Evaluation of O2 Deficiency Resulting from a Nitrogen Gas Release
RSS 7728- Control Area 102Grand

The following steps were used to calculate a worst-case scenario in which the entire contents of the largest cylinder are released and no ventilation is present:

1. The nitrogen gas expansion rate was calculated to be 136 based on a 2000 psi cylinder pressure.

   $$\frac{2000 \text{ psi}}{14.7 \text{ psi}} = 136 \quad \text{expansion ratio}$$

2. The expanded gas volume was calculated based on a 46 L liquid volume in the cylinder.

   $$46 \text{ L} \quad X \quad \frac{1 \text{ ft}^3}{28.32 \text{ L}} = 1.62 \text{ ft}^3$$

   $$1.62 \text{ ft}^3 \quad X \quad 136 = 220.3 \text{ ft}^3$$

3. The room volume was calculated based on a 1710 ft^2 area provided by S. Cline and estimated 8 ft ceilings.

   $$1710 \text{ ft}^2 \quad X \quad 8 \text{ ft} = 13680 \text{ ft}^3$$

4. The final O2 concentration in the room was calculated using the following formula:

   C1 = VG/VR
   $\%0_2AR = 20.9 (1- C1)$
   Where:
   C1= Ratio of air displaced by contaminant
   Vg = Volume Gas
   Vr = Volume Room
   AR = After Release

   For room 102GRAND:
   C1 = VG/VR
   C1 = 220.3 ft^3/13680 ft^3 = 0.016

   %02AR = 20.9 (1- C1)
   %02AR = 20.9 (1- 0.016)
   %02AR = 20.56 ACCEPTABLE

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References: 1) ACGIH (2009). Appendix F: Minimal Oxygen Content. In (Ed.), *TLVs and BEIs* (pp. 81-83); 2) ACGIH (1988). General Industrial Ventilation. In (Ed.), *Industrial Ventilation* (20th ed., pp. 2.3 - 2.7).; 2) NFPA (2005). Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks. In (Ed.), (pp. 24-25).