Summary of MSHA’s Requirements for Breathable Air, Air Monitoring, and Harmful Gas Removal Components

The following summarizes certain requirements in respective sections, but not all of the requirements for an approval are highlighted. The applicant will need to review the entire respective sections to assure all requirements are met. The component applications will be evaluated by MSHA based upon all of Subpart A of Part 7 (including 7.9 (Revocation), Sections 7.503 (application requirements), 7.504 (general requirements), 7.506 (breathable air component), 7.507 (Air-monitoring component), and 7.508 (Harmful gas removal component).

Under Part 7 (Testing by Applicant or Third Party) the applicant, usually a manufacturer, provides the required information and test results to MSHA to demonstrate that the refuge alternative or component meets the applicable technical requirements and test criteria. No specific tests are identified for the breathable air component; however measurements and calculations will need to be submitted in the application. MSHA will issue an approval for a refuge alternative or one of its components based on the Agency’s evaluation of the information and test results submitted with the approval application. The MSHA approval under Part 7 assures operators and miners that the approved refuge alternative can be used safely and effectively in underground coal mines and that the components can be used safely with each other. The unit must be maintained by the mine operator according to manufacturer specifications.

The existing general provisions of Subpart A of part 7 (§§ 7.1 through 7.10) apply to the testing and approval of refuge alternatives. Existing § 7.3(f) addresses the certification statement and requires that each application for original approval, subsequent approval, or extension of approval of a product shall include a certification by the applicant that the product meets the design portion of the technical requirements, as specified in the appropriate Subpart, and that the applicant will perform the quality assurance functions specified in § 7.7. Consistent with the existing requirement, the applicant must provide a certification for refuge alternatives and components.

Approval revocation is addressed in § 7.9 as follows:

30 CFR § 7.9 Revocation.
(a) MSHA may revoke for cause an approval issued under this part if the product:
(1) Fails to meet the applicable technical requirements; or
(2) Creates a hazard when used in a mine

MSHA’s requirements for the approval of the breathable air, air-monitoring, and harmful gas removal components are contained in 30 CFR Part 7, Subpart L.

§ 7.503 Application requirements. (Note that not all requirements from this section are listed; some pertinent requirements are shown)
(a) An application for approval of a refuge alternative or component shall include: (1) The refuge alternative’s or component’s make and model number, if applicable.
(2) A list of the refuge alternative’s or component’s parts that includes—
   (i) The MSHA approval number for electric-powered equipment;
   (ii) Each component’s or part’s in-mine shelf life, service life, and recommended replacement schedule;
   (iii) Materials that have a potential to ignite used in each component or part with their MSHA approval number; and
   (iv) A statement that the component or part is compatible with other components and, upon replacement, is equivalent to the original component or part.

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

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

(b) The application for approval of the refuge alternative shall include the following:
   (1) A description of the breathable air component, including drawings, air supply sources, piping, regulators, and controls.
   (2) Drawings that show the features of each component and contain sufficient information to document compliance with the technical requirements.
   (7) A manual that contains sufficient detail for each refuge alternative or component addressing in-mine transportation, operation, and maintenance of the unit.
   (8) A summary of the procedures for deploying refuge alternatives.
   (9) A summary of the procedures for using the refuge alternative.
   (10) The results of inspections, evaluations, calculations, and tests conducted under this subpart.

§ 7.504 Refuge alternatives and components; general requirements. (Note that not all requirements from this section are listed; some pertinent requirements are shown)
(a) Refuge alternatives and components:
   (1) Electrical components that are exposed to the mine atmosphere shall be approved as intrinsically safe for use. Electrical components located inside the refuge alternative shall be either approved as intrinsically safe or approved as permissible.
   (2) Shall not produce continuous noise levels in excess of 85 dBA in the structure’s interior.
   (5) Shall be designed to withstand forces from collision of the refuge alternative structure during transport or handling.
(c) The refuge alternative shall include:
   (5) Materials, parts, and tools for repair of components.
   (6) A fire extinguisher that— (i) Meets the requirements for portable fire extinguishers used in underground coal mines under part 75; (ii) Is appropriate for extinguishing fires involving the chemicals used for harmful gas removal; and (iii) Uses a low-toxicity extinguishing agent that does not produce a hazardous by-product when deployed.

§ 7.506 Breathable air components. (Note that not all requirements from this section are listed; some pertinent requirements are shown)
(a) Breathable air shall be supplied by compressed air cylinders, compressed breathable-oxygen cylinders, or boreholes with fans installed on the surface or
compressors installed on the surface. Only uncontaminated breathable air shall be supplied to the refuge alternative.

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

1) The breathable air sustains each person for 96 hours, (2) The oxygen concentration is maintained at levels between 18.5 and 23 percent, and (3) The average carbon dioxide concentration is 1.0 percent or less and excursions do not exceed 2.5 percent.

d) Compressed breathable oxygen shall—

1) Include instructions for deployment and operation;
2) Provide oxygen at a minimum flow rate of 1.32 cubic feet per hour per person;
3) Include a means to readily regulate the pressure and volume of the compressed oxygen;
4) Include an independent regulator as a backup in case of failure; and
5) Be used only with regulators, piping, and other equipment that is certified and maintained to prevent ignition or combustion.

(e) The applicant shall prepare and submit an analysis or study demonstrating that the breathable air component will not cause an ignition.

1) The analysis or study shall specifically address oxygen fire hazards and fire hazards from chemicals used for removal of carbon dioxide.
2) The analysis or study shall identify the means used to prevent any ignition source.

§ 7.507 Air-monitoring components. (Note that not all requirements from this section are listed; some pertinent requirements are shown)

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

(b) Refuge alternatives designed for use in mines with a history of harmful gases, other than carbon monoxide, carbon dioxide, and methane, shall be equipped to measure the harmful gases' concentrations.

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

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

1) The total measurement error, including the cross-sensitivity to other gases, shall not exceed ± 10 percent of the reading, except as specified in the approval.
2) The measurement error limits shall not be exceeded after start-up, after 8 hours of continuous operation, after 96 hours of storage, and after exposure to atmospheres with a carbon monoxide concentration of 999 ppm (full-scale), a carbon dioxide concentration of 3 percent, and full-scale concentrations of other gases.

(5) The detectors shall be capable of being kept fully charged and ready for immediate use.
§ 7.508 Harmful gas removal components. (Note that not all requirements from this section are listed; some pertinent requirements are shown)

(a) Each refuge alternative shall include means for removing harmful gases.
   (1) Purging or other effective procedures shall be provided for the airlock to dilute the carbon monoxide concentration to 25 ppm or less and the methane concentration to 1.0 percent or less as persons enter, within 20 minutes of persons deploying the refuge alternative.
   (2) Chemical scrubbing or other effective procedures shall be provided so that the average carbon dioxide concentration in the occupied structure shall not exceed 1.0 percent over the rated duration, and excursions shall not exceed 2.5 percent.
      (ii) Carbon dioxide removal components shall remove carbon dioxide at a rate of 1.08 cubic feet per hour per person.
   (3) Instructions shall be provided for deployment and operation of the harmful gas removal component.

(b) The harmful gas removal component shall meet the following requirements:
   Each chemical used for removal of harmful gas shall be—
   (1) Contained such that when stored or used it cannot come in contact with persons, and it cannot release airborne particles.
   (2) Provided with all materials; parts, such as hangers, racks, and clips; equipment; and instructions necessary for deployment and use.
   (3) Stored in an approved container that is conspicuously marked with the manufacturer's instructions for disposal of used chemical.

(c) Each harmful gas removal component shall be tested to determine its ability to remove harmful gases.
   (2) For testing the component’s ability to remove carbon monoxide, the structure shall be filled with a test gas of either purified synthetic air or purified nitrogen that contains 400 ppm carbon monoxide, ±5 percent.
   (3) For testing the component’s ability to remove carbon dioxide, the carbon dioxide concentration shall not exceed 1.0 percent over the rated duration and excursions shall not exceed 2.5 percent under the following conditions:
      (i) At 55 °F (±4 °F), 1 atmosphere (±1 percent), and 50 percent (±5 percent) relative humidity.
      (ii) At 55 °F (±4 °F), 1 atmosphere (±1 percent), and 100 percent (±5 percent) relative humidity.
      (iii) At 90 °F (±4 °F), 1 atmosphere (±1 percent), and 50 percent (±5 percent) relative humidity.
      (iv) At 82 °F (±4 °F), 1 atmosphere (±1 percent), and 100 percent (±5 percent) relative humidity.
   (4) Testing shall demonstrate the component’s continued ability to remove harmful gases effectively throughout its designated shelf-life, specifically addressing the effects of storage and transportation.