

## **Equipment Alert -- February 10, 2011**

### **Update on Failure of High Pressure Gas Fittings and Valves in Refuge Alternatives**

On January 25, 2011, MSHA issued an Equipment Alert regarding a catastrophic failure that occurred in an oxygen cylinder fitting in an A. L. Lee refuge alternative in an underground coal mine ([Click here to view January 25, 2011 Alert](#)). The investigation revealed that the failed fitting did not meet the dimensional specifications of the applicable Compressed Gas Association (CGA) standard, CGA-701. Mine operators are working with A. L. Lee to identify and replace any other fittings that do not meet the CGA dimensional specifications. The Alert also mentioned the discovery of a second failed fitting in another refuge unit. This update provides recently obtained information related to this second failed fitting, as well as information related to recently identified cracks in brass cylinder valves and fittings in a third refuge alternative.

On January 21, 2011, A. L. Lee reported a second CGA 701 brass fitting failure in a refuge alternative that had been returned to their shop. This fitting met the dimensional specifications of the CGA standard. On February 3, 2011, A. L. Lee reported that cracks had been discovered in both the brass fittings and cylinder valves of a third refuge alternative that had been returned to their shop. These fittings also met the dimensional specifications of the CGA standard. These fitting failures are significant because they demonstrate that the problem extends beyond dimensionally incorrect fittings.

Because the second and third failures involve dimensionally correct fittings, MSHA and A. L. Lee are investigating several factors that may have acted individually or collectively to contribute to the failures. These factors include: the metallurgical composition of fittings, the potential interaction of the fittings with corrosive atmospheres produced either by materials used to manufacture the refuge alternative or by the mine atmosphere itself, and the stress on fittings due to high cylinder pressures or over-tightening.

A visual examination may not permit a satisfactory assessment of the condition of the fitting (as seen in Figure 1). However, fittings examined under a microscope showed significant cracking inside the second fitting (Figure 2). This area cannot be viewed without first removing the fitting from the cylinder and nipple.



Figure 1 – View of Installed Fitting



Figure 2 – magnified view inside brass fitting showing cracking (this fitting was still intact and held compressed gas)

Likewise, the cracks in the cylinder valves associated with the third refuge unit were not readily visible until the cylinders had been removed from the refuge alternative.



Figure 3 – View of cracked cylinder valve. Arrow points to crack.

### **Recommended Actions**

Mine operators should contact their refuge alternative manufacturer and request that the manufacturer conduct a prompt and thorough examination of their units for interior and exterior cracks on fittings and cylinder valves. If this examination identifies any fittings or valves exhibiting cracking, then the refuge alternative should be removed from service until it can be repaired or replaced. These steps are necessary to assure that all refuge alternatives can be safely used in underground coal mines.

The mine operator should only use properly trained manufacturer’s representatives to disassemble refuge units and to make necessary repairs and adjustments.

Prior to the movement, examination, or repair of any refuge alternative, the MSHA Safety Hazard Alert relative to “Oxygen Safety in Refuge Alternatives” (<http://www.msha.gov/Alerts/OxygenSafety11202009.pdf>) should be reviewed and all precautions and warnings observed.

Portable oxygen detectors / meters should be used during pre-shift examinations and maintenance examinations to monitor for elevated levels of oxygen in and around the refuge alternative.

Refuge alternatives should be handled with care during transport, and in accordance with manufacturer's recommendations.

Mine operators should discuss the safety issues described in this alert with their refuge alternative manufacturer so that the refuge alternative design and construction will perform in accordance with Title 30 Code of Federal Regulations, Part 75, Section 75.1506.