



Contribution ID: 660

Type: **Contributed Oral Presentation**

C1Or2A-03: Cryogenic Storage and Supply Systems for Breathing Protection

Monday 22 July 2019 16:30 (15 minutes)

Respiratory Protective Devices such as a self-contained breathing apparatus or a hose supplied breathing apparatus connected to a stationary source, are used by first responders during an emergency. The most common means to store air is in high pressure gas cylinders up to 7,500psi. NIOSH conducted research in conjunction with NASA to employ cryogenics as a more efficient, safer way of storing air and also capitalize on its cooling aspects. This presentation is on two prototype storage and supply systems that were developed. In one case, an Air Storage and Fill Station (CryoASFS) was built to refill cryogenic breathing apparatus (CryoBA). The other was a Supply System for refuge chambers (CryoRASS) used to shelter in place during an emergency until rescued. Both use large dewars and cryocoolers to store and maintain the commodity in the liquid phase and low pressure to prevent venting. Liquid air was blended from liquid oxygen and liquid nitrogen in the ratio 1 : 5 and the oxygen content analyzed for verification. These units were built onto steel baseplates, with the dewars oriented horizontally and covered with a steel enclosures for protection against rough handling. Functional tests showed that the CryoASFS was able to fill multiple CryoBAs simultaneously without issues. The CryoRASS was able to provide breathing air and remove heat and humidity in a refuge chamber and maintain the chamber environment within applicable life support standards for long periods of time. These prototypes are now ready to be tested by first responders in simulated emergency situations to get feedback on the designs and recommendations for improvement.

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Session Classification: C1Or2A - Applications: Safety and Instrumentation