As of: August 19, 2008
Received date: Not specified
Status: Posted
Posted: August 18, 2008
Tracking No. 806c893c
Comments Due: August 18, 2008
Submission Type: Web

PUBLIC SUBMISSION

Docket: MSHA-2008-0007
Refuge Alternatives for Underground Coal Mines.

Comment On: MSHA-2008-0007-0001
Refuge Alternatives for Underground Coal Mines

Document: MSHA-2008-0007-0014
Comment from Ed Roscioli, ChemBio Shelter, Inc.

Submitter Information

Name: Ed Roscioli
Address:
968 Postal Rd., Suite 320
Allentown, PA, 18109
Email: ed@ChemBioShelter.com
Phone: 610-266-6667
Organization: ChemBio Shelter, Inc.

General Comment

See attachment.

AB58 - COMM - 35

Attachments

MSHA-2008-0007-0014.1: Comment from Ed Roscioli, ChemBio Shelter, Inc.

Re: RIN 1219–AB58

Key: Red = Text of Concern in Proposed Regulation
Blue = Comment

34142 Federal Register / Vol. 73, No. 116 / Monday, June 16, 2008 / Proposed Rules

1 1 R.G. Steadman (1979). **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 prefabricated 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.

"Other harmful gases" is not specific. Monitors are gas specific so any gas that would need to be monitored would need to be identified in advance and a monitor capable of detecting that specific gas would need to be provided. MSHA should delete "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.

MSHA should limit the required regulations to "provide performance based approval criteria; and promote innovative new technology". Specifying the amount and quality of the needed oxygen with a method of testing both the amount and quality of the oxygen and pass/fail limits on each should be sufficient. Specifying how to provide the oxygen is unnecessarily restrictive. This prescriptive requirement actually stifles creativity and eliminates innovative new technology.

Other methods of supplying oxygen could be acceptable. Therefore, providing oxygen from a compressed gas cylinder does not affect performance of the refuge alternative to meet the requirement that it sustain persons for 96 hours. The text highlighted in red should be stricken from the rulemaking and a method of testing both the amount and quality of the oxygen along with pass/fail limits should be included.

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

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 crosssensitivity of each detector or device to other gases. This information on the airmonitoring 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 airmonitoring 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

MSHA should limit the required regulations to "provide performance based approval criteria; and promote innovative new technology". Specifying the quality of the air in the airlock in terms of limits of contaminants and a method to test it should be sufficient. Specifying how to improve the quality of air in the airlock is unnecessarily restrictive. This prescriptive requirement actually stifles creativity and eliminates innovative new technology. Other methods of improving the quality of air in the airlock could be acceptable. The text highlighted in red should be stricken from the rulemaking and a method of testing the quality of the air in the airlock along with pass/fail limits should be included.

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.

MSHA should limit the required regulations to "provide performance based approval criteria; and promote innovative new technology". Specifying the quality of the air in the shelter both at start-up and while persons enter or exit through the airlock in terms of limits of contaminants and a method to test it should be sufficient. Specifying how to improve the quality of air in the shelter both at start-up and while persons enter or exit through the airlock is unnecessarily restrictive. This prescriptive requirement actually stifles creativity and eliminates innovative new technology. Other methods of improving the quality of the air in the shelter both at start-up and while persons enter or exit through the airlock could be acceptable. The text highlighted in red should be stricken from the rulemaking and a method of testing the quality of the air in the shelter both at start-up and while persons enter or exit through the airlock along with pass/fail limits should be included.

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

The text highlighted in red describes only subjective qualities of various components. The following terms are not descriptive enough: "suitable materials" "good quality workmanship" "sound engineering principles" "safe for its intended use" "compatible with other components in the refuge alternative " Subjective opinions have no place in rulemaking. All required items must have specific parameters that are measurable and have a clear limit beyond which they fail. MSHA should either provide parameters that are measurable and have a clear limit beyond which they fail, or strike this language from the rulemaking.

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

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

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

When the shelter is in the stored configuration, only the externally exposed components need to be tested for toxic gases when exposed to a flash fire test. If the materials in use inside the shelter, when the shelter is in the deployed configuration, are subjected to a flash fire, the toxic gases will be the least of the problems the inhabitants have. MSHA should clarify the wording to indicate this only applies to materials potentially exposed to flash fires in the storage configuration.

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 lifethreatening, 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

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

In a 35 man shelter, this wording would require the lighting throughout the entire shelter to be 35 foot candles. Also, the unit of 1 foot candle per miner per day does not make sense. A foot candle is a measure of illumination at any given moment in time. A foot candle per day makes no sense. MSHA should change the wording of the units to be in absolute foot candles since one person needs just as much light as 35 to read instructions. The minimum illumination should not be a variable depending the number of people in the shelter. Also, MSHA should correct the erroneous units of foot candle per miner per day.

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

MSHA should limit the required regulations to "provide performance based approval criteria; and promote innovative new technology". Specifying the functional requirements for waste disposal should be sufficient. Specifying individually packaged sanitation supplies, including toilet paper and hand sanitizer is unnecessarily restrictive. This prescriptive requirement actually stifles creativity and eliminates innovative new technology. Other methods of providing for waste disposal could be acceptable. The text highlighted in red should be stricken from the rulemaking.

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.

MSHA should limit the required regulations to "provide performance based approval criteria; and promote innovative new technology". Specifying the functional requirements for containers used for storage of refuge alternative components should be sufficient. Specifying individual,

disposable packages is unnecessarily restrictive. This prescriptive requirement actually stifles creativity and eliminates innovative new technology. Proven alternatives could be available. Therefore, providing food and water in individual, disposable packages does not affect performance of the refuge alternative to meet the requirement that it sustain persons for 96 hours. The text highlighted in red should be stricken from the rulemaking.

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

The amount of useable floor space of 15 square feet is excessive. We have found that 9 square feet of usable floor space per miner is sufficient. As can be seen by the photographs of the shelter and shelter outline with 35 people in them, 9 square feet per miner allows ample room. There is no basis for requiring volumetric requirements in this application. MSHA should lower the required usable floor space to 9 square feet per miner and eliminate the volume requirement.

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.

The existence of a limit on the internal apparent temperature of the shelter is all that is necessary to ensure miners are not subjected to excessive heat. MSHA should limit the required regulations to "provide performance based approval criteria; and promote innovative new technology". Specifying the use of larger volume shelters to dissipate heat is too prescriptive and not necessary. This prescriptive requirement actually stifles creativity and eliminates innovative new technology. Other methods of maintaining the apparent temperature below the limit could be acceptable. 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.

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.

MSHA should limit the required regulations to "provide performance based approval criteria; and promote innovative new technology". Specifying the quality of the air in the shelter at start-up in terms of limits of contaminants and a method to test it should be sufficient. Specifying how to improve the quality of air (by purging) in the shelter at start-up is unnecessarily restrictive. This prescriptive requirement actually stifles creativity and eliminates innovative new technology. Other methods of improving the quality of the air in the shelter at start-up could be acceptable. The text highlighted in red should be stricken from the rulemaking and a method of testing the quality of the air in the shelter at start-up along with pass/fail limits should be included.

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. Overpressurization 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

MSHA should limit the required regulations to "provide performance based approval criteria; and promote innovative new technology". Specifying the quantity and quality of the air or oxygen entering the shelter in terms of cubic feet per minute and limits of contaminants, and a method to test them should be sufficient. Specifying how to provide the quantity and quality of air or oxygen entering the shelter is unnecessarily restrictive. This prescriptive requirement actually stifles creativity and eliminates innovative new technology. Other methods of providing the quantity and quality of the air in the shelter at start-up could be acceptable. The text highlighted in red should be stricken from the rulemaking and a method of testing the quantity and quality of the air or oxygen entering the shelter along with pass/fail limits should be included.

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

MSHA should limit the required regulations to "provide performance based approval criteria; and promote innovative new technology". Specifying the quantity and quality of the air or oxygen entering the shelter in terms of cubic feet per minute and limits of contaminants, and a method to test them should be sufficient. Specifying how to provide the quantity and quality of air or oxygen entering the shelter is unnecessarily restrictive. This prescriptive requirement actually stifles creativity and eliminates innovative new technology. Other methods of providing the

quantity and quality of the air in the shelter at start-up could be acceptable. The text highlighted in red should be stricken from the rulemaking and a method of testing the quantity and quality of the air or oxygen entering the shelter along with pass/fail limits should be included.

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,

MSHA should limit the required regulations to "provide performance based approval criteria; and promote innovative new technology". Specifying the quantity and quality of the oxygen entering the shelter in terms of cubic feet per minute and limits of contaminants, and a method to test them should be sufficient. Specifying how to provide the quantity and quality of oxygen entering the shelter is unnecessarily restrictive. This prescriptive requirement actually stifles creativity and eliminates innovative new technology. Other methods of providing the quantity and quality of the oxygen entering in the shelter could be acceptable. The text highlighted in red should be stricken from the rulemaking and a method of testing the quantity and quality of the oxygen entering the shelter along with pass/fail limits should be included.

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 4/5 at rest and 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 (4/5 at rest and 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

It is not clear that the 12.5 cubic feet per minute of breathable air for each miner only applies when carbon dioxide is not scrubbed. The wording should be made clear that this flow rate only applies to shelter alternatives that do not scrub carbon dioxide.

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 inline 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 overpressurized 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

Inflatable shelters do not have nearly the .25 psi of pressure listed here. To pressurize a shelter that is 32 feet long by 14 feet wide to .25 psi would place a force of 16,128 pounds on the roof of the shelter. The text highlighted in red should be modified to reflect a more realistic measure of the pressure in the shelter, for example .02 inches of water.

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 moistureladen 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 4/5 at rest and 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.

MSHA lists no data backing up the probability of failure of oxygen regulators. These devices have been used for decades with an excellent safety record. The probability that one of these regulators will fail in the 96 hours of operation of the shelter is negligible. In addition, redundant regulators, and the piping and fittings necessary for this, would increase the risk of oxygen leaks. MSHA should back up their concern of oxygen regulator failure with a cost benefit analysis, including a probabilistic risk assessment of the failure of these devices during the 96 hours of use while the shelter is in operation. This cost benefit analysis should include the added risks of oxygen leakage caused by additional piping, fittings, and the redundant regulator.

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

incompatible with outlets for nonrespirable 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

There is no reason to measure carbon dioxide in the mine atmosphere. Also, the measurements inside the airlock could be eliminated if the operating procedure and training program require the miners to keep their SCSR on until after exiting the airlock and safely inside the shelter. This would also minimize the time the miners spend inside the airlock. In the case where the miners' SCSR's have little time remaining, processing through the airlock and into the shelter quickly, without atmospheric monitoring in the airlock, will take less time. MSHA should reword this

section to eliminate the requirement to measure carbon dioxide in the mine air and to provide an exception to airlock monitoring when SCSR's are required to be worn in the airlock.

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 fullscale concentrations of other gases.

The wording of this sentence is not clear. Also, the carbon monoxide level inside the shelter is limited to 25 ppm. There should be no time when the carbon dioxide level in the shelter reaches 999 ppm. If this occurs, the measurement accuracy of the monitors will not be the most important problem.

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 crosssensitivity 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 □5% error specification in § 7.86(b)(10) refers to the instrument error specification. The □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 □10% limit. Measurements that fall outside of the □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 □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.

The carbon monoxide level inside the shelter is limited to 25 ppm. There should be no time when the carbon dioxide level in the shelter reaches 1000, 2000, or 4000 ppm. If this occurs, the measurement accuracy of the monitors will not be the most important problem.

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 airmonitoring 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.

MSHA states that purging or other effective methods be provided for the airlock to dilute the carbon monoxide concentration to 25 ppm or less, but then goes on to require only purging equipment. This eliminates the use of other effective methods. The goal here is to minimize the effect of carbon monoxide or other harmful gases from entering the shelter from the airlock. MSHA should limit the required regulations to "provide performance based approval criteria; and promote innovative new technology". Specifying the method to minimize the effect of carbon monoxide or other harmful gases from entering the shelter from the airlock is unnecessarily restrictive. This prescriptive requirement actually stifles creativity and eliminates innovative new technology. Other methods of minimize the effect of carbon monoxide or other harmful gases from entering the shelter from the airlock could be acceptable. MSHA should reword this paragraph to allow other effective methods of lowering the effect of carbon monoxide or other harmful gases from entering the shelter from the airlock. For example: "Each entry through the airlock will not increase the carbon monoxide level in the shelter by more than X ppm."

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 perminer 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

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 postemergency 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

The amount of useable floor space of 15 square feet is excessive. We have found that 9 square feet of usable floor space per miner is sufficient. As can be seen by the photographs of the shelter and shelter outline with 35 people in them, 9 square feet per miner allows ample room. There is no basis for requiring volumetric requirements in this application. MSHA should lower the required usable floor space to 9 square feet per miner and eliminate the volume 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.

The existence of a limit on the internal apparent temperature of the shelter is all that is necessary to ensure miners are not subjected to excessive heat. MSHA should limit the required regulations to "provide performance based approval criteria; and promote innovative new technology". Specifying the use of larger volume shelters to dissipate heat is too prescriptive and not necessary. This prescriptive requirement actually stifles creativity and eliminates innovative new technology. Other methods of maintaining the apparent temperature below the limit could be acceptable.

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

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 prepositioned 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 selfcontained 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 selfcontained 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.

MSHA lists no data backing up the probability of failure of oxygen regulators. These devices have been used for decades with an excellent safety record. The probability that one of these regulators will fail in the 96 hours of operation of the shelter is negligible. In addition, redundant regulators, and the piping and fittings necessary for this, would increase the risk of oxygen leaks. MSHA should back up their concern of oxygen regulator failure with a cost benefit analysis, including a probabilistic risk assessment of the failure of these devices during the 96 hours of use while the shelter is in operation. This cost benefit analysis should include the added risks of oxygen leakage caused by additional piping, fittings, and the redundant regulator.

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.

MSHA states that purging or other effective methods be provided for the airlock to dilute the carbon monoxide concentration to 25 ppm or less, but then goes on to require only purging equipment. This eliminates the use of other effective methods. The goal here is to minimize the effect of carbon monoxide or other harmful gases from entering the shelter from the airlock. MSHA should limit the required regulations to "provide performance based approval criteria; and promote innovative new technology". Specifying the method to minimize the effect of carbon monoxide or other harmful gases from entering the shelter from the airlock is unnecessarily restrictive. This prescriptive requirement actually stifles creativity and eliminates innovative new technology. Other methods of minimize the effect of carbon monoxide or other harmful gases from entering the shelter from the airlock could be acceptable. MSHA should reword this paragraph to allow other effective methods to be used. For example: "Each entry through the airlock will not increase the carbon monoxide level in the shelter by more than X ppm."

Additional Comment on Schedule

If MSHA finalizes this regulation by the end of 2008, manufacturers will then begin re-designing shelters to meet the new rules. Engineering re-design will take 3 – 6 months, depending on the extent of the changes needed. It will take another 2 – 3 months for testing and manufacturing. When you take this into account, the earliest a shelter meeting the new regulation will be available is May of 2009, more likely, September of 2009.

What will mine operators do if they need a new shelter in the 6 -9 months starting in January of 2009?

CONCLUSION

I hope these comments assist in the development of a comprehensive specification conducive to the employment of innovative ideas and the development of new products and processes.