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ODH Risk Assessment
Test Lab High Bay, Building 58
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Introduction.

This assessment addresses the risk of oxygen deficiency hazard for the Jefferson Laboratory Building 58 High Bay Area. The assessment is conducted according to the requirements of Appendix 6500-T3, "ODH Risk Assessment". Two general sources of ODH hazards is identified in the facility. These are sources of nitrogen and helium gas which can dilute the normal oxygen content with health effects as outlined in Appendix 6500-T3.

The following sections covers the modeling scope and methodology for the cryogen dispersion release, a description of the work space, operational modes which affect the risk factors, the risk assess assessment, failure rates of the components, and the resultant ODH Area Classification.

Model for Cryogen Dispersion Release

Sources of ODH

The sources of ODH are identified as gaseous and vaporized helium, nitrogen, small dewars of liquefied gases or bottled gas which may leak. Sources of helium gas is associated with the CTF helium cryogenic plant, VTA helium dewars, and a CMTF. cryomodule which may be under test. Nitrogen gas sources include vaporized LN2 from the 3000 gallon LN2 dewar which serve the Test Lab. The helium gas source considered for this analysis includes all of the VTA inventory (1325 gallons), 1000 gallons available from the CTF, and 400 gallons of LHe from a full cryomodule under test in the CMTF. This total He gas source availability is 290,300 standard cubic feet. The LN2 gas source from the 3000 gallon LN2 service dewar is 279,300 standard cubic feet. The maximum ODH source gas available for a single event is 290,300 scf.

The Probability of an ODH Event

Due to the number of pipe fittings, valves, vessels which may have loss of insulating vacuum, etc. and the likelihood that a leak could occur, this analysis is conducted with a conservative safety analysis by placing a probability factor of Pi=1 (100%) that a leak will occur. With a probability factor of 1, this analysis then evaluates the effects of the full single ODH volume source of a single event. This analysis does not rely on building ventilation or electrical power.

The Building Space Description:

The Test Lab building is 297'x 132' x 60' for a total of 2.35 million cubic feet of space.

Recent helium spill tests within the JLAB accelerator tunnel has shown that rising helium gas interacts with the surrounding air, mixing with it as it rises. Once combined with air, the helium does not readily separate out of the air/helium mixture thus is not reversible. It will retain the same helium to air percentages as long as it does not further interact with additional sources of air (dilution) or higher concentrations of helium (enrichment, which is unlikely). Since the helium/air gas "mixture is lighter than air, the mixture rises. If natural convection ventilation is provided, both oxygen and helium are purged from the contained area and the helium will displace more of the confined space in a vertical downward direction.

Failure rate estimates (P_i) are based on previous JLAB cryomodule probability and JLAB listed equipment rates under EH+S Section 6500. Fatality Factors (Fi) are derived from Figure 3, of the EH+S Appendix 6500-T3. The sum of the failure product of the F_i and P_i for each of the operational modes determined the area classification in accordance with table 6 of Section 6500 of the EH+S manual. The classification was adjusted if the normal calculation placed the event in the upper range of the classification and factors, such as ease of escape, were apparent.

ODH RISK ASSESSMENT

The following are the set of events and the associated probability and fatality factors.

Test Lab High Bay Area

EVENT	SPILL RATE, cfm	SPILL, cf	%O2	P_i	Fi
N2 Line Ruptue	3765	279,300	18.7	1	0
He Line Rupture	250	290,300	18.6	1	0

In accordance with Table 6: The ODH Hazard Classification of SUM (Pi * Fi) < 10^{-6} therefore:

ODH AREA CLASSIFICATION is: ODH-0