compressed oxygen and air. Refuge alternatives may be damaged by persons, mining equipment, or the mine environment. Compressed gas storage systems may leak. Due to the critical nature of refuge alternatives, each refuge alternative must be examined as part of the preshift examination. Visible damage to the refuge alternative and damage to the tamper-evident seal would be checked during the preshift examination. The preshift examination would reveal loss of compressed gas pressures, electrical charge, or communications system.

MSHA requests specific comments on the visual damage that would be revealed during the preshift examinations. The Agency is concerned with the feasibility and practicality of visually checking the status of refuge alternatives without having to enter the structure or break the tamper-evident seal. Please be specific in your response, regarding methods or alternatives, rationale, safety benefits to miners, technological and economic feasibility, and data to support your comment.

Section 75.372 Mine Ventilation Map

Paragraph § 75.372(b)(11) would require that each refuge alternative be shown on the mine ventilation map. Showing the location of the refuge alternatives in relationship to the mine ventilation system facilitates an evaluation of the effectiveness of a potential refuge alternative location. The location of the refuge alternative in relationship to potential hazards such as seals and oil and gas wells will be evaluated during the ventilation map review. The mine ventilation map is often referenced during mine rescue efforts. Plotting refuge alternatives on the ventilation map could aid decisions during rescue operations.

Section 75.1200 Mine Map

Paragraph § 75.1200(g) would require that the mine map show the locations of refuge alternatives. The existing § 75.1200 mine map forms the basis for decisions made during mine rescue efforts. Plotting refuge alternatives on the mine map allows the mine rescue planners to consider where miners may be sheltered after a mine emergency. This information will be critical to mine rescue efforts in locating trapped personnel.

Section 75.1202-1 Temporary Notations, Revisions, and Supplements

Paragraph § 75.1202-1(b)(4) would require that refuge alternatives that are moved be shown on the mine map with temporary notations. During an emergency, mine maps form the basis for mine rescue efforts. Locations of refuge alternatives are critical to decisions made in rescue efforts and must be kept current on the mine map.

Section 75.1500 Emergency Shelters

MSHA proposes to remove and reserve this section and delete the existing language of § 75.1500. This section would be replaced with specific requirements for refuge alternatives in existing §§ 75.1501, 75.1502, 75.1504, and 75.1505 and new §§ 75.1506, 75.1507, and 75.1508.

Section 75.1501 Emergency Evacuations

Paragraph § 75.1501(a)(1) would require that the responsible person know the locations of refuge alternatives. Under the proposal, the designated responsible person must have current knowledge of the locations, types, and capacities of refuge alternatives to make informed mine evacuation decisions in the event of an emergency.

Section 75.1502 Mine Emergency Evacuation and Firefighting Program of Instruction

Paragraph § 75.1502(c)(3) would be a new provision and require that instruction in the activation and use of refuge alternatives be added to the mine emergency evacuation program of instruction. This proposal would assure that miners are able to effectively activate and use refuge alternatives in case of an emergency. Existing § 75.1502(c)(3) would be redesignated as paragraph (c)(4). Paragraph (c)(4)(vi) would be new and require that the program of instruction include a scenario for using refuge alternatives. Although MSHA expects that miners would occupy refuge alternatives only if no other options are available, they need

to be aware of the circumstances that may require this difficult decision.

Existing § 75.1502(c)(7) would be redesignated as paragraph (c)(8) and would require that the program of instruction include the locations of refuge alternatives. The locations of refuge alternatives may be critical for miners who are involved in mine emergencies.

Paragraph § 75.1502(c)(10) would be new and require a summary of the procedures related to constructing and activating refuge alternatives. This summary information would be necessary for miners during training. The summary would assure that all critical steps of constructing and activating the refuge alternative are reviewed in training.

Paragraph § 75.1502(c)(11) would be new and require a summary of the procedures related to refuge alternative use. This summary information would be necessary for the miners to review during training. The summary would assure that all critical steps of using the refuge alternative are reviewed in training.

Section 75.1504 Mine Emergency Evacuation Training and Drills

The best refuge technology, equipment and emergency supplies are of little benefit if they are misused or not used at all. In its report, NIOSH stated that—

The potential of refuge alternatives to save lives will only be realized to the extent that mine operators develop comprehensive escape and rescue plans, which incorporate refuge alternatives.

Emergencies can result in miner disorientation and panic. Using sound judgment in a given emergency can be critical for survival. MSHA and NIOSH have found that training is necessary to instill the discipline, confidence, and skills necessary to survive a mine emergency. This proposal would improve miner training and help assure that underground coal miners know when to use a refuge alternative and know how to use the various components to sustain life until rescued. During each quarterly drill, miners would be required to locate the refuge alternatives and review the activation and use of the refuge alternative for the area where the miners normally work and travel during each quarterly drill. Refuge alternatives expectations training would emphasize that miners first try to evacuate the mine and that refuge alternatives are a haven of last resort when escape is impossible.

MSHA has identified problems related to skill degradation in

emergency evacuations of mines. In a series of studies from 1990 through 1993, the U.S. Bureau of Mines, University of Kentucky, and MSHA researchers measured skills degradation. In one study, the proficiency rates dropped about 80 percent in follow-up evaluations conducted about 90 days after training. MSHA recognizes that with any non-routine task, such as constructing, activating, and using a refuge alternative, knowledge and skill diminish rapidly. In another study⁴ researchers concluded that “companies should adopt a hands-on training protocol.” The proposed rule reflects MSHA’s conviction that frequent and effective refuge alternative training would be necessary to assure miner proficiency.

Proposed § 75.1504(b)(3)(ii) and (4)(ii) would require that in quarterly training and drills, miners locate refuge alternatives. This knowledge would be critical to miners in a mine emergency.

Paragraph § 75.1504(b)(6) would require a review of the checklist for constructing and activating the refuge alternatives and components. MSHA proposes that quarterly training and drills includes this training as recognition that with any non-routine task, such as activating and using a refuge alternative, knowledge and skill diminish rapidly.

Miners need to be aware of how to construct and activate a refuge alternative safely. The information in the proposed checklist would be used in the training and should include all of the step-by-step procedures easily understood by the miners to perform these tasks. For easy availability, mine operators should consider laminated cards or other equally durable forms of the checklist for use by miners.

Paragraph § 75.1504(b)(7) would require a review of the procedures related to use of refuge alternatives and components. Miners need to be aware of how to use a refuge alternative safely in the event of an emergency. MSHA recognizes that manufacturers generally provide information on the safe use of their products. This information would be used in training and should include the step-by-step procedures necessary to use refuge alternatives and should be easily understood by the miners. This information will be critical for miners who need to spend a sustained period in a refuge alternative.

MSHA’s Office of Educational Policy and Development will assist mine operators with job task analysis and training materials such as videos to improve the quality and effectiveness of

programs of instruction. NIOSH is developing a refuge alternative training program that is expected to be available by the end of 2008. MSHA plans to include a delayed effective date in the final rule to allow mine operators to develop Emergency Response Plans and training plans and submit them to MSHA.

Proposed § 75.1504(c)(3) would require annual expectations training in construction, where applicable, activation, and use of refuge alternatives and components. Under the existing standard, each miner must participate in expectations training over the course of each year. This training includes donning and transferring self-contained self-rescuers (SCSRs) in smoke, simulated smoke, or an equivalent environment. The training also requires breathing through a realistic SCSR training unit that provides the sensation of SCSR airflow resistance and heat.

Under the proposal, miners would have to be trained in construction, where applicable, activation, and use of refuge alternatives similar to those in use at the mine, including activation and operation of component systems; and instruction on when to use refuge alternatives during a mine emergency. Refuge alternatives expectations training would emphasize that miners first try to evacuate the mine and that refuge alternatives are a haven of last resort when escape is impossible. The proposed expectations training would require an annual realistic experience of constructing where applicable, activating, and using a refuge alternative in a simulated emergency situation. The proposed refuge alternative expectations training could be combined with the existing expectations training.

Expectations training will be essential to reduce the level of panic and anxiety associated with the use of refuge alternatives. NIOSH supports expectations training to reduce the level of panic and anxiety associated with the use of refuge alternatives.⁵

Properly constructing and activating a refuge alternative can be a relatively complex procedure that must be done correctly to establish a breathable air environment in a smoke-filled mine. The operation of most refuge alternatives requires periodic monitoring and adjustments to the gases to assure a breathable atmosphere. Failure to correctly perform these tasks may imperil the lives of miners within the refuge alternative. MSHA envisions the use of a modified version of the

⁴The U.S. Bureau of Mines (Vaught *et al.*, 1993).

⁵NIOSH, Research Report on Refuge Alternatives for Underground Coal Mines (2007), p. 14.

refuge alternative in the mine for this training purpose.

The miners would have to construct the refuge alternative, if applicable, activate the refuge alternative, purge the atmosphere, and turn on the breathable air and maintain a viable atmosphere. Although MSHA does not specify a minimum time for this annual training exercise, the duration should be sufficient to allow miners to perform all of the necessary tasks and give them a realistic experience of using the refuge alternative. The Agency would require that this training expose the miners to the expected heat and humidity conditions in the refuge alternative. MSHA does not expect that this training would include the actual use of oxygen and harmful gas removal components; these actions may be performed with compressed air and simulated removal components. The training must also emphasize that, in the event of an emergency, miners should first try to evacuate the mine and that refuge alternatives are the option of last resort when escape is impossible.

MSHA solicits comment from the public on the Agency's proposed approach to expectations training. The Agency is interested in comment on its proposed strategy and the proposed elements of training. Please be specific in your response, including alternatives, rationale, safety benefits to miners, technological and economic feasibility, and data to support your comment.

Proposed § 75.1504(c)(4), redesignated from existing § 75.1504(c)(3), would require that a miner participate in expectations training within one quarter of being employed at the mine. MSHA would expect that any new miner would be given the expectations training within this timeframe. This could be accomplished during new miner or newly employed miner training.

Section 75.1505 Escapeway Maps

Proposed § 75.1505(a)(3) would require that the escapeway map be posted or readily accessible at each refuge alternative. The location of refuge alternatives relative to the escapeway may be vital to the survival of miners during mine emergencies. Escapeway maps form the basis for decisions made during mine evacuation. Having escapeway maps on hand for miners would facilitate important decisionmaking.

Proposed § 75.1505(b) would require that escapeway maps include the locations of refuge alternatives, and that any change be shown on the map. Escapeway maps form the basis for mine rescue efforts. Locations of refuge alternatives are critical to decisions

made during rescue efforts and must be kept current on the escapeway map.

Section 75.1506 Refuge Alternatives

This section would require that mine operators provide refuge alternatives to accommodate all persons working underground and specify criteria for the use and maintenance of refuge alternatives. MSHA believes that refuge alternatives will provide a refuge of last resort for miners unable to evacuate the mine during an emergency. By providing the essential elements of survival (breathable air, water, food, communications, etc.) the likelihood of miners surviving an inhospitable post-emergency environment would be increased. MSHA realizes that a flexible approach to providing refuge alternatives is necessary due to the wide range of mining conditions (seam height, pitch, mining method, and mine layout) that exist in underground coal mines. To address these widely-varying conditions, MSHA has taken a performance-based approach to refuge alternatives. For example, the refuge alternative has to provide for essential needs of occupants, but the proposal does not require specific methods, equipment, or devices.

Paragraph (a) would require each operator to provide refuge alternatives with sufficient capacity to accommodate all persons working underground. MSHA believes that escape to the surface is more protective than using a refuge alternative. However, when escape is impossible, a refuge alternative must be available for all persons underground. MSHA recognizes that the highest concentration of miners is near a working section. Toward this end, refuge alternatives would need to be located to accommodate the miners at or near a working section. Refuge alternatives would also be required for miners working in outby locations. The proposed rule would not require refuge alternatives for miners who can reach a surface escape facility within 30 minutes. Under the proposal, mines in which all miners would be within 30 minutes of the surface or a surface escape facility would not have to have a refuge alternative.

Paragraph (a)(1) would require at least 15 square feet of usable floor space and at least 60 cubic feet of usable volume per person. This proposed requirement of interior floor space and volume is necessary to provide adequate room for miners during any period of time confined in the refuge alternative. MSHA is interested in practical floor space and volume requirements for mining operations. The proposed requirements are intended to mean that

the miner would have this space available to them without being affected by any other factors, e.g., stored items. MSHA intends that space requirements would not include airlock space. The NIOSH report recommended key design values of 15 square feet of floor space and 85 cubic feet volume per miner. However, in its report, NIOSH stated that these recommendations were not to be considered absolute. MSHA recognizes that achieving the volume per miner in refuge alternatives for low coal mines could be problematic.

To lie down, miners would require a certain length and width. For example, 15 square feet would be provided by a space 6 feet long and 2.5 feet wide. This space would have to be 4 feet high, which would give each miner 60 cubic feet of volume. These dimensions would serve as a minimum for the miner during the periods of confinement. In lower mining heights, the 60 cubic feet of volume may need to be gained by increasing the floor space. For example, 60 cubic feet of volume in a refuge alternative 2.5 feet high would require 24 square feet of floor space, which could be provided by a space 6 feet long and 4 feet wide.

MSHA solicits comment from the public on these proposed values for floor space and volume, particularly in low mining heights. Please be specific in your response, including alternatives, rationale, safety benefits to miners, technological and economic feasibility, and data to support your comment.

Miners would need to have additional space to perform duties such as attending to the harmful gas removal components, performing gas tests or attending to basic needs—drinking, eating, and using the sanitation facilities—and providing for injured miners. Curtains suspended as part of a passive system to remove carbon dioxide should be considered when determining volume.

Another important factor in the volume design is the need to control the apparent temperature in the interior space of the refuge alternative. Larger volumes are more effective at dissipating heat because of increased surface area.

Paragraph (a)(2) would require that refuge alternatives for working sections accommodate the maximum number of persons that can be expected on or near the section at any time. The refuge alternatives for the working sections would need to include space to accommodate all persons working near the section. It should accommodate all miners that join those working at the section during a shift change. For example if a mine has a practice of "hot

seat” change-out of crews at the face, the refuge alternative would need to accommodate both crews; any other persons who would routinely work near the section, such as managers, surveyors, vendors, and state and Federal inspectors. Mines that have just begun development in which the working section is within 30 minutes travel time (walking or crawling) from a portal or surface escape facility would not be required to have a refuge alternative.

Paragraph (a)(3) would require that refuge alternatives for outby areas accommodate persons assigned to work in the outby area. The proposed rule would not require that outby refuge alternatives be able to accommodate all persons working inby its location. Refuge alternatives are used to shelter in-place only when evacuation is not feasible. Under the proposal, outby refuge alternatives would have to accommodate supply persons, locomotive operators, examiners, state and Federal inspectors, pumpers, maintenance persons, belt persons, and other persons who may be working in the outby areas. A refuge alternative must be sufficient to maintain the miners who can reasonably be expected to use it.

MSHA solicits comment from the public on the Agency’s proposed approach to refuge alternative capacity. Please be specific in your response, including alternatives, rationale, safety benefits to miners, technological and economic feasibility, and data to support your comment.

Paragraph (b) addresses proposed locations for placement of refuge alternatives. Refuge alternatives would have to be near locations where miners are typically stationed. MSHA’s experience shows that the highest concentration of miners underground will be at the working section, therefore, a refuge alternative capable of accommodating these miners must be positioned close to the working section.

Paragraph (b)(1) would require that refuge alternatives be located between 1,000 feet and 2,000 feet from the working face and from areas where mechanized mining equipment is being installed or removed. MSHA is proposing these distances to accommodate the periodic advancement of the working section, to recognize the potential for damage from an explosion, and to limit travel time from the working section to the refuge alternative.

In its report, NIOSH recommended that the refuge alternative be located no further from the working face than the distance a miner could reasonably travel

in 30 to 60 minutes under expected travel conditions. NIOSH also recommended that the refuge alternative be located at least 1,000 feet from the working face to limit damage from explosions at the working face. In its report, NIOSH recognized that establishing the exact location is problematic and indicated it would appear advantageous to place the refuge alternative as close to the face as possible to minimize the time and effort required for miners to reach it. NIOSH added that locating the refuge alternative closer to a possible explosion source will increase the chance it is damaged by overpressure or flying debris from the initial explosion. NIOSH analyzed past disasters as well as various probable scenarios. NIOSH further noted that lower seam heights, difficult bottom conditions, and the presence of smoke, among other factors, would affect travel times. NIOSH went on to say that,

[n]onetheless, the experience of studying mine explosions at NIOSH’s Lake Lynn experimental mine suggests that refuge chambers should normally be located a minimum of 1000 feet from the working face and could be as far as 2000 feet * * *.

This NIOSH reasoning is consistent with MSHA’s rationale for at least 1,000 feet, which is based on explosion pressure.

West Virginia requires “An emergency shelter/chamber shall be maintained within one thousand (1,000) feet of the nearest working face in each working section.” Illinois requires that “Rescue chambers must be provided and located within 3,000 feet of each working section of a mine, in accordance with a plan submitted by an operator and approved by the Mining Board.” The proposal would require that refuge alternatives be located between 1000 feet and 2000 feet from the working face and from locations where mechanized mining equipment is being installed or removed. As an alternative to the proposed requirement that refuge alternatives be located between 1,000 feet and 2,000 feet from the working face and from areas where mechanized mining equipment is being installed or removed, MSHA is considering including the following alternative in the final rule. As an alternative to the specific requirements in the proposal for locating refuge alternatives in inby areas, MSHA is proposing to allow, depending on mine specific conditions, refuge alternatives with boreholes to be located up to 4,000 feet from the working face. MSHA solicits comments on this proposed alternative to locating refuge

alternatives in inby areas. MSHA also solicits comments on the proposed requirement that refuge alternatives be located between 1,000 feet and 2,000 feet from the working face and from areas where mechanized mining equipment is being installed or removed. Please be specific in your response, including alternatives, rationale, safety benefits to miners, technological and economic feasibility, and data to support your comments.

Paragraph (b)(2) would require that refuge alternatives be spaced within one-hour travel distances in outby areas where persons work such that persons in outby areas are never more than a 30-minute travel distance from a refuge alternative or safe exit. Proposed paragraph (b)(2) further provides that the operator may request and the District Manager may approve a different location in the Emergency Response Plan (ERP). The operator’s request would have to be based on an assessment of the risk to persons in outby areas, considering the following factors: Proximity to seals; proximity to potential fire or ignition sources; conditions in the outby areas; location of stored SCSRs; and proximity to the most direct, safe, and practical route to an intake escapeway. This approach is generally consistent with NIOSH’s recommendations. Persons who work in outby areas may need to travel more than 30 minutes to reach a refuge alternative. They should be provided with additional SCSRs to assure that they can reach a refuge alternative from outby areas.

In 2006, MSHA examined how far miners could travel during 30 minutes for the Emergency Mine Evacuation final rule (71 FR 71430, December 8, 2006). Existing § 75.1714–4(c)(2) provides two methods for determining the 30-minute spacing of SCSR storage locations in escapeways. The first method, in existing § 75.1714–4(c)(2)(i), requires the mine operator to calculate the spacing based on a sample of typical miners walking a selected length of each escapeway. A sample of typical miners is a cross-section of the population of all miners who would have to evacuate the mine and use the SCSRs stored in the escapeways. In general, operators using this option must use a sample that includes miners of various ages, weights, levels of physical fitness, and smoking habits; and a selected portion of the escapeway that reflects entry height, slope, and underfoot conditions representative of the entire escapeway.

The second method, in existing § 75.1714–4(c)(2)(ii), requires a mine operator to use a table that specifies maximum SCSR storage location

spacing based on average entry height. This table is based on statistical data collected from the 1997 MSHA–NIOSH study.⁶ The mine operator may use the SCSR storage location spacing specified in the following table, except for escapeways with uphill grades over 5 percent.

Average entry height	Maximum distance between SCSR storage locations (in feet)
<40 in. (Crawl)	2,200
>40–<50 in. (Duck Walk)	3,300
>50–<65 in. (Walk Head Bent)	4,400
>65 in. (Walk Erect)	5,700

For spacing refuge alternatives in outby areas, the mine operator may choose either of the above methods.

MSHA solicits comment from the public on the Agency's proposed approach to locating refuge alternatives in outby areas, including the minimum and maximum distances. Please be specific in your response, including alternatives, rationale, safety benefits to miners, technological and economic feasibility, and data to support your comment.

Paragraph (c) would require that roof and rib support for the refuge alternative locations be specified in the mine's roof control plan. The proposed provision addresses hazards from falling material, which may compromise the integrity of the refuge alternative. MSHA understands that no currently available refuge alternatives can withstand significant roof and rib falls. Humidity resulting from fires, vibrations, shock, and thermal effects are often associated with catastrophic events that may require the use of additional roof support for areas housing refuge alternatives.

Due to the vital need for refuge alternatives to serve their intended purpose, mine operators must assure that they are adequately protected from roof and rib falls. MSHA encourages mine operators to plan and prepare locations for refuge alternatives in advance. The necessary steps to protect refuge alternatives from roof and rib falls must be described in the roof control plan. MSHA anticipates that in a significant number of instances, operators will need to provide supplemental roof and rib support to protect the refuge alternative.

Paragraph (d) would require that the operator protect the refuge alternative

and contents from damage during transportation and storage. The proposed provision is intended to assure that care will be taken to avoid damage to the refuge alternative at all times. Mine operators need to assure that miners follow all safe procedures when transporting a refuge alternative from one location to another. Attention needs to be paid to procedures such as the use of proper connections for transportation and devices such as tow bars, clevises and hitches. Refuge alternatives that have materials and components stored on transportable equipment, such as a skid, would require care to assure that they are not damaged while in storage.

Paragraph (e) would require that a refuge alternative be removed from service if examination reveals damage or tampering that could interfere with the functioning of the refuge alternative or any component. Refuge alternatives may be damaged by persons, mining equipment or the mine environment. The proposed rule would require that damage must be evaluated and any indication that it interferes with the functioning of the refuge alternative or its components would require that the refuge alternative be immediately removed from service. For example, if examination reveals a leak in a compressed gas storage system, the refuge alternative would have to be removed from service since it would be unable to provide breathable air in an emergency.

Paragraph (e)(1) would require the operator to withdraw all persons from the area serviced by the refuge alternative if the refuge alternative is removed from service, except those persons referred to in § 104(c) of the Mine Act. Under the proposal, if an inoperable or damaged refuge alternative would not provide the protection intended, all persons would have to be withdrawn from the area serviced by the refuge alternative. This would not include persons performing the repairs, who should be provided with additional SCSRs to assure that they can reach another refuge alternative.

Paragraph (e)(2) would require that refuge alternative components removed from service be replaced or be repaired in accordance with manufacturer's specifications. This proposed provision would require mine operators to maintain the refuge alternative in its approved condition by using approved components and repairing it in accordance with the manufacturer's specifications. Miners would be provided the protection afforded by approved refuge alternatives at all times.

Paragraph (f) would require that, at all times, the site and area around the refuge alternative be kept clear of machinery, materials, and obstructions that could interfere with the activation or use of the refuge alternative. Under the proposal, refuge alternative locations would be easily accessible in that the areas around them would be maintained without obstructions to hinder access to the refuge alternative or to allow the refuge alternative to expand or be constructed to create the secure space. The proposal is necessary to assure the availability and survivability of the refuge alternative and its occupants.

Paragraph (g) would require that each refuge alternative be conspicuously identified with a sign or marker. The proposal would provide a quick way for persons not using the lifeline system to easily locate the refuge alternative in an emergency.

Paragraph (g)(1) would require that a sign or marker made of reflective material with the word "Refuge" be posted conspicuously at each refuge alternative. Reflective material greatly increases the visibility of these signs. This requirement is the same as the existing § 75.1714–4(f), which requires reflective signs on SCSR storage locations.

Paragraph (g)(2) would require that a directional sign, made of reflective material, be posted leading to each refuge alternative location. Miners may not be located in escapeways when an emergency occurs. For these miners, a clear system of signs may be critical during an emergency. Persons traveling in adjacent entries would have signs directing them to the refuge alternative.

Section 75.1507 Emergency Response Plan; Refuge Alternatives

Proposed § 75.1507 would require mine operators to include refuge alternative provisions in their Emergency Response Plan (ERP). Section 2 of the MINER Act requires each underground coal mine operator to develop and adopt an emergency response plan.

Paragraph (a)(1) would require that the mine operator specify the types of refuge alternatives and components used in the mine. There are three types of refuge alternatives envisioned in the proposed rule. The proposed rule would provide flexibility in the type of refuge alternatives that will meet the requirements. The type of alternative is not specific to the seam heights.

One type is a pre-fabricated self-contained unit. The unit is portable and may be used in outby applications as

⁶MSHA–NIOSH study, "The Oxygen Cost of a Mine Escape" (Kovac, Kravitz, and Rehak, 1997).

well as near the working section. This unit has all the components built-in.

A second type is constructed in place. Typically, the components of this unit are placed in a cross-cut or dead-end entry and stoppings are built to create a secure area with an isolated atmosphere. The components, including breathable air, removal of harmful gases, and air monitoring should be approved components and placed such that they are ready to be activated when miners reach the secure area. The stoppings and doors would have to be designed to resist a 15 psi overpressure. This refuge alternative would typically be used outby. If used near the working section, the stoppings could be removed to allow the components to be moved periodically to the next location and new stoppings would have to be built. A method and materials, if needed, would be necessary to provide breathable air for the miners while this type is being moved.

A third type uses materials pre-positioned for miners to construct a secure area with an isolated atmosphere. The materials and components are portable and used to construct a secure area following an accident. The components, including breathable air, removal of harmful gases, and air monitoring should be approved components and placed such that they are ready to be activated when miners reach the secure area. MSHA envisions that mine operators using this type would have all materials and components in a protected self-contained unit ready to be activated. The proposed rule would allow for the refuge alternative materials and components to be placed at locations such that, following an accident, a secure space could be constructed with the materials and the breathable air component would be readily activated within the secure space to create an isolated atmosphere. This provision would require the operator to provide details of this refuge alternative in the ERP. This alternative would require the operator to have the materials situated in a safe location and to move them as necessary to be located near the working section as required. The provisions are necessary to assure the availability and survivability of the structure and the occupants.

As appropriate, MSHA would approve the refuge alternatives and components. The pre-fabricated self-contained unit would need to be approved under Part 7, including structural, breathable air, air monitoring, and harmful gas removal components of the unit. The structural components of units constructed in

place and with materials pre-positioned would be approved by the District Manager and as appropriate, would be inspected during the enforcement process. The breathable air, air monitoring, and harmful gas removal components of these units would be approved under Part 7.

Paragraph (a)(2) would require that the ERP include procedures for maintaining the approved refuge alternatives and components. This proposal would assure that miners are able to maintain or correct any problems that may develop during storage or use of the refuge alternatives. Procedures should include maintenance checks and replacement schedules for components.

Paragraph (a)(3) would require that the rated capacity of each refuge alternative, the number of persons expected to use each refuge alternative, and the duration of breathable air provided per person by the approved breathable air component of each refuge alternative be defined in the ERP. The ERP would need to state specifically that the refuge alternatives can support a specified number of persons for a designated length of time. This information assists MSHA in evaluating whether the refuge alternative or component meets the requirements for sustaining persons for 96 hours. MSHA solicits comments from the public on the 96-hour duration. Please be specific in your response, including alternatives, rationale, safety benefits to miners, technological and economic feasibility, and data to support your comment.

Paragraph (a)(4) would require that the ERP include the method for providing breathable air and removing carbon dioxide with sufficient detail of the component's capability to provide breathable air over the duration stated in the approval. For example, the Agency recognizes that different types and combinations of equipment and methods from several manufacturers may be used to provide for breathable air and for the removal of carbon dioxide. This information assists MSHA in evaluating whether the breathable air meets the requirements for sustaining persons for 96 hours.

Paragraph (a)(5) would require that the ERP include methods to provide ready backup oxygen controls and regulators. The term "ready" is meant to be pre-connected valves and regulators. Redundant oxygen control valves and regulators are necessary to assure that miners will always have breathable air available in case of component failures.

Paragraph (a)(6) would require that the ERP include the methods for providing an airlock and methods for providing breathable air in the airlock.

Refuge alternatives that require an airlock would be required to provide breathable air in the airlock at all times. However, when miners enter the airlock, it is necessary to monitor and provide purge air to remove any contaminants and minimize contamination inside the refuge alternative. Sufficient purge air is necessary to clear the airlock of contaminants.

Paragraph (a)(6) would require that the ERP specify that the airlock is capable of maintaining breathable air, except where adequate positive pressure is maintained. The ERP should provide specific information regarding how the airlock will provide and maintain breathable air. Purging or other effective methods would be necessary, within 20 minutes of miners activating the refuge alternative, for the airlock to dilute the carbon monoxide concentration to 25 ppm or less and the methane concentration to 1.5 percent or less as persons enter. The proposed rule includes an exception for an airlock if the refuge alternative is capable of maintaining adequate positive pressure. The positive pressure would prevent outside air from contaminating the refuge alternative. The proposal would assist MSHA in evaluating whether the airlock would function effectively.

Paragraph (a)(7) would require that the ERP include methods for providing sanitation facilities. The ERP should contain information on containing waste and eliminating objectionable odors. The ERP should also include information that the sanitation facilities are adequate for the specified number of persons and where it is to be located. The proposal would assist MSHA in determining that the refuge alternative includes an adequate means for containing waste.

Paragraph (a)(8) would require that the ERP include the methods for harmful gas removal. Sufficient purge air is necessary to clear the refuge alternative of smoke and carbon monoxide unless the design of the refuge alternative prevents the infiltration of these combustion products. Information on harmful gas removal is essential for MSHA to determine the ability of the refuge alternative to sustain occupants for 96 hours. The purpose of this component is primarily to remove carbon dioxide exhaled by the occupants. MSHA also intends that this component be capable of removing toxic and irritant gases, fumes, mists, and dusts that may enter the refuge alternative through the airlock.

Paragraph (a)(9) would require that the ERP include methods for monitoring

gas concentrations, and charging and calibrating equipment. This information is essential for MSHA to determine that persons inside the refuge alternative will be aware of the concentrations of carbon dioxide, carbon monoxide, methane, and oxygen inside and outside the structure, including the airlock. This information assists MSHA in evaluating whether the air-monitoring component meets the requirements for sustaining persons for 96 hours. Different types and combinations of instruments may be used to comprise an air-monitoring component. The proposal allows MSHA to determine that discrete components are appropriate, available, and functional for monitoring breathable air.

MSHA believes that a properly designed system would control gas concentrations inside the refuge alternative. The intent of this provision is that detectors would be used to periodically check and provide a means of increasing the miner's awareness of gas concentrations. Instruments that require fresh air for initial startup would not be appropriate to be stored for use in refuge alternatives. If the battery life of the instruments is not sufficient for 96 hours of monitoring then multiple detectors would be required.

Paragraph (a)(10) would require that the ERP include the method to provide lighting sufficient to perform tasks. Sufficient light is essential to allow persons to read instructions and warnings, as well as reading gages, operating gas monitoring detectors, and other activities related to the operation of the refuge alternatives and the needs of the occupants. Lighting that generates significant heat, or requires continual manual power for light generation, would be unacceptable for use in a refuge alternative.

Paragraph (a)(11) would require mine operators to affirmatively state in the ERP that the locations are suitable for refuge alternatives. The proposed rule would require that refuge alternatives be protected from known hazards in the coal mine. Refuge alternatives would also need to be located so that they are easily accessible. The proposed rule would require that refuge alternatives be placed at locations that do not have obstructions to future physical dimensions of the refuge alternative. The provisions are necessary to assure the availability and survivability of the structure and the occupants.

Paragraph (a)(11)(i) and (ii) would require that the ERP specify that refuge alternatives are not within direct line of sight of the working face and, where feasible, not in areas directly across from, nor closer than 500 feet radially from, belt drives, take-ups, transfer

points, air compressors, explosive magazines, seals, entrances to abandoned areas, and fuel, oil, or other flammable or combustible material storage. The proposed rule addresses the potential damage from a working face explosion and, additionally, the potential of a fire at certain areas or equipment. Locating refuge alternatives away from these areas would minimize the heat or explosive forces that could occur and affect the safety of persons in the refuge alternative.

NIOSH recommended that refuge alternatives be positioned in crosscuts rather than entries, or located in dead-end cuts to decrease the possibility of damage from overpressure or flying debris from an explosion. NIOSH also recommended that refuge alternatives be located away from potential sources of fires, such as belt drives. NIOSH further recommended that, whenever practical, the refuge alternative should not be located in nor off of track entries nor within approximately 1,000 feet of any mine seal.

This proposal includes locations for refuge alternatives that are consistent with NIOSH's recommendations. The Agency would consider exceptions to this requirement when it is not feasible to locate the refuge alternative according to this provision.

Proposed paragraph (b) contains provisions for ERPs for refuge alternatives constructed in place. The proposal would require that the ERP specify that stoppings and doors are designed to resist 15 psi overpressure.

Paragraph (b)(1) would require that the ERP include information on breathable air components approved by MSHA. Breathable air is intended to protect miners from injury or death from a contaminated atmosphere. MSHA is proposing that breathable air contain an oxygen concentration between 18.5 and 23 percent and a carbon dioxide concentration not exceeding a 1.0 percent time-weighted average and that at no time exceeds 2.5 percent for any 24-hour period. These concentrations are consistent with NIOSH's recommendation. Breathable air delivered from fans or compressors through pipes or air lines would need to meet the requirements of Part 7.

Paragraph (b)(2) would require that the ERP specify that the refuge alternative is capable of withstanding exposure to a flash fire of 300 °F for 3 seconds and a pressure wave of 15 psi overpressure for 0.2 seconds. Because the stoppings must protect the components of the refuge alternative and persons inside, the stoppings must be able to withstand both flash fires and explosive overpressures.

Proposed paragraph (c) contains provisions for ERPs for refuge alternatives consisting of materials pre-positioned for miners to construct a secure space with an isolated atmosphere.

Paragraph (c)(1) would require that the ERP specify the means to store and protect materials from being damaged when moved. The operator would be required to provide details of how the components are placed on a transportation device to provide security, transportation readiness and component integration to assure this alternative will be available when needed and readily constructed and activated. The materials should be arranged together and protected from potential damage when moved.

Paragraph (c)(2) would require that the ERP specify that the refuge alternative can withstand exposure to a flash fire of 300 °F for 3 seconds and a pressure wave of 15 psi overpressure for 0.2 seconds prior to construction and activation. Because this type of refuge alternative is constructed following an accident, materials and components would be stored in a crosscut or dead-end entry until needed. The materials and components must be stored in a container that will withstand a flash fire of 300 °F for 3 seconds and a pressure wave of 15 psi overpressure for 0.2 seconds so that the components would operate as intended and would be available and functional when needed.

Paragraph (c)(3) would require that the ERP specify the method for assuring that the refuge alternative could be constructed and functional in 10 minutes. Under the location requirements for refuge alternatives, miners would never be more than 30 minutes from either the portal or a refuge alternative. In the event of an accident, a miner with only one SCSR would have 30 minutes to reach the portal or a refuge alternative. The proposal would allot 10 minutes to establish a barrier between the interior and exterior atmospheres. The remaining 20 minutes of breathable air provided by the SCSR would allow time for purging the refuge alternative to establish a breathable atmosphere.

Paragraph (c)(4) would require that the ERP specify the method for having all components ready to be activated and used. Components include breathable air, harmful gas removal, air monitoring, communication, first aid, food and water, and sanitation. The proposal would assist MSHA in determining that components comprise a complete functional refuge alternative.

Paragraph (c)(5) would require that the ERP specify the means to assure that

the initial air quality is breathable once the refuge alternative is constructed. This refuge alternative is built following an accident, which could produce smoke and contaminated air in the area where the refuge alternative is constructed. Therefore, the atmosphere may be contaminated and would need purging or other effective methods as necessary, within 20 minutes of miners activating the refuge alternative, for the airlock to dilute the carbon monoxide concentration to 25 ppm or less and the methane concentration to 1.5 percent or less as persons enter. An operator would need to provide sufficient compressed air to purge the refuge alternative to establish a breathable atmosphere.

Paragraph (d) contains provisions for ERPs if the refuge alternative would only sustain persons for 48 hours. It would require that the ERP specify that advance arrangements have been made to assure that persons who cannot be rescued within 48 hours will receive additional supplies to sustain them until rescue. The basis for the proposal is MSHA's existing PIB on breathable air.

Paragraph (d)(1) would require that the advance arrangements specified in the ERP include pre-surveyed areas for refuge alternatives with closure errors of less than 20,000:1. The proposed provision is intended to assure that the survey that is done on the surface and the one performed underground are closed. The surface survey could be done with global positioning satellite equipment. When a survey connects back to itself, it is called a loop. The loop in this provision would begin with the surface survey of the location above the location of the refuge alternative and along a route to the underground location of the refuge alternative and back to the beginning survey location on the surface. If a loop is surveyed perfectly, the survey should come back to the exact point at which it started. If the loop does not come back to the exact starting point, it is called a closure error. Closure errors indicate that some or all of the survey measurements within a loop have errors. This provision assures accuracy in getting the borehole to the correct location underground.

Paragraph (d)(2) would require that the advance arrangements specified in the ERP include an analysis to indicate that the surface terrain, the strata, the capabilities of the drill rig, and all other factors that could affect drilling are such that a hole sufficient to provide required supplies and materials reliably can be promptly drilled within 48 hours of an accident at a mine. This provision is intended to assure that conditions that could interfere with or delay drilling are

discovered and prepared for well in advance. The drill rig capabilities should be examined to assure the appropriate drill model is selected. This allows planning so that correct equipment and supplies are available when needed.

Paragraph (d)(3) would require that the advance arrangements specified in the ERP include permissions to cross properties, build roads, and construct drill sites. This provision is intended to assure that the arrangement to drill a borehole is done in advance so that normal delays that would occur during a mine emergency are eliminated and the drilling can proceed immediately upon arrival of the drill rig.

Paragraph (d)(4) would require that the advance arrangements specified in the ERP include an arrangement with a drilling contractor or other supplier of drilling services to provide a suitable drilling rig, personnel, and support so that a hole can be completed to the refuge alternative within 48 hours. MSHA expects that the arrangements that are finalized with the drilling contractor and other suppliers are such that all details including, but not limited to, mobilization, availability, ancillary services, back-up plans, drill-hole specifications, completion schedules, and spare parts are considered and included.

Paragraph (d)(5) would require that the advance arrangements specified in the ERP include the capability to promptly transport a drill rig to a pre-surveyed location such that a drilled hole would be completed and located near a refuge alternative structure within 48 hours of an accident at a mine. MSHA intends that this provision would assure the prompt delivery of the drill to the site. If the site is not easily accessible, the operator should have advance arrangements to have the appropriate equipment to transport, deliver, or carry the drill rig to the site. The operator should consider and prepare for potential delays. These procedures should be adequately evaluated to assure that 48 hours are more than reasonable. MSHA expects that the borehole would be drilled near the location of the refuge alternative. A method for supplying breathable air from the surface through the borehole would need to have the capability to provide a sufficient quantity of air to dilute any harmful gases in and around the refuge alternative.

MSHA requests comments on whether the rule should contain a provision that the advance arrangements specified in the ERP include a method for assuring that there will be a suitable means to connect the drilled hole to the refuge

alternative and that the connection be made within 10 minutes. Under this provision, MSHA would expect the operator to have detailed plans for making connections from the drill hole casing to the refuge alternative. These plans would have to address the conditions that the miners will encounter during this planned work, including smoke, contaminated atmosphere, lack of adequate lighting, etc. The means to connect the drill hole casing should include all necessary clamps, fittings, connections, proper and sufficient hosing, mechanical supports, and tools. The connection to the refuge alternative should also be planned. The number of steps to accomplish this task of making the connections should be minimized and simplified.

Under this provision, MSHA would also expect that advance arrangements specified in the ERP include the capability to provide full-face breathing apparatus to persons exiting the refuge alternative to make necessary connections from the borehole. The breathing apparatus would be necessary to protect the miner from any gases or toxic products of combustion generated by a fire or explosion. The apparatus would need to have adequate capacity to allow sufficient time to complete the connection. The operator would also need to provide several breathing apparatus to enable occupants to come to the aid of an injured miner. Other devices, such as tag lines or tethers, would need to be available to assist miners in returning to the refuge alternative. Comments should be specific, including alternatives, rationale, safety benefits to miners, technological and economic feasibility and supporting data.

Paragraph (d)(6) would require that the advance arrangements specified in the ERP include a list of the pipes, air lines, approved fan, and approved compressor that will be used. This information decreases the possibility that an inappropriate or inadequate source of breathable air would be connected to the borehole.

Paragraph (d)(7) would require that the advance arrangements specified in the ERP include a method for assuring that the breathable air system, including compressors and fans, is designed for the planned conditions. The design should include consideration of pipe resistance, volumes and velocities needed, connections required on the surface, power needs, supplies required and necessary redundant or back-up requirements. The system should be on hand and ready to provide breathable air after the borehole is completed.

Paragraph (d)(8) would require that the advance arrangements specified in the ERP include a method for assuring the immediate availability of a backup source for supplying breathable air and a backup power source for surface installations. This information assists MSHA in evaluating the continued availability of breathable air.

Paragraph (e) would require the ERP to specify that the refuge alternative is stocked with essential supplies.

Paragraph (e)(1) would require that the ERP specify a minimum of 2,000 calories of food and 2.25 quarts of potable water per person per day to sustain the maximum number of persons reasonably expected to use the refuge alternative at one time. These requirements would provide adequate amounts of food and water and are consistent with NIOSH recommendations. These components should be replaced prior to their expiration.

Paragraph (e)(2) would require that the ERP specify that manuals and instructions for operation, training, and maintenance for the refuge alternative and components are provided. The proposal requires operators to obtain information necessary for the safe and effective use of the refuge alternative and its components.

Paragraphs (e)(3) and (e)(4) would require that the ERP specify that the refuge alternative is stocked with sufficient quantities of materials and tools to do repairs and first aid supplies.

MSHA proposed rules have provided flexibility in the type of refuge alternatives that will meet the requirements. The type of alternative is not specific to the seam heights. MSHA recognizes that the 60 cubic feet requirement may be of concern in mines with low seam heights.

Section 75.1508 Training and Records for Examination, Maintenance, Transportation, and Repair of Refuge Alternatives and Components

Paragraph (a) would require that persons be trained on examining, maintaining, transporting, and repairing refuge alternatives and components. A refuge alternative includes a number of functional components that are vital to the survival of persons using it. This proposal addresses training for routine examination, maintenance, transportation, and repair of refuge alternatives and components in addition to the training and drills provided all underground miners.

Paragraph (a)(1) would require the operator to assure that all persons assigned to examine, maintain, transport, and repair refuge alternatives

and components are trained prior to performing the task. This training assures that these critical facilities and components are available and usable when needed. All facilities and components should be maintained using the manufacturer's specifications and procedures. The examiner should be trained in the aspects critical to the activation and use of the refuge alternative. In addition, paragraph (a)(1) would require training in proper transportation of the refuge alternative or component. Miners need to be aware of the safe procedures necessary to transport a refuge alternative or component from one location to another. Training in these procedures would include knowledge of all connections necessary for transportation, such as tow bars, clevises, and hitches. MSHA requests comments on these training requirements and whether it would be more appropriate to include training on examining, maintaining, transporting, and repairing refuge alternatives under the training provisions of Part 48. Comments should be specific, including alternatives, rationale, safety benefits to miners, technological and economic feasibility, and supporting data.

Paragraph (a)(2) would require the operator to certify, by signature and date, the training of persons who examine, maintain, transport, and repair refuge alternatives and components. The training certifications help MSHA and the operator assure that the appropriate personnel have received the required training. Maintenance and repair work on refuge alternatives and components will not occur at regular intervals. To facilitate these maintenance tasks a just-in-time approach to training is required. The required training can vary given the scope of the tasks and the interval since the last training in that same task.

Paragraph (b) would require the person conducting the maintenance or repair to make a record of all corrective action taken at the completion of each repair required by this paragraph. Records of training help assure that persons are periodically re-trained to prevent skills degradation.

Paragraph (c) would require that the mine operator keep the training certifications and repair records at the mine for one year. Certification and repair records are necessary to help MSHA and the operator identify any systemic defects or problems with the refuge alternative are identified and corrected.

Section 75.1600-3 Communications Facilities; Refuge Alternatives

Paragraph (a) would require that refuge alternatives be provided with a two-way communication system and an additional communication system when approved in the mine operator's Emergency Response Plan.

Communications with the persons in refuge alternatives are vital to mine rescue efforts. The knowledge of where miners are in refuge alternatives, their condition, and the conditions in the mine may make the difference between life-and-death in a post-accident crisis.

Paragraph (a)(1) would require a two-way communication facility that is a part of the mine communication system, which can be used from inside the refuge alternative. The communications device must be usable without further exposing persons to smoke and toxic gases. MSHA solicits comments on the proposed two-way communication facility. Please be specific in your response, including alternatives, rationale, safety benefits to miners, technological and economic feasibility, and data to support your comments.

Paragraph (a)(2) would require an additional communication system when approved in the operator's Emergency Response Plan (ERP).

III. Executive Order 12866

Executive Order (E.O.) 12866 requires that regulatory agencies assess both the costs and benefits of regulations. To comply with E.O. 12866, MSHA has prepared a Preliminary Regulatory Economic Analysis (PREA) for this proposed rule. The PREA contains supporting data and explanation for the summary materials presented in this preamble, including the covered mining industry, costs and benefits, feasibility, small business impacts, and paperwork. The PREA can be found at MSHA's Web site at <http://www.msha.gov/REGSINFO.HTM>. A copy of the PREA can be obtained from MSHA's Office of Standards, Regulations and Variances at the address in the **ADDRESSES** section of this preamble. MSHA requests comments on all the estimates of costs and benefits presented in this preamble and in the PREA, and on the data and assumptions the Agency used to develop estimates.

Under E.O. 12866, a significant regulatory action is one meeting any of a number of specified conditions, including the following: Having an annual effect on the economy of \$100 million or more, creating a serious inconsistency or interfering with an action of another agency, materially altering the budgetary impact of

entitlements or the rights of entitlement recipients, or raising novel legal or policy issues. Based on the PREA, MSHA has determined that this proposed rule would have an annual effect of \$100 million or more on the economy and that, therefore, it is an economically significant regulatory action.

Congressional Review Act

The costs in the PREA represent what MSHA believes to be the upper bound of the range of estimated compliance costs: \$102.6 million first year and \$43.3 million yearly. MSHA has presented these upper-bound estimates as a conservative approach to estimating compliance costs. However, based upon a review of literature and discussions with manufacturers of refuge alternatives, MSHA believes that a more realistic assumption of the types of refuge alternatives required under the proposal provides a lower-bound estimate of costs: \$84.1 million first year and \$38.7 million yearly. MSHA has revised the PREA to include these lower-bound estimates of costs. If costs are more in line with the lower-bound estimates, the Congressional Review Act (CRA) would not apply. If costs are more in line with MSHA's upper-bound estimates, then the rule would be classified as a major rule and MSHA would comply with the CRA. Under the CRA, major rules generally cannot take effect until 60 days after the rule is published.

A. Population at Risk

The proposal would apply to all underground coal mines in the United States. Based on the most recent MSHA data, there were 624 underground coal mines, employing approximately 42,200 miners, in the United States in 2007, of which 613 mines employ miners working underground. These 613 mines employ approximately 37,800 miners and 5,100 miners working underground, for a total of approximately 42,900 workers underground.

B. Benefits

1. Introduction

One of the goals of the MINER Act is to improve emergency response capability in underground coal mines. MSHA has published a number of standards in the last several years and has stated in them that, in the event of a mine emergency in an underground coal mine, the miner should be trained to evacuate the mine. Over the years, MSHA has promulgated a number of rules that address the safety of miners in the event of explosions, fires, or

inundations in underground coal mines. These rules include requirements which address escape from a mine, such as: Two separate and distinct escapeways for each working section, maps in an underground mine that delineate escape routes out of the mine, miner participation in practice drills to escape the mine in an emergency situation, and life-saving devices such as lifelines and self-contained self-rescue (SCSR) devices to facilitate escape. This proposed rule would require refuge alternatives in the event that escape is delayed or not possible.

This proposal would improve mine operators' preparedness for mine emergencies and increase miners' safety by requiring refuge alternatives underground to protect and sustain miners trapped when a life-threatening event occurs that prevents escape. The refuge alternatives proposed in the rule may also assist miners in escaping from the mine.

2. Evaluation of Accident and Injury Data

MSHA has evaluated its accident and injury data from 1900 through 2006. During that period, 264 miners who were alive after a mine accident died later during rescue or escape. Because forty-three lives have previously been attributed to other recent MSHA regulatory actions, a total of 221 lives could have been saved over the 107 year period for purposes of estimating benefits for this proposal. If refuge alternatives had been available, MSHA estimates that the range of lives saved would be between a low of 25 percent and a high of 75 percent. MSHA estimates that 55 lives could have been saved under the lower estimate, and that 166 lives could have been saved under the higher estimate. Using these estimates, the proposal would result in approximately one-half life saved per year under the lower estimate or one and one-half lives saved per year under the higher estimate.

3. Conclusion

The proposed rule would implement the MINER Act. It would require that mine operators install refuge alternatives and would include requirements for use, transport, maintenance, and inspection of refuge alternatives. These provisions would be essential for effective operation of the refuge alternatives during an emergency. The proposed rule would also include requirements for training of miners on how to use refuge alternatives during an emergency. To facilitate mine emergency preparedness, refuge alternative training would be integrated

into existing escapeway drill training—quarterly mine evacuation training and annual expectations training. The proposed rule would include requirements for installing necessary roof support in areas where refuge alternatives are placed to assure that they will not be damaged. It would also require that the locations of refuge alternatives be noted on the mine maps so that miners can easily locate the refuge alternatives in an emergency. The proposal would also require that miners be trained to maintain and repair refuge alternatives. In addition, the proposal would require that refuge alternatives (and their components) be inspected before each shift to assure that they are always functioning properly and will be effective in the event of any emergency. The proposal would also include requirements for the location of refuge alternatives to assure that they are readily accessible to all miners underground when an emergency occurs.

C. Compliance Costs

MSHA estimates that the total yearly cost of the proposed rule would be approximately \$43.3 million for underground coal mine operators and refuge alternative manufacturers. MSHA estimates that the proposed rule would result in a total yearly cost of \$2.1 million for manufacturers and \$41.2 million for underground coal mine operators.

The first-year cost of the proposed rule is approximately \$102.6 million. The costs in the PREA represent what MSHA believes to be the upper bound of the range of estimated compliance costs: \$102.6 million first year and \$43.3 million yearly. MSHA has presented these upper-bound estimates as a conservative approach to estimating compliance costs. However, based upon a review of literature and discussions with manufacturers of refuge alternatives, MSHA believes that a more realistic assumption of the types of refuge alternatives required under the proposal provides a lower-bound estimate of costs: \$84.1 million first year and \$38.7 million yearly. MSHA has revised the PREA to include these lower-bound estimates of costs.

By mine size, the estimated yearly cost would be \$3.1 million for operators with 1–19 employees; \$33.1 million for operators with 20–500 employees; and \$5 million for operators with 501+ employees.

The approximate cost of the proposed rule by provision would be: \$2.1 million for refuge alternative and component application and approval costs; \$21.8 million for the costs to purchase, install,

transport, and repair refuge alternatives; \$6.6 million for the costs for pre-shift exams and revisions to plans and maps; and \$12.8 million for training costs.

Table 1 presents a summary of the yearly costs of the proposed rule by mine size and by cost category. MSHA solicits comments on the yearly costs of

the proposed rule. Comments should be specific including alternatives, rationale, and supporting data.

TABLE 1.—SUMMARY OF YEARLY COSTS OF PROPOSED RULE

Detail				Yearly cost
Cost to Manufacturers				
Application and Approval Costs				\$2.1 million.
Cost to Mine Operators				
	Mine size			
	1–19 employees	20–500 employees	501+ employees	Total
Cost for Purchase, Installation, Moving, and Repair of Refuge Alternatives.	\$2.4 million	\$17.5 million	\$1.9 million	\$21.8 million.
Cost for Pre-Shift Exams and Revisions to Plans, Maps, and Programs.	\$300,000	\$5.2 million	\$1.2 million	\$6.6 million.
Cost for Training	\$520,000	\$10.4 million	\$1.9 million	\$12.8 million.
Total	\$3.1 million	\$33.1 million	\$5 million	\$41.2 million.

Note: In some cases, the totals may deviate from the sum of the components due to rounding.

IV. Feasibility

Although MSHA has concluded that the requirements of the proposed rule would be both technologically and economically feasible, MSHA recognizes that all refuge alternative applications may not be appropriate for all mining conditions.

A. Technological Feasibility

MSHA believes that this proposed rule is feasible because refuge alternatives are currently being manufactured for use in underground coal mines in West Virginia and Illinois. MSHA recognizes that it may not be feasible to locate the refuge alternative according to this proposal. In addition, MSHA recognizes that using the refuge alternatives in low coal mines could be problematic. The Agency further recognizes that certain types of refuge alternatives may not be feasible in low coal mines. MSHA also recognizes that research on some requirements of refuge alternatives, for example, post accident communications, is on-going. MSHA will continue to work with NIOSH and the mining community as refuge alternative technology continues to be developed. MSHA solicits comment from the public on the location of refuge alternatives, the use of refuge alternatives in low coal mines, and the feasibility of requirements for refuge alternatives. Please be specific in your response, including alternatives, rationale, safety benefits to miners, technological and economic feasibility, and data to support your comment.

Also, MSHA may approve refuge alternatives or components that incorporate new technology, if the applicant demonstrates that the refuge alternative or components provide no less protection than those meeting the requirements of the proposed rule.

B. Economic Feasibility

MSHA estimated that the yearly compliance cost of the proposed rule is approximately \$41.2 million for underground coal mine operators, which is 0.3 percent of annual revenue of \$14.1 billion for all underground coal mines. MSHA concludes that the proposed rule would be economically feasible for these mines because the total yearly compliance cost is below one percent of the estimated annual revenue for all underground coal mines.

V. Regulatory Flexibility Act and Small Business Regulatory Enforcement Fairness Act

Pursuant to the Regulatory Flexibility Act (RFA) of 1980, as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA), MSHA has analyzed the impact of the proposed rule on small entities. Based on that analysis, MSHA has notified the Chief Counsel for Advocacy, Small Business Administration (SBA), and made the certification under the RFA at 5 U.S.C. 605(b) that the proposed rule would not have a significant economic impact on a substantial number of small entities. The factual basis for this certification is presented in the PREA and summarized below.

A. Definition of a Small Mine

Under the RFA, in analyzing the impact of the proposed rule on small entities, MSHA must use the SBA definition for a small entity, or after consultation with the SBA Office of Advocacy, establish an alternative definition for the mining industry by publishing that definition in the **Federal Register** for notice and comment. MSHA has not established an alternative definition and is required to use the SBA definition. The SBA defines a small entity in the mining industry as an establishment with 500 or fewer employees.

MSHA has also examined the impact of this proposed rule on underground coal mines with fewer than 20 employees, which MSHA has traditionally referred to as “small mines.” These small mines differ from larger mines not only in the number of employees, but also in economies of scale in material produced, in the type and amount of production equipment, and in supply inventory. Therefore, the cost of complying with MSHA’s proposed rule and the impact of the proposed rule on small mines will also be different.

This analysis complies with the legal requirements of the RFA for an analysis of the impact on “small entities” while continuing MSHA’s traditional concern for “small mines.”

B. Factual Basis for Certification

MSHA initially evaluates the impact on small entities by comparing the estimated compliance cost of a rule for

small entities in the sector affected by the rule to the estimated revenue of the affected sector. When the estimated compliance cost is less than one percent of the estimated revenue, the Agency believes it is generally appropriate to conclude that the rule would not have a significant economic impact on a substantial number of small entities. When the estimated compliance cost exceeds one percent of revenue, MSHA investigates whether further analysis is required.

Total underground coal production in 2007 was approximately 278 million tons for mines with 500 or fewer employees. Using the 2007 price of underground coal of \$40.37 per ton, MSHA estimates that underground coal revenue was approximately \$11.2 billion for mines with 500 or fewer employees. Under MSHA's upper-bound estimate, the yearly cost of the proposed rule for mines with 500 or fewer employees is estimated to be approximately \$36 million, or approximately \$59 thousand per mine. This is equal to approximately 0.32 percent of annual revenue. Under MSHA's lower-bound estimate, the yearly cost of the proposed rule for mines with 500 or fewer employees is estimated to be approximately \$32 million, or approximately \$52 thousand per mine. This is equal to approximately 0.29 percent of annual revenue. Since, under both the upper and lower-bound estimates, the yearly cost of the proposed rule is less than one percent of annual revenue for small underground coal mines, as defined by SBA, MSHA has certified that the proposed rule would not have a significant impact on a substantial number of small mining entities, as defined by SBA. However, MSHA has provided, in the PREA accompanying this rule, a complete analysis of the cost impact on this category of mines.

Total underground coal production in 2007 was approximately 7.7 million tons for mines with fewer than 20 employees. Using the 2007 price of underground coal of \$40.37 per ton, MSHA estimates that underground coal revenue was approximately \$310.2 million for mines with fewer than 20 employees. Under MSHA's upper-bound estimate, the yearly cost of the proposed rule for mines with fewer than 20 employees is estimated to be approximately \$3.15 million, or approximately \$14,116 per mine. This is equal to approximately 1.02 percent of annual revenue. Under MSHA's lower-bound estimate, the yearly cost for mines with fewer than 20 employees is estimated to be approximately \$2.8 million, or approximately \$13 thousand

per mine. This is equal to approximately 0.91 percent of annual revenue.

In the Agency's PREA, MSHA estimates that some mines might experience costs somewhat higher than the average per mine in its size category while others might experience lower costs. Even though the analysis reflects a range of impacts for different mine sizes, from 0.32 to 1.02 percent of annual revenue under MSHA's upper-bound estimate and from 0.29 to 0.91 percent of annual revenue under MSHA's lower-bound estimate, the Agency concludes that this is not a significant economic impact on a substantial number of small mines. MSHA has provided, in the PREA accompanying this rule, a complete analysis of the cost impact on this category of mines.

VI. Paperwork Reduction Act

A. Summary

This proposed rule contains information collection requirements that would affect requirements in existing paperwork packages with OMB Control Numbers 1219-0004, 1219-0054, 1219-0066, 1219-0073, 1219-0088, and 1219-0141. The new information collection requirements contained in the proposed rule are found in proposed §§ 7.503, 75.221, 75.360, 75.372, 75.1200, 75.1502, 75.1505, 75.1506, 75.1507, and 75.1508, which would establish new approval requirements for refuge alternatives. This proposed rule would result in 90,189 burden hours and related costs of approximately \$6.8 million in the first year the rule is in effect. In the second year the rule is in effect, and every year thereafter, the proposed rule would result in 78,138 burden hours and related costs of approximately \$6.6 million.

For a detailed summary of the burden hours and related costs by provision, see the PREA accompanying this proposed rule. The PREA is posted on MSHA's Web site at <http://www.msha.gov/REGSINFO.HTM>. A copy of the PREA can be obtained from MSHA's Office of Standards, Regulations, and Variances at the address provided in the **ADDRESSES** section of this preamble.

B. Procedural Details

The information collection package has been submitted to OMB for review under 44 U.S.C. 3504, paragraph (h) of the Paperwork Reduction Act of 1995, as amended. A copy of the information collection package can be obtained from the Department of Labor by electronic mail request to king.darrin@dol.gov or by phone request to 202-693-4129.

MSHA requests comments to:

- Evaluate whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information will have practical utility;

- Evaluate the accuracy of the Agency's estimate of the burden of the proposed collection of information, including the validity of the methodology and assumptions used;

- Enhance the quality, utility, and clarity of the information to be collected; and

- Minimize the burden of the collection of information on those who are to respond, including through the use of appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology, e.g., permitting electronic submission of responses.

Comments on the information collection requirements should be sent to both OMB and MSHA. Addresses for both offices can be found in the **ADDRESSES** section of this preamble. The regulated community is not required to respond to any collection of information unless it displays a current, valid, OMB control number. MSHA displays OMB control numbers in 30 CFR part 3.

VII. Other Regulatory Analyses

A. The Unfunded Mandates Reform Act of 1995

MSHA has reviewed the proposed rule under the Unfunded Mandates Reform Act of 1995 (2 U.S.C. 1501 et seq.). MSHA has determined that the proposed rule would not include any Federal mandate that may result in increased expenditures by State, local, or tribal governments or significantly or uniquely affect small governments. MSHA estimates that the proposed rule would increase private sector expenditures by more than \$100 million in the first year and has included an analysis of the costs of the requirements of the proposed rule in this PREA.

B. Treasury and General Government Appropriations Act of 1999: Assessment of Federal Regulations and Policies on Families

The proposed rule would have no effect on family well-being or stability, marital commitment, parental rights or authority, or income or poverty of families and children. Accordingly, § 654 of the Treasury and General Government Appropriations Act of 1999 (5 U.S.C. 601 note) requires no further agency action, analysis, or assessment.

C. Executive Order 12630: Government Actions and Interference With Constitutionally Protected Property Rights

The proposed rule would not implement a policy with takings implications. Accordingly, Executive Order 12630 requires no further agency action or analysis.

D. Executive Order 12988: Civil Justice Reform

The proposed rule was written to provide a clear legal standard for affected conduct and was carefully reviewed to eliminate drafting errors and ambiguities, so as to minimize litigation and undue burden on the Federal court system. Accordingly, the proposed rule meets the applicable standards provided in § 3 of Executive Order 12988.

E. Executive Order 13045: Protection of Children From Environmental Health Risks and Safety Risks

The proposed rule would have no adverse impact on children. Accordingly, Executive Order 13045 requires no further agency action or analysis.

F. Executive Order 13132: Federalism

The proposed rule would not have “federalism implications” because it would not “have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government.” MSHA acknowledges that West Virginia and Illinois have laws and/or regulations on refuge alternatives and has drafted the proposed rule to minimize conflict with these laws and regulations.

G. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

The proposed rule would not have “tribal implications” because it would not “have substantial direct effects on one or more Indian tribes, on the relationship between the Federal government and Indian tribes, or on the distribution of power and responsibilities between the Federal government and Indian tribes.” Accordingly, Executive Order 13175 requires no further agency action or analysis.

H. Executive Order 13211: Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use

The proposed rule has been reviewed for its impact on the supply,

distribution, and use of energy because it applies to the coal mining industry. Insofar as the proposed rule would result in yearly costs of approximately \$41.2 million to the underground coal mining industry, relative to annual revenues of \$14.1 billion in 2007, it is not a “significant energy action” because it is not “likely to have a significant adverse effect on the supply, distribution, or use of energy * * * (including a shortfall in supply, price increases, and increased use of foreign supplies).” Accordingly, Executive Order 13211 requires no further Agency action or analysis.

I. Executive Order 13272: Proper Consideration of Small Entities in Agency Rulemaking

MSHA has reviewed the proposed rule to assess and take appropriate account of its potential impact on small businesses, small governmental jurisdictions, and small organizations. MSHA has determined and certified that the proposed rule would not have a significant economic impact on a substantial number of small entities.

List of Subjects

30 CFR Part 7

Coal mines, Mine safety and health, Reporting and recordkeeping requirements, Underground mining.

30 CFR Part 75

Coal mines, Mine safety and health, Reporting and recordkeeping requirements, Safety, Training programs, Underground mining.

Dated: June 11, 2008.

Richard E. Stickler,

Acting Assistant Secretary for Mine Safety and Health.

For the reasons discussed in the preamble, the Mine Safety and Health Administration is proposing to amend 30 CFR parts 7 and 75 as follows:

PART 7—TESTING BY APPLICANT OR THIRD PARTY—[AMENDED]

1. The authority citation for part 7 continues to read as follows:

Authority: 30 U.S.C. 957.

2. Add new subpart L to read as follows:

Subpart L—Refuge Alternatives

Sec.

- 7.501 Purpose and scope.
- 7.502 Definitions.
- 7.503 Application requirements.
- 7.504 Refuge alternatives and components; general requirements.
- 7.505 Structural components.
- 7.506 Breathable air components.
- 7.507 Air-monitoring components.

- 7.508 Harmful gas removal components.
- 7.509 Approval markings.
- 7.510 New technology.

Subpart L—Refuge Alternatives

§ 7.501 Purpose and scope.

This subpart L establishes requirements for MSHA approval of a refuge alternative and components for use in underground coal mines. Refuge alternatives are intended to provide a life-sustaining environment for miners trapped underground when escape is impossible. Refuge alternatives may also be used to facilitate escape.

§ 7.502 Definitions.

The following definitions apply in this subpart:

Apparent temperature. The combined effects of air movement, heat, and humidity on the human body.

Breathable oxygen. Oxygen that is at least 99 percent pure with no harmful contaminants.

Flash fire. A fire that rapidly spreads through a diffuse fuel, such as airborne coal dust or methane, without producing damaging pressure.

Noncombustible material. Material, such as concrete or steel, that will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat.

Overpressure. The highest pressure over the background atmospheric pressure that results from an explosion, which includes the impact of the pressure wave on an object.

Refuge alternative. A protected, secure space with an isolated atmosphere and integrated components that create a life-sustaining environment for persons trapped in an underground coal mine.

§ 7.503 Application requirements.

(a) An application for approval of a refuge alternative or component shall include:

(1) The refuge alternative or component’s make and model number, if applicable.

(2) A list of the refuge alternative or component’s parts that includes—

(i) The MSHA approval number for electric-powered equipment;

(ii) Each component’s or part’s in-mine shelf life, service life, and recommended replacement schedule; and

(iii) The materials used in each component or part with their MSHA approval number or a statement that the materials are noncombustible.

(3) The capacity and duration (the number of persons it is designed to maintain and for how long) of the refuge alternative or component on a per-person per-day basis.

(4) The length, width, and height of the space required for storage of each component.

(b) The application for approval of the refuge alternative shall specify the following:

(1) A description of the breathable air component, including drawings, air-supply sources, piping, regulators, and controls.

(2) The maximum volume, excluding the airlock; the dimensions of space provided for each person using the refuge alternative; and the interior dimensions of the airlock.

(3) The maximum allowable positive pressures in the interior space and the airlock and describe the means used to limit or control the positive pressure.

(4) The maximum allowable apparent temperature of the interior space and the airlock and the means to control the apparent temperature.

(5) Drawings that show the features of each component and contain sufficient information to document compliance with the technical requirements.

(6) A training manual that contains sufficient detail for each refuge alternative or component addressing in-mine transportation, operation, and maintenance of the unit.

(7) A summary of the procedures for constructing and activating refuge alternatives.

(8) A summary of the procedures for using the refuge alternative.

(9) The results of inspections, evaluations, calculations, and tests conducted under this subpart.

(c) The application for approval of the air-monitoring component shall specify the following:

(1) The operating range, type of sensor, gas or gases measured, and environmental limitations, including the cross-sensitivity to other gases, of each detector or device in the air-monitoring component.

(2) The method for operation of the individual devices so that they function as necessary to test gas concentrations over a 96-hour period.

(3) Procedures for monitoring and maintaining breathable air in the airlock, before and after purging.

(4) Instructions for determining the quality of the atmosphere in the airlock and refuge alternative interior and a means to maintain breathable air in the airlock.

(d) The application for approval of the harmful gas removal component shall specify the following:

(1) The volume of breathable air available for removing harmful gas both at start up and while persons enter through the airlock.

(2) The maximum volume of each gas that the component is designed to remove on a per-miner per-day basis.

(e) The applicant shall certify that each component is constructed of suitable materials, is of good quality workmanship, is based on sound engineering principles, is safe for its intended use, and is designed to be compatible with other components in the refuge alternative, within the limitations specified in the approval.

§ 7.504 Refuge alternatives and components; general requirements.

(a) Refuge alternatives and components:

(1) Shall be intrinsically safe for use and designed with fire and explosion-proof features for use with an oxygen supply component.

(2) Shall not produce continuous noise levels in excess of 85 dBA in the structure's interior.

(3) Shall not liberate harmful or irritating gases or particulates into the structure's interior or airlock.

(4) Shall be designed so that the refuge alternative can be safely moved with the use of appropriate devices such as tow bars.

(5) Shall be designed to withstand forces from collision of the refuge alternative structure during transport or handling.

(b) The apparent temperature in the structure shall be controlled as follows:

(1) When used in accordance with the manufacturer's instructions and defined limitations, the apparent temperature in the fully occupied refuge alternative shall not exceed 95° Fahrenheit.

(2) Calculations or tests shall be conducted to determine the maximum apparent temperature in the refuge alternative when used at maximum occupancy and in conjunction with required components. The results shall be reported in the application.

(c) The refuge alternative shall include:

(1) Accommodations for the following means of communications—

(i) A telephone or an equivalent two-way facility that can be used from inside the refuge alternative, and

(ii) A two-way wireless system when it is approved in the operator's Emergency Response Plan (ERP).

(2) Lighting sufficient to perform tasks;

(3) A means to contain human waste effectively and minimize objectionable odors;

(4) First aid supplies; and

(5) Materials, parts, and tools for repairs of components.

(d) Containers used for storage of refuge alternative components shall be:

(1) Airtight, waterproof, and rodent-proof;

(2) Easy to open and close without the use of tools; and

(3) Conspicuously marked with an expiration date and instructions for use.

§ 7.505 Structural components.

(a) The structure shall—

(1) Provide at least 15 square feet of floor space and at least 60 cubic feet of volume per person;

(2) Include storage space that secures and protects the components during transport and that permits ready access to components for inspection, maintenance, and activation;

(3) Include an airlock that creates a barrier and isolates the interior space from the mine atmosphere, except for a refuge alternative capable of maintaining adequate positive pressure.

(i) The airlock shall be designed for multiple uses to accommodate the structure's maximum occupancy.

(ii) The airlock shall be configured to accommodate a stretcher without compromising its function;

(4) Be designed and constructed to withstand 15 pounds per square inch (psi) overpressure for 0.2 seconds prior to activation;

(5) Be designed and constructed to withstand exposure to a flash fire of 300° Fahrenheit for 3 seconds prior to activation;

(6) Be constructed with materials that are noncombustible or MSHA-approved flame resistant;

(7) Be constructed from reinforced material that has sufficient durability to withstand routine handling and resist puncture and tearing during activation and use;

(8) Be guarded or reinforced to prevent damage to the structure that would hinder activation, entry, or use; and

(9) Permit measurement of outside gas concentrations without exiting the structure or allowing entry of the outside atmosphere.

(b) Inspections or tests shall be conducted to determine or demonstrate that—

(1) Trained persons can fully activate the structure, without the use of tools, within 10 minutes of reaching the refuge alternative;

(2) An overpressure of 15 psi applied to the pre-activated refuge alternative structure for 0.2 seconds does not allow gases to pass through the barrier separating the interior and exterior atmospheres;

(3) A flash fire of 300° Fahrenheit for 3 seconds does not allow gases to pass from the outside to the inside of the structure;

(4) The overpressure forces of 15 psi do not prevent the stored components from operating;

(5) A flash fire of 300° Fahrenheit for 3 seconds does not prevent the stored components from operating;

(6) Each structure resists puncture and tearing when tested in accordance with ASTM D2582-07 *Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting*;

(7) Each reasonably anticipated repair can be completed within 10 minutes of opening the storage space for repair materials and tools; and

(8) No harmful gases or noticeable odors are released from nonmetallic materials before or after the flash fire test. The test shall determine the identity and concentrations of gases released.

(c) If pressurized air is used to activate the structure or maintain its shape, the structure shall—(1) Include a pressure regulator or other means to prevent overpressurization of the structure, and

(2) Provide a means to repair and repressurize the structure in case of failure of the structure or loss of air pressure.

(d) The refuge alternative structure shall provide a means—

(1) To conduct a preshift examination, without entering the structure, of components critical for activation; and

(2) To indicate unauthorized entry or tampering.

§ 7.506 Breathable air components.

(a) Breathable air shall be supplied by compressed air cylinders, compressed breathable-oxygen cylinders, fans installed on the surface or compressors installed on the surface. Only uncontaminated breathable air is allowed to be supplied to the refuge alternative.

(b) Mechanisms shall be provided and procedures shall be followed such that, within the refuge alternative—

(1) The breathable air sustains each person for 96 hours,

(2) The oxygen concentration is maintained at levels between 18.5 and 23 percent, and

(3) The average carbon dioxide concentration is maintained at 1.0 percent or less, with excursions not to exceed 2.5 percent.

(c) Breathable air supplied by compressed air from cylinders, fans, or compressors shall provide a minimum flow rate of 12.5 cubic feet per minute of breathable air for each miner.

(1) Fans or compressors shall meet the following:

(i) Be equipped with a carbon monoxide detector located at the surface

that automatically provides a visual and audible alarm if carbon monoxide in supplied air exceeds 10 parts per million (ppm).

(ii) Provide in-line air-purifying sorbent beds and filters or other equivalent means to assure the breathing air quality and prevent condensation.

(iii) Include maintenance instructions that provide specifications for periodic replacement or refurbishment of sorbent beds and filters or alternate means.

(iv) Provide positive pressure and an automatic means to assure that the pressure is relieved at 0.25 psi above mine atmospheric pressure in the refuge alternative.

(v) Include warnings to assure that only uncontaminated breathable air is supplied to the refuge alternative.

(vi) Include air lines to supply breathable air from the fan or compressor to the refuge alternative.

(A) Air lines shall be capable of preventing or removing water accumulation.

(B) Air lines shall be designed and protected to prevent damage during normal mining operations, a flash fire of 300° Fahrenheit (F) for 3 seconds, a pressure wave of 15 psi overpressure for 0.2 seconds, and ground failure.

(vii) Assure that harmful or explosive gases, water, and other materials cannot enter the breathable air.

(2) Redundancy of fans or compressors and each power source shall be provided to permit prompt reactivation of equipment in the event of failure.

(d) Compressed breathable oxygen shall—

(1) Include instructions for activation and operation;

(2) Provide oxygen at a minimum flow rate of 1.32 cubic feet per hour per miner;

(3) Include a means to readily regulate the pressure and volume of the compressed oxygen;

(4) Include an independent regulator as a backup in case of failure; and

(5) Be used only with regulators, piping, and other equipment that is certified and maintained to prevent ignition or combustion.

(e) Carbon dioxide removal components shall—

(1) Include instructions for activation and operation;

(2) Be used with breathable air cylinders or oxygen cylinders;

(3) Remove carbon dioxide at a rate of 1.08 cubic feet per hour per miner;

(4) Be contained to prevent contact with the chemicals and the release of airborne particles;

(5) Be provided and packaged with all necessary means to expedite use, such as hangers, racks, and clips; and

(6) Be stored in containers that are conspicuously marked with instructions for disposal of used chemicals.

(f) The carbon dioxide removal component shall be tested and evaluated to demonstrate that it can maintain average carbon dioxide concentration at 1.0 percent or less, with excursions not to exceed 2.5 percent under the following conditions:

(1) At 55 °F (±4 °F), 1 atmosphere (±0.5 percent), and 50 percent (±0.5 percent) relative humidity.

(2) At 55 °F (±4 °F), 1 atmosphere (±0.5 percent), and 100 percent (±0.5 percent) relative humidity.

(3) At 90 °F (±4 °F), 1 atmosphere (±0.5 percent), and 50 percent (±0.5 percent) relative humidity.

(4) At 82 °F (±4 °F), 1 atmosphere (±0.5 percent), and 100 percent (±0.5 percent) relative humidity.

(g) Respirators or breathing apparatus used with a breathable air component shall—

(1) Be NIOSH-approved with a means of flow and pressure regulation;

(2) Be equipped with fittings that connect only to a breathable air compressed line;

(3) Allow for communication, and the provision of food, and water while preventing the entry of any outside atmosphere; and

(4) Be capable of being worn for up to 96 hours.

(h) The applicant shall prepare and submit a risk analysis to assure that the breathable air component will not cause an ignition.

(1) The analysis shall specifically address oxygen fire hazards and fire hazards from chemicals used for removal of carbon dioxide.

(2) The analysis shall identify the means used to prevent any ignition source.

(i) The breathable air component shall include a fire extinguisher that—

(1) Is compatible with the chemicals used for removal of carbon dioxide; and

(2) Uses a non-toxic extinguishing agent that does not produce a hazardous by-product when heated or activated.

§ 7.507 Air-monitoring components.

(a) Each refuge alternative shall have an air-monitoring component that provides persons inside with the ability to determine the concentrations of carbon dioxide, carbon monoxide, oxygen, and methane, inside and outside the structure, including the airlock.

(b) Refuge alternatives designed for use in mines with a history of harmful

gases, other than carbon monoxide, carbon dioxide, and methane, shall be equipped to measure the harmful gases' concentrations.

(c) The air-monitoring component shall be inspected or tested and the test results shall be included in the application.

(d) All air-monitoring components shall be approved as permissible by MSHA and the MSHA approval number shall be specified in the application.

(e) The air-monitoring component shall meet the following:

(1) The total measurement error, including the cross-sensitivity to other gases, shall not exceed ±10 percent of the reading, except as specified in the approval.

(2) The measurement error limits shall not be exceeded after startup, after 8 hours of continuous operation, after 96 hours of storage, and after exposure to atmospheres with a carbon monoxide concentration of 999 ppm (full-scale), a carbon dioxide concentration of 3 percent, and full-scale concentrations of other gases.

(3) Calibration gas values shall be traceable to the National Institute for Standards and Testing (NIST) "Standard Reference Materials" (SRMs).

(4) The analytical accuracy of the calibration gas values shall be within 2.0 percent of NIST gas standards.

(5) The analytical accuracy of the span gas values shall be within 2.0 percent of NIST gas standards.

(6) The detectors shall be capable of being kept fully charged and ready for immediate use.

§ 7.508 Harmful gas removal components.

(a) Each refuge alternative shall include means for removing harmful gases.

(1) Purging or other effective methods shall be provided for the airlock to dilute the carbon monoxide concentration to 25 ppm or less and the methane concentration to 1.5 percent or less as persons enter, within 20 minutes of miners activating the refuge alternative.

(2) Chemical scrubbing or other effective methods shall be provided to maintain the average carbon dioxide concentration in the occupied structure at 1.0 percent or less with excursions not to exceed 2.5 percent.

(b) The harmful gas removal component shall meet the following requirements:

(1) Each chemical for removal of harmful gas shall be contained such that when stored or used they cannot come in contact with persons.

(2) Each chemical used for removal of harmful gas shall be provided together

with all materials, parts, or equipment necessary for its use.

(3) Each chemical used for removal of harmful gas shall be stored in an approved container that is conspicuously marked with the manufacturer's instructions for disposal of used chemical.

(c) Each harmful gas removal component shall be tested to determine its ability to remove harmful gases.

(1) The component shall be tested in a refuge alternative structure that is representative of the configuration and maximum volume from which the component is designed to remove harmful gases.

(i) The test shall include three sampling points located vertically along the centerlines of the length and width of the structure and equally spaced over the horizontal centerline of the height of the structure.

(ii) The structure shall be sealed airtight.

(iii) The operating gas sampling instruments shall be placed inside the structure and continuously exposed to the test atmosphere.

(iv) Sampling instruments shall simultaneously measure the gas concentrations at the three sampling points.

(2) For testing the component's ability to remove carbon monoxide, the structure shall be filled with a test gas of either purified synthetic air or purified nitrogen that contains 400 ppm carbon monoxide.

(i) After a stable concentration of 400 ppm, ±5 percent, carbon monoxide has been obtained for 5 minutes at all three sampling points, a timer shall be started and the structure shall be purged or carbon monoxide otherwise removed.

(ii) Carbon monoxide concentration readings from each of the three sampling devices shall be recorded every 2 minutes.

(iii) The time from the start of harmful gas removal until the readings of the three sampling instruments shall all indicate a carbon monoxide concentration of 25 ppm or less shall be recorded.

(d) Alternate performance tests may be conducted if the tests provide the same level of assurance of the harmful gas removal component's capability as the tests specified in paragraph (c) of this section. Alternate tests shall be specified in the approval application.

§ 7.509 Approval markings.

(a) Each approved refuge alternative or component shall be identified by a legible, permanent approval marking that is securely and conspicuously attached to the component or its container.

(b) The approval marking shall include the refuge alternative's and component's MSHA approval number and expiration date.

(c) The refuge alternative structure shall provide a conspicuous means for indicating an out-of-service status, including the reason it is out of service.

(d) The airlock shall be conspicuously marked with the recommended maximum number of persons that can use it at one time.

§ 7.510 New technology.

MSHA may approve a refuge alternative or a component that incorporates new knowledge or technology, if the applicant demonstrates that the refuge alternative or component provides no less protection than those meeting the requirements of this subpart.

PART 75—MANDATORY SAFETY STANDARDS—UNDERGROUND COAL MINES

3. The authority citation for part 75 continues to read as follows:

Authority: 30 U.S.C. 811.

4. Amend § 75.221 by adding paragraph (a)(12) to read as follows:

§ 75.221 Roof control plan information.

(a) * * *

(12) A description of the roof and rib support necessary for the refuge alternatives.

* * * * *

5. Amend § 75.313 by adding paragraph (f) to read as follows:

§ 75.313 Main mine fan stoppage with persons underground.

* * * * *

(f) Any electric-powered refuge alternative component that may be operated during fan stoppages shall be intrinsically safe.

6. Amend § 75.360 by redesignating paragraphs (d) through (g) as paragraphs (e) through (h) and adding a new paragraph (d) to read as follows:

§ 75.360 Preshift examination at fixed intervals.

* * * * *

(d) The person conducting the preshift examination shall check the refuge alternative for damage, the integrity of the tamper-evident seal and the mechanisms required to activate the refuge alternative, and the ready availability of compressed oxygen and air.

* * * * *

7. Amend § 75.372 by revising paragraph (b)(11) to read as follows:

§ 75.372 Mine ventilation map.

* * * * *

(b) * * *

(11) The location of all escapeways and refuge alternatives.

* * * * *

8. Amend § 75.1200 by revising paragraph (g) to read as follows:

§ 75.1200 Mine map.

* * * * *

(g) Escapeways and refuge alternatives;

* * * * *

9. Amend § 75.1202-1 by revising paragraph (b)(4) to read as follows.

§ 75.1202-1 Temporary notations, revisions, and supplements.

* * * * *

(b) * * *

(4) Escapeways and refuge alternatives designated by means of symbols.

§ 75.1500 [Removed and reserved]

10. Remove and reserve § 75.1500.

11. Amend § 75.1501 by revising paragraph (a)(1) to read as follows:

§ 75.1501 Emergency evacuations.

(a) * * *

(1) The responsible person shall have current knowledge of the assigned location and expected movements of miners underground, the operation of the mine ventilation system, the locations of the mine escapeways and refuge alternatives, the mine communications system, any mine monitoring system if used, locations of firefighting equipment, the mine's Emergency Response Plan, the Mine Rescue Notification Plan, and the Mine Emergency Evacuation and Firefighting Program of Instruction.

* * * * *

12. Amend § 75.1502 as follows:

A. Redesignate paragraphs (c)(3) through (c)(8) as paragraphs (c)(4) through (c)(9).

B. Add new paragraph (c)(3).

C. Revise newly designated paragraphs (c)(4)(iv) and (v).

D. Revise newly designated paragraph (c)(8).

E. Add paragraph (c)(4)(vi).

F. Add paragraphs (c)(10) and (c)(11). The revisions read as follows:

§ 75.1502 Mine emergency evacuation and firefighting program of instruction.

* * * * *

(c) * * *

(3) The activation and use of refuge alternatives.

(4) * * *

(iv) Switching escapeways, as applicable;

(v) Negotiating any other unique escapeway conditions; and

(vi) Using refuge alternatives.

* * * * *

(8) A review of the mine map; the escapeway system; the escape, firefighting, and emergency evacuation plans in effect at the mine; and the location of refuge alternatives and abandoned areas.

(9) * * *

(10) A summary of the procedures related to constructing and activating refuge alternatives; and

(11) A summary of the procedures related to refuge alternative use.

* * * * *

13. Amend § 75.1504 by revising paragraphs (b)(3)(ii), (b)(4)(ii), and (c), and adding paragraphs (b)(6) and (b)(7) to read as follows:

§ 75.1504 Mine emergency evacuation training and drills.

* * * * *

(b) * * *

(3) * * *

(ii) Physically locates and practices using the continuous directional lifelines or equivalent devices and tethers, and physically locates the stored SCSRs and refuge alternatives;

* * * * *

(4) * * *

(ii) Locating escapeways, exits, routes of travel to the surface, abandoned areas, and refuge alternatives.

* * * * *

(6) Reviewing the checklist for constructing and activating refuge alternatives and components.

(7) Reviewing the procedures for use of the refuge alternatives and components.

(c) *Annual expectations training.* Over the course of each year, each miner shall participate in expectations training that includes the following:

(1) Donning and transferring SCSRs in smoke, simulated smoke, or an equivalent environment.

(2) Breathing through a realistic SCSR training unit that provides the sensation of SCSR airflow resistance and heat.

(3) Construction, where applicable; activation; and use of refuge alternatives similar to those in use at the mine, including—

(i) Construction, where applicable; activation; and operation of component systems; and

(ii) Instruction on when to use refuge alternatives during a mine emergency, emphasizing that it is the last resort when escape is impossible.

(4) A miner shall participate in expectations training within one quarter of being employed at the mine.

* * * * *

14. Amend § 75.1505 by revising paragraphs (a) and (b) to read as follows:

§ 75.1505 Escapeway maps.

(a) *Content and accessibility.* An escapeway map shall show the designated escapeways from the working sections or the miners' work stations to the surface or the exits at the bottom of the shaft or slope, refuge alternatives, and SCSR storage locations. The escapeway map shall be posted or readily accessible for all miners—

(1) In each working section;

(2) In each area where mechanized mining equipment is being installed or removed;

(3) At the refuge alternative; and

(4) At a surface location of the mine where miners congregate, such as at the mine bulletin board, bathhouse, or waiting room.

(b) *Keeping maps current.* All maps shall be kept up-to-date and any change in route of travel, location of doors, location of refuge alternatives, or direction of airflow shall be shown on the maps by the end of the shift on which the change is made.

* * * * *

15. Add §§ 75.1506, 75.1507, and 75.1508 to subpart P to read as follows:

§ 75.1506 Refuge alternatives.

(a) Each operator shall provide refuge alternatives with sufficient capacity to accommodate all persons working underground.

(1) Refuge alternatives shall provide at least 15 square feet of floor space and at least 60 cubic feet of volume per person.

(2) Refuge alternatives for working sections shall accommodate the maximum number of persons that can be expected on or near the section at any time.

(3) Refuge alternatives for outby areas shall accommodate persons assigned to work in the outby area.

(b) Refuge alternatives shall be provided at the following locations:

(1) Between 1,000 feet and 2,000 feet from the working face and from locations where mechanized mining equipment is being installed or removed;

(2) Spaced within one-hour travel distances in outby areas where persons work such that persons in outby areas are never more than a 30-minute travel distance from a refuge alternative or safe exit. However, the operator may request and the District Manager may approve a different location in the Emergency Response Plan (ERP). The operator's request shall be based on an assessment of the risk to persons in outby areas, considering the following factors:

proximity to seals; proximity to potential fire or ignition sources; conditions in the outby areas; location of stored SCSRs; and proximity to the most direct, safe, and practical route to an intake escapeway.

(c) Roof and rib support for the refuge alternative locations shall be specified in the mine's roof control plan.

(d) The operator shall protect the refuge alternative and contents from damage during transportation, installation, and storage.

(e) A refuge alternative shall be removed from service if examination reveals damage that interferes with the functioning of the refuge alternative or any component.

(1) If a refuge alternative is removed from service, the operator shall withdraw all persons from the area serviced by the refuge alternative, except those persons referred to in section 104(c) of the Mine Act.

(2) Refuge alternative components removed from service shall be replaced or be repaired for return to service in accordance with the manufacturer's specifications.

(f) At all times, the site and area around the refuge alternative shall be kept clear of machinery, materials, and obstructions that could interfere with the activation or use of the refuge alternative.

(g) Each refuge alternative shall be conspicuously identified with a sign or marker as follows:

(1) A sign or marker made of a reflective material with the word "REFUGE" shall be posted conspicuously at each refuge alternative.

(2) Directional signs made of a reflective material shall be posted leading to each refuge alternative location.

§ 75.1507 Emergency response plan; refuge alternatives.

(a) The *Emergency Response Plan* (ERP) shall include the following for each refuge alternative and component:

(1) The types of refuge alternatives used in the mine, i.e., a pre-fabricated self-contained unit; a secure space, constructed in place, with an isolated atmosphere; or materials pre-positioned for miners to use to construct a secure space with an isolated atmosphere.

(2) Procedures or methods for maintaining approved refuge alternatives and components.

(3) The rated capacity of each refuge alternative, the number of persons expected to use each refuge alternative, and the duration of breathable air provided per person by the approved breathable air component of each refuge alternative.

(4) The methods for providing breathable air and removing carbon dioxide with sufficient detail of the component's capability to provide breathable air over the duration stated in the approval.

(5) The methods for providing ready backup oxygen controls and regulators.

(6) The methods for providing an airlock and methods for providing breathable air in the airlock; except where adequate positive pressure is maintained.

(7) The methods for providing sanitation facilities.

(8) The methods for harmful gas removal (if necessary).

(9) The methods for monitoring gas concentrations, including charging and calibration of equipment.

(10) The method for providing lighting sufficient to perform tasks.

(11) Suitable locations of the refuge alternatives and an affirmative statement that the locations are—

(i) Not within direct line of sight of the working face; and

(ii) Where feasible, not placed in areas directly across from, nor closer than 500 feet radially from, belt drives, take-ups, transfer points, air compressors, explosive magazines, seals, entrances to abandoned areas, and fuel, oil, or other flammable or combustible material storage.

(b) For a refuge alternative constructed in place, the ERP shall specify that—

(1) The breathable air components shall be approved by MSHA; and

(2) The refuge alternative can withstand exposure to a flash fire of 300 °Fahrenheit (F) for 3 seconds and a pressure wave of 15 psi overpressure for 0.2 seconds.

(c) For refuge alternatives consisting of materials pre-positioned for miners to use to construct a secure space with an isolated atmosphere, the ERP shall specify—

(1) The means to store and protect materials from being damaged when moved;

(2) That the refuge alternative can withstand exposure to a flash fire of 300 °F for 3 seconds and a pressure wave of 15 psi overpressure for 0.2 seconds prior to construction and activation.

(3) The method to assure the refuge alternative is constructed and functional in 10 minutes after a person arrives at the pre-positioned materials;

(4) That all necessary materials have been provided as a self-contained unit ready to be activated and used within the secure space once constructed; and

(5) The means to assure establishment of approved breathable air in the refuge alternative promptly after construction.

(d) If the refuge alternative sustains persons for only 48 hours, the ERP shall detail advanced arrangements that have been made to assure that persons who cannot be rescued within 48 hours will receive additional supplies to sustain them until rescue. Advance arrangements shall include the following:

(1) Pre-surveyed areas for refuge alternatives with closure errors of less than 20,000:1.

(2) An analysis to indicate that the surface terrain, the strata, the capabilities of the drill rig, and all other factors that could affect drilling are such that a hole sufficient to provide required supplies and materials reliably can be promptly drilled within 48 hours of an accident at a mine.

(3) Permissions to cross properties, build roads, and construct drill sites.

(4) Arrangement with a drilling contractor or other supplier of drilling services to provide a suitable drilling rig, personnel and support so that a hole can be completed to the refuge alternative within 48 hours.

(5) Capability to promptly transport a drill rig to a pre-surveyed location such that a drilled hole would be completed and located near a refuge alternative structure within 48 hours of an accident at a mine.

(6) The specifications of pipes, air lines, and approved fans or approved compressors that will be used.

(7) A method for assuring that within 48 hours, breathable air shall be provided.

(8) A method for assuring the immediate availability of a backup source for supplying breathable air and a backup power source for surface installations.

(e) The ERP shall specify that the refuge alternative is stocked with the following:

(1) A minimum of 2,000 calories of food and 2.25 quarts of potable water per person per day in approved containers sufficient to sustain the maximum number of persons reasonably expected to use the refuge alternative for at least 96 hours, or for 48 hours if advance arrangements are made under paragraph (d) of this section;

(2) Manuals for the refuge alternative and components;

(3) Sufficient quantities of materials and tools to repair components; and

(4) First aid supplies.

§ 75.1508 Training and records for examination, maintenance, transportation, and repair of refuge alternatives and components.

(a) Persons who examine, maintain, transport, or repairing refuge

alternatives and components shall be instructed in how to perform this work.

(1) The operator shall assure that all persons assigned to examine, maintain, transport, and repair refuge alternatives and components are trained.

(2) The mine operator shall certify, by signature and date, the training of persons who examine, maintain, transport, and repair refuge alternatives and components.

(b) At the completion of each repair, the person conducting the maintenance

or repair shall make a record of all corrective action taken.

(c) Training certifications and repair records shall be kept at the mine for one year.

16. Add § 75.1600–3 to subpart Q to read as follows:

§ 75.1600–3 Communications facilities; refuge alternatives.

(a) Refuge alternatives shall be provided with a communications system that consists of—

(1) A two-way communication facility that is a part of the mine communication system, which can be used from inside the refuge alternative; and

(2) Additional communication system and other requirements as defined in the communications portion of the operator's approved Emergency Response Plan.

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