Fermilab

Particle Physics Division
Mechanical Department Engineering Note

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Project Internal Reference:

Project: NuMI / MINOS

Title: ODH Analysis for Minos Service Building and Shaft

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Key Words: ODH Analysis,

Abstract Summary: Analysis of the effects of inert gas rack located in the MINOS service building and routed down the shaft. Result is that under all conditions, these spaces with the quantities of gas used or stored below ground, remain ODH classification 0.

Analysis considers:

- Inert gas used in the Muon and Hadron monitors in the muon alcove and absorber enclosure. Gas is either Helium or Argon (depending on the run conditions) per Sacha Kopp.

Applicable Codes: FESHM 5064

Discussion:

After the original analysis, Sacha Kopp wanted to move the gas rack from underground to the service building. This analysis considers this change. It does not require a change to the original analysis.

All gas cylinders are planned to be 200 cubic feet. 220 cubic feet is used in the calculations in the spread sheets to account for cylinders filled to 110%.

ODH Calculations for the MINOS Service Building with the inert gas mixture used in the muon detectors and the hadron monitor:

Complete Loss of Gas Bottle Contents at the Gas Rack in the MINOS Service Building:

Muon Monitor and the Hadron gas system will use eight (8) two hundred (200) cubic foot bottles of inert gas connected to a manifold.
This bottle manifold will be in the MINOS service building high bay (not in the fire escape egress passage).
The volume in the area of the MINOS service building high bay is not less than : 103428 cubit feet
based on a building width of 39 feet, length of 78 feet and height of 34 feet.
Should this manifold suddenly loose 110% of all eight bottle inert contents (includes bottles filled to 110%) into this space, the oxygen concentration (assuming no ventilation) will drop to:

Concentration, O2 %= 20.64863

This does not cause an ODH condition since the oxygen concentration remains above 18%
One does not need to go any further and consider the probability if this failure occuring since even if the bottle was breached, the oxygen concentration stays above 18%

Complete Loss of Gas Bottle Contents in the MINOS Shaft:

Muon Monitor and the Hadron gas system will use eight (8) two hundred (200) cubic foot bottles of inert gas connected to a manifold.
This bottle manifold will be in the MINOS service building high bay (not in the fire escape egress passage).
The volume in the area of the MINOS shaft is not less than : 64622.56 cubit feet
based on a shaft diameter of 22 feet, (assume half is open) and height of 340 feet.
Should this manifold suddenly loose 110% of all eight bottle inert contents (includes bottles filled to 110%) into this space, the oxygen concentration (assuming no ventilation) will drop to:

Concentration, O2 %= 20.44323

This does not cause an ODH condition since the oxygen concentration remains above 18%
One does not need to go any further and consider the probability if this failure occuring since even if the bottle was breached, the oxygen concentration stays above 18%

SERVICE BLDG - OK

IN THE SHAFT, IS THERE A CHANCE OF LEAKING ARGON AT THE BOTTOM CAUSING REDUCED OXYGEN LOCALLY? ARGON WON'T NECESARILY MIX, BUT MIGHT PURGE THE AIR UPWARDS.

RAL 1-25-05

THE ATTACHED NOTE (53) ADDRESSED THE LOSS OF THE WHOLE GAS SUPPLY @ THE BOTTOM OF THE SHAFT. - IT NEEDS TO GO BACK TO THE FILE WHEN YOU ARE DONE.

DAVE