T962 Elevator Foyer ODH Analysis Calculations

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(1.0) Introduction

This document presents the Minos Hall Elevator Foyer ODH Analysis for a T962 argon vent pipe that will run through it. This foyer is part of the Minos Hall emergency route for fire safety. During operations of the T962 experiment an argon atmosphere will be maintained in the vent pipe, to reduce permeation of contamination through relief valve oring seals into the high purity T962 argon cryogenic system. The argon atmosphere in the vent pipe requires that an ODH anaysisbe written. Since the foyer is part of a emergency escape route, this anaysis is very conservative.

This analysis assumes no ventilation and an inexhaustible supply of argon to the vent pipe. Neither assumption is true. There is a significant amount of ventilation in the elevator foyer that is on diesel powered generator backup. During normal operation the only source of argon in the vent pipe will be a few compressed gas cylinders with a very small argon bleed into the vent pipe 0. Note that failures or generator maintenance and power outages do affect the ODH safety.

A number of approximations and estimates were made in these calculations that will have to be revised for the final safety documentation. The intent here was to have calculations accurate enough to show that it is feasible for the Minos foyer to be ODH Class 0. After the vent pipe is installed, this analysis will need to be revised to reflect the actual number of welds and length of pipe.

(2.0) Basic Equipment Failure Rates

FESHM 5064.TA pages 4-5, Table 2, NRC Equipment Failure Rate Estimates

```
Pfdew  =  1e-6**(1/hr)      (probability of dewar rupture)
```

FESHM 5064.TA page 3, Table 1, Fermilab Equipment Failure Rate Estimates

```
Pfp  =  1e-9**(1/hr)      (probability of pipe section failure)
Pfv  =  1e-8**(1/hr)      (probability of valve external leak)
Pfr  =  1e-5**(1/hr)      (probability of premature opening of relief valve)
Pfw  =  3e-9**(1/hr)      (probability of weld failure)
Pfg  =  3e-7**(1/hr)      (probability of gasket failure)
Pfms  =  3e-4      (probability of motor failure to start on demand)
Pmoterfail  =  1e-5**(1/hr)      (probability of running motor failure)
Ppowerout  =  1e-4**(1/hr)      (probability of a power outage)
Pdieselfail  =  3e-2      (probability of diesel plant not starting on demand)
```

(3.0) Case 3, Probability of Failed Argon Piping

The number of different types of components is required for an ODH analysis. The total number of argon valves, including relief valves but not including vacuum valves is.

```
NumArV  =  0      (number of argon valves)
```

FESHM 5064 lists failure rates of piping as per section of pipe. Generally pipes come in 20 ft sections. Assume 30 ft of pipe and tubing.

```
SecArPipe  =  1.5      (sections of argon piping)
```

The number of relief valves does not include vacuum reliefs.

```
NumArRV  =  0      (number of argon relief valves)
```

Number of welds on the argon piping system.

```
NumArWelds  =  20      (number of welds on argon piping)
```

There will be no piping gaskets on the system.

```
NumArGasket  =  0      (number of joints with seals)
```

Probability of a failure on the whole system

```
Prfail  =  Pfp*SecArPipe+Pfv*NumArV+Pfw*NumArWelds+Pfg*NumArGasket      (case 3 probability)
Prfail  =  0.615e-7**(1/hr)
```

(4.0) ODH Classification

Any argon leak into the foyer is assumed to have a fatality factor of 1.

```
FF  =  1.0**fatalities      (fatality factor with no ventilation)
Phi  =  Prfail*FF
Phi  =  0.615e-7**(fatalities/hr)
ODHclassification(Phi)  =  ODH Class 0
```

The elevator foyer has an ODH 0 classification.