

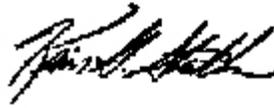
EFFECTIVE DATE: 11/04/ 2011

EXPIRATION DATE: 03/31/2013

PROGRAM POLICY LETTER NO. P11-V-17

FROM:

KEVIN G. STRICKLIN
Administrator for
Coal Mine Safety and Health



LINDA F. ZEILER
Director of Technical Support



SUBJECT:

Brass Compressed Gas Cylinder Valves and Associated Fittings
Used in Refuge Alternatives

Scope

This Program Policy Letter (PPL) applies to Mine Safety and Health Administration (MSHA) personnel, underground coal mine operators, miners' representatives, and refuge alternative manufacturers.

Purpose

The purpose of this PPL is to provide guidance to the mining industry, enforcement personnel, and other parties concerning methods for maintaining approvals on refuge alternatives given the premature failures of brass valves and fittings on breathable air components of refuge alternatives and their impact on MSHA approved Emergency Response Plans (ERPs).

Policy

As a result of the premature failures of brass valves and fittings on breathable air components, the West Virginia Office of Miners' Health Safety & Training (WVOMHS&T) issued an order on October 14, 2011, to refit state-approved underground mine shelters (the "Order" – see attached).¹ The Order generally establishes an October 31, 2011,

¹ The State of West Virginia refers to "refuge alternatives" as "underground mine shelters." When discussing the Order, the PPL uses the West Virginia terminology.

deadline for manufacturers to inspect all mine shelters with approval granted in accordance with West Virginia Code of State Regulations § 56-4-8. In accordance with the Order, shelters found to contain valves or fittings showing signs of corrosion, stress corrosion cracking, or having improper dimensions must be taken out of service immediately, unless the manufacturer provides a signed statement that the shelter is safe to remain in service until the scheduled refit date. The order further requires that by the scheduled refit date, all brass compressed gas cylinder valves and associated fittings used in mine shelters must be replaced. In addition, the Order requires that the refitted mine shelters cannot be returned to service unless all of the shelter's components comply with current MSHA breathable air, air-monitoring, and harmful gas removal regulations and have necessary MSHA component approvals.

MSHA also has been working with West Virginia on this issue and recognizes the safety hazard associated with existing valves and fittings, and the Agency concurs with the procedures established in the Order. However, while the Order affects all manufacturers with West Virginia-approved refuge alternatives regardless of the state in which the units are used, underground coal mine operators in states other than West Virginia and those using refuge alternatives that are not West Virginia-approved are not subject to the Order. Because MSHA's regulation grandfathered refuge alternatives that were approved by West Virginia, MSHA is issuing a policy consistent with the Order to address the hazard with respect to refuge alternatives in all underground coal mines. The policy provides for timely replacement of brass valves and fittings, and it recognizes West Virginia's regulation mandating that refuge alternative manufacturers demonstrate compliance with current MSHA refuge alternative component approval requirements to maintain their West Virginia approvals.

State-Approved Prefabricated Refuge Alternatives

The Order directs West Virginia underground coal mine operators to submit refit schedules and other documentation to the WVOMHS&T Director. Manufacturers also are required to submit information to the WVOMHS&T Director. Mine operators located in West Virginia with ERPs that specify use of West Virginia-approved prefabricated refuge alternatives as a basis for compliance with § 75.1506(a) will need to comply with the inspection, removal, refit, and component replacement schedule established in the Order and by WVOMHS&T to maintain the status of their refuge alternatives as state approved units. MSHA district managers will determine whether mine operators in West Virginia have taken actions necessary to maintain the West Virginia state approvals that are required for their refuge units to continue to be used under the grandfathering provisions of § 75.1506(a)(3).

Underground coal mine operators in states other than West Virginia who have an ERP specifying the use of West Virginia-approved prefabricated refuge alternatives as a basis for compliance with § 75.1506(a) must demonstrate to the MSHA district manager that their refuge alternatives have been inspected in accordance with the provisions of the Order and that damaged units have been removed from service until the defects can be

corrected. District managers will designate the date on which operators must provide any requested inspection information, recognizing that the Order requires submission of inspection results by October 31, 2011, unless the WVOMHS&T Director establishes an alternative date. These operators also must communicate with the district manager to establish a schedule for replacing brass valves and fittings. While individual replacement schedules will be developed in conjunction with district managers, replacement dates should be set according to the refuge alternative's installation date and the condition of existing valves and fittings. Based on currently available information from manufacturers, the Agency anticipates that replacement valves and fittings will start to become available within five months, and all valves and fittings must be replaced by December 31, 2013. However, if West Virginia subsequently establishes a replacement schedule applicable to all West Virginia-approved units, operators relying on their West Virginia approvals would need to comply with that schedule. Also, as discussed in the Order, once provided with replacement valves and fittings, refuge alternatives cannot be placed back into service without components that comply with current MSHA breathable air, air-monitoring, and harmful gas removal regulations and have necessary MSHA component approvals.

ERP-Accepted Prefabricated Refuge Alternatives

A few operators currently are using prefabricated refuge alternatives that do not rely on a state approval for compliance with § 75.1506(a); these units were grandfathered because MSHA accepted them as being in service and approved in an emergency response plan prior to March 2, 2009. The potential for the premature failure of brass valves and fittings also exists in breathable air components associated with these units. For this reason, these valves and fittings also must be promptly inspected by a qualified person, removed unless verified to be safe for continued use, and ultimately refitted with appropriate valves and fittings. MSHA district managers will work with these operators to establish the manner in which they will timely convey their inspection results, determine whether existing refuge alternatives need to be removed from service until the defects can be cured, and establish a schedule for replacing brass valves and fittings. While individual replacement schedules will be developed in conjunction with district managers, replacement dates should be set according to the refuge alternative's installation date and the condition of existing valves and fittings. Based on currently available information from manufacturers, the Agency anticipates that replacement valves and fittings will start to become available within five months.

15-psi Stopping Refuge Alternatives

A number of operators are using refuge alternatives consisting of 15-psi stoppings in conjunction with breathable air, air-monitoring, and harmful gas removal components. The components used in these units are not state-approved, but either were grandfathered for use or were permitted pursuant to an emergency response plan approval because Part 7 approved components were not commercially available. The potential for premature failure of brass valves and fittings associated with compressed air cylinders also exists with respect to these breathable air components. This policy requires that valves and fittings in 15-psi stopping refuge alternatives must be

promptly inspected by a qualified person, removed unless verified to be safe for continued use, and ultimately refitted with appropriate valves and fittings. MSHA district managers will work with these operators to establish the manner in which they will timely convey their inspection results, determine whether existing refuges need to be removed from service until the defects can be cured, and establish a schedule for replacing brass valves and fittings. While individual replacement schedules will be developed in conjunction with district managers, replacement dates should be set according to the refuge alternative's installation date and the condition of existing valves and fittings. Based on currently available information from manufacturers, the Agency anticipates that replacement valves and fittings will start to become available within five months.

Background

Refuge alternatives are required in all underground coal mines in accordance with 30 CFR 75.1506(a). Refuge alternatives operate with structural, breathable air, air monitoring, and harmful gas removal components. Prefabricated self-contained refuge alternative structures that states have approved and those that MSHA has accepted in approved ERPs that were in service prior to March 2, 2009, are permitted for use under the MSHA standards until December 31, 2018, or until replaced, whichever comes first. While § 75.1506(a)(3) allows for the use of these structural components until December 31, 2018, the breathable air, air-monitoring, and harmful gas removal components associated with grandfathered refuge alternative structures are permitted only until December 31, 2013, or until replaced, whichever comes first.

On Sunday, January 9, 2011, a catastrophic failure occurred in an oxygen cylinder fitting connected to the breathable air system in a refuge alternative located in an underground coal mine. This failure allowed a rapid release of oxygen, which pressurized the interior of the steel structure and created an oxygen enriched environment. The pressure build-up inside the container forced open both the tent deployment door and the air-lock access door, ejecting a supply container and 5-gallon water containers from the access door area onto a nearby rib.

Investigations conducted by MSHA and WVOMHS&T led to the discovery of cracks on multiple valves and fittings, as well as fittings that did not meet Compressed Gas Association (CGA) dimensional specifications. These compromised valves and fittings were discovered on high pressure oxygen and air cylinders used in approved shelters from multiple manufacturers.

In January and February 2011, MSHA and the State of West Virginia published notifications alerting manufacturers, mine operators, miners, and other interested parties to hazards associated with cracked valves and fittings and dimensionally incorrect fittings. At that time, MSHA stated that mine operators should contact their refuge alternative manufacturer and request a prompt and thorough examination of the valves and fittings associated with breathable air components. The Agency has been informed that much of the inspection activity contemplated in this PPL already has been performed in response to information earlier provided by MSHA and the State of West Virginia.

Subsequent metallurgical analyses were conducted by two independent laboratories. Results of these analyses pointed to fracturing due to stress-corrosion cracking. This could have resulted from the interaction of a chemical agent or possibly moisture with the zinc in the brass.

Authority

Federal Mine Safety and Health Act of 1977, as amended, 30 U.S.C. § 801 et seq.; 30 CFR § 75.1506(a).

Internet Availability

This Program Policy Letter may be viewed on the World Wide Web by accessing the MSHA Home Page (www.msha.gov) and choosing "Compliance Info" and "Program Policy Letters."

Who are the MSHA contact persons for this PPL?

Coal Mine Safety and Health, Division of Safety
Johnny P. Calhoun, (202) 693-9507
E-mail: Calhoun.Johnny@dol.gov

Technical Support, Approval and Certification Center
Howard C. Epperly, (304) 547-2034
E-mail: Epperly.Howard@dol.gov

Distribution

MSHA Program Policy Manual Holders
MSHA Special Interest Groups
Underground Coal Mine Operators
Miners' Representatives



State of West Virginia
Earl Ray Tomblin, Governor

WV Office of Miners' Health, Safety & Training
C. A. Phillips, Director
1615 Washington Street East • Charleston, West Virginia • 25311-2126
Telephone 304-558-1425 • Fax 304-558-1282
www.wvminesafety.org

TO: WV Underground Mine Operators and Shelter Manufacturers

FROM: C. A. Phillips, Director *C. A. Phillips*

DATE: October 14, 2011 (Supersedes September 29, 2011 Order of same name)

SUBJECT: **Order to Refit Approved Underground Mine Shelters**

UNDERGROUND MINE SHELTER SAFETY ISSUE

On Sunday, January 9, 2011, a catastrophic failure occurred in a high pressure gas cylinder fitting connected to the breathable air system in an approved shelter located in an underground West Virginia coal mine. The West Virginia approved shelter, model number 4042-35, was manufactured by the A.L. Lee Corporation on March 21, 2008. This inflatable design shelter was equipped with 12 high pressure oxygen cylinders, each pressurized at 4,500 psi and connected to a manifold. This catastrophic failure allowed a rapid release of oxygen, which pressurized the interior of the steel structure. Following an inspection of the failed shelter, OMHS&T and MSHA initially determined that the pressure build-up inside the container forced open both the tent deployment door and the air-lock access door and ejected a supply container and 5-gallon water containers from the access door area onto a nearby rib.

ANALYSIS

Subsequent analysis of the failed shelter led to the discovery of cracks on multiple valves and fittings and identification of fittings that did not meet Compressed Gas Association dimensional specifications. Inspections of additional underground mine shelters conducted at OMHS&T's request discovered similar issues on valves and fittings of high pressure oxygen, air cylinders and associated distribution manifolds used in approved shelters produced by all manufacturers. A significant number of fittings and valves on high pressure cylinders had developed cracks after only three years of service. Specifically, in one instance, half of the valves and fittings in a refuge shelter had developed cracks that were classified by valve

manufacturer, Sherwood, as “moderate to severe.” In addition, multiple fittings were found during subsequent inspections by manufacturers, OMHS&T, and MSHA to be manufactured to improper dimensional specifications (see attached).

Additionally, Sherry Laboratories of Daleville, Indiana, conducted a metallurgical analysis of valves and fittings utilized in underground mine shelters. The results pointed to fracture by stress-corrosion cracking resulting from the interaction of an agent with the zinc in the brass. Corrosion occurs as a chemical process on the atom level changing zinc into an oxide and reaction preferentially progresses through areas of current or residual stress in the brass until a crack develops (see attached).

Finally, the Salt Lake Technical Center (SLTC) of the Occupational Safety and Health Administration (OSHA) performed a metallurgical analysis of the valves and fittings from inspected shelters. Their analysis confirmed that the failures were a result of stress-corrosion cracking. The SLTC report also stated that the stress-corrosion cracks in the fittings and valves examined, which had not yet failed, indicated that they were on the path to failure. SLTC noted generally that brass is susceptible to corrosion cracking in moist atmospheres that contain certain chemical compounds (see attached).

ORDER

After reviewing the issues and investigations associated with the premature failure of brass valves and fittings in multiple underground shelters, OMHS&T hereby orders, in accordance with W. Va. Code § 22A-1-4 and consistent with the mandates of W. Va. Code R. § 56-4-8, the following:

1) All underground mine shelters required by the mine’s approved Shelter Plan and in service under an approval granted by the Director pursuant to W. Va. Code R. §56-4-8 shall be inspected by a qualified representative of the manufacturer to determine the condition of every brass compressed gas cylinder valve and associated fitting, and such inspection shall be attested to have occurred by a person certified by OMHS&T (“Certified Person”) and employed by the permit holder. The inspections required by this paragraph 1 shall include physical examinations of all brass valves and fittings specifically designed to detect signs of corrosion, stress-corrosion cracking, and fittings that do not meet the standard dimensions required by the current Compressed Gas Association dimensional specifications. Inspections performed after January 13, 2011, but prior to the date hereof that were conducted consistent with this Order and for which Inspection Reports, Attestations and Manufacturer’s Statements, as applicable, are submitted to and approved by the Director as set forth herein shall satisfy the requirements of this paragraph 1.

Inspections of all shelters performed by a qualified representative of the manufacturer following the January 13, 2011, Equipment Failure Notice shall be recorded. For each inspection completed, the manufacturer’s representative shall submit a written inspection report (an “Inspection Report”) to the Director, which shall include the date of the inspection, serial number(s) of the shelter inspected, manufacture date of the shelter, name and permit number of the mine in which such shelter is located, location at the mine, number of brass fittings inspected,

number of brass valves inspected, and a listing of any visible signs of corrosion, stress-corrosion cracking or out of dimensional tolerance. Each Inspection Report shall be signed by the manufacturer's qualified representative who completed the inspection and, when filed with the Director, shall be accompanied by a written attestation ("Attestation") signed by a Certified Person employed by the permit holder attesting that the inspection was completed on the date indicated in the inspection report.

Shelters found to contain valves or fittings showing signs of corrosion, stress corrosion cracking or having improper dimensions shall be immediately taken out of service, unless a responsible representative of the manufacturer provides a signed statement ("Manufacturer Statement") that the shelter is safe to remain in service until the scheduled date of refit required by paragraph 2 below. In either case a report shall be made to the permit holder and the Director of the action taken within 24 hours.

All inspections required by this paragraph 1 shall be completed by no later than October 31, 2011, unless an alternative schedule is approved in writing by the Director. If a shelter was deployed less than twelve months prior to October 31, 2011 an alternative schedule should be proposed by the manufacturer for the Director's approval. Permit holders shall submit to the Director for approval Inspection Reports, Attestations, and Manufacturer Statements applicable to each completed inspection on or before October 31, 2011, unless modified by an approved alternative schedule provided for herein.

Each manufacturer shall submit to the Director for approval by October 31, 2011, unless an alternative schedule is approved in writing by the Director, a proposed "Manufacturer Compliance Plan," which shall consist of the compilation of all inspection results for West Virginia Approved Shelters, including the serial number(s) of the shelters, manufacture date of the shelter, the name and permit number of the mines in which each is located, the number of brass fittings inspected, the number of brass valves inspected, a listing of any visible signs of corrosion, stress-corrosion cracking or out of dimensional tolerance and the manufacturer's method and schedule for ensuring that sufficient quantities of all valves, fittings and other necessary parts will be available when necessary to complete the Refit process required by paragraph 2. The dates contained in approved Manufacturer Compliance Plans are enforceable as part of the manufacturers approval requirement.

2) In addition to the inspections required by paragraph 1, permit holders shall submit to the Director for approval by October 31, 2011, unless an alternative schedule is approved in writing by the Director, a written plan setting forth the manner and schedule by which each permit holder will replace all brass compressed gas cylinder valve and associated fittings utilized in underground mine shelters ("Refit Plan"). Such brass valves and fittings shall be replaced by December 31, 2013, with valves and fittings constructed of materials designed to withstand extended service in the underground mine environment without corrosion and stress-corrosion cracking (the "Refit"). Replacement valves and fittings shall also be subject to MSHA approval i.e., breathable air, harmful gas removal and monitoring components. The dates contained in approved Refit Plans are enforceable as part of the Emergency Shelter Plan.

West Virginia law requires that “[a]ny emergency shelter/chamber approved by the Director shall . . . [p]rovide proof of current approval for all items and materials subject to MSHA approval” W. Va. Code R. § 56-4-8.6(16). Accordingly, in order to comply with W. Va. Code R. § 56-4-8.6(16), permit holders must provide to the Director written documentation from the respective shelter manufacturers demonstrating that, at the time that each refitted shelter is returned to the applicable underground mine, all components thereof comply with current MSHA breathable air, harmful gas removal, and air monitoring component regulations and have necessary component approvals (see attached).

Upon completion of the Refit and the shelter being returned to the mine, an addendum to the mine’s Emergency Shelter Plan shall be filed with the appropriate OMHS&T regional office certifying the Refit.¹ Failure to comply shall result in the West Virginia approval for the unit being revoked and the operator being in violation of its Emergency Shelter Plan. West Virginia approved shelters refitted in accordance with this paragraph 2 and for which a properly completed addendum have been submitted to the appropriate OMHS&T regional office shall be deemed compliant with their West Virginia approval.

Note that under MSHA regulations 30 CFR §75.1506(a)(3), by December 31, 2018, prefabricated refuge alternative structures must also be MSHA-approved.

OMHS&T will provide future informational memoranda regarding the Refit process.

CONCLUSIONS

The demonstrated unpredictable service life of the brass valves and fittings is troublesome. The current situation left unchecked represents a safety hazard.

Identification of the exact compound or compounds responsible for facilitating the stress-corrosion cracking of the brass fittings and valves requires additional time and testing. However, corrective action does not require the exact identification of the corrosive agent as there are options that are capable of withstanding the underground mine environment without suffering zinc corrosion, which was identified as the root of the problem with the brass valves and fittings.

OMHS&T’s investigation strongly suggests delay may increase the number of failures and thus imposes an unacceptable safety risk. Therefore, all underground mine shelters must be inspected in accordance with paragraph 1 and the Refit of all brass compressed gas cylinder valves and fittings shall be completed in accordance with paragraph 2 and future OMSH&T instructions.

¹ After the Director has approved an operator’s emergency shelter/chamber plan, the operator shall submit revisions to the emergency shelter/chamber plan at any time that changes in operational conditions result in substantive modification. In addition, at any time after approval, the operator may submit proposed modifications or revisions to its plan along with reasons therefore to the Director. Within thirty (30) days after receipt by the Director of any proposed revisions or modifications to the emergency shelter/chamber plan, the Director shall either approve or reject the revisions, stating in detail the reasons for such rejection. W. Va. Code R. § 56-4-8.11.

PREVIOUS ACTIONS TAKEN

OMHS&T issued a safety notice on January 13, 2011, which notified the industry and instructed manufacturers to examine deployed units for similar issues (see attached).

MSHA published two hazard alert documents—Equipment Alert and a subsequent update memo concerning the hazard (see attached).

Manufacturers and the two agencies inspected units and examined valves and fittings suspected of potential failure.

A sample of the valves and fittings were submitted for metallurgical testing to Sherry Laboratories and to OSHA (see attached).

Consultations were held between the agencies and manufacturers of approved shelters and of the valves.

A joint OMHS&T and MSHA briefing was held on September 19, 2011, on the investigation and next steps.

ATTACHMENTS AVAILABLE FOR DOWNLOAD AT WWW.WVMINESAFETY.ORG.

Examination template

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

West Virginia Equipment Failure Notice 13 January 2011

MSHA Refuge Chamber Alert 20 January 2011

Sherry Laboratory Metallurgy Report 27 January 2011

MSHA Refuge Chamber Alert Update 10 February 2011

Superior Products Letter 3 May 2011

OSHA Metallurgy Report 18 May 2011

Superior Products Letter 6 July 2011

Compress Gas Association Standard – Connection 701

Briefing Presentation September 19, 2011

References