GPU Nuclear

GPU Nuclear Corporation
Post Office Box 480
Route 441 South
Middletown, Pennsylvania 17057
717 944-7621
TELEX 84-2386
Writer's Direct Dial Number:

October 6 , 1982
4410-82-L-0023

TMI Program Office
Attn: Mr. L. H. Barrett, Deputy Program Director
US Nuclear Regulatory Commission
c/o Three Mile Island Nuclear Station
Middletown, PA 17057-0191

Dear Sir:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Recovery Operations Plan Change Request No. 18 Revision 1

The attached Recovery Operations Plan Change Request is submitted for your approval and is intended to replace GPU's original Change Request No. 18 previously submitted by GPU letter 4410-82-L-0006 dated September 16, 1982. This revision incorporates information gained by additional analyses performed since the original submittal. This Change Request is submitted to permit the opening of both equipment hatch airlock doors in order to allow certain excessive length tools and equipment to be transported into the containment.

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The capability to open both equipment hatch airlock doors will greatly facilitate the decontamination of the Reactor Building and the refurbishment of the polar crane.

If you have any questions, please contact Mr. J. J. Byrne of my staff.

Sincerely,

B. K. Kanga

B. K. Kanga
Director, TMI-2

BKK/RBS/jep

Attachment

CC: Dr. B. J. Snyder, Program Director - TMI Program Office

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320

I. Recovery Operations Plan Change Request No. 18

The licensee requests that the attached pages 4.6-1 and 4.6-1a of the TMI Recovery Operations Plan (ROP) replace the existing Recovery Operations Plan page 4.6-1.

II. Reason for Change

This change is requested to support the movement of extra long pieces of equipment into the containment building. The equipment consists of four 30 foot long sections of scaffolding to be used in the decontamination of the Reactor Building dome and for the decontamination and refurbishment of the Polar Crane. The refurbishment of the Polar Crane is considered essential for the continued cleanup of the Reactor Building. After refurbishment of the Polar Crane, the scaffolding will be utilized in other phases of the cleanup operation. The scaffolding's excessive length prohibits the usage of the Personnel Airlock No. 2 doors for moving the scaffolding into containment. Although not specifically defined, there could be other evolutions which would require the opening of both airlock doors.

III. Safety Evaluation Justifying Change

Technical Specifications 3.6.1.3 permits both doors of a containment airlock to be open simultaneously when necessary to permit the passage of tools and equipment. Procedures approved pursuant to Technical Specification 6.8.2 are required for operations which require that both airlock doors be open simultaneously.

Procedures will ensure that there will be no significant release of radioactivity while both airlock doors are open.

One or two trains of the purge exhaust system, which has a maximum flow capacity of approximately 20,000 CFM for each of the two trains, will be operated with the supply dampers closed when both airlock doors are open. At any steady-state condition, regardless of wind or other atmospheric conditions, the continuity equation requires that air flow will be from outside containment to inside containment through the airlocks with the purge system so configured. Thus, under any steady-state purge and atmospheric conditions, release of radioactivity to the atmosphere through the airlock will be precluded by inflow of air through the airlock.

The postulated mechanism by which outflow through the airlock could occur would be by transient cycling of the static air pressure at the airlock opening. This cycling could result from changing of the local air velocity (speed or direction) outside the airlock. Cyclic changes in barometric pressure conditions have been calculated to be insignificant in comparison with potential transient air velocity effects. The potential for outflow resulting from transient air velocity effects can be defined by the difference between the containment stagnation pressure and the component of external atmospheric pressure acting parallel to the axis of airlock.

At steady-state conditions, the difference between the component of external pressure acting parallel to the axis of the airlock and the containment stagnation pressure can be defined by

$$P_{ext} - P_{cont} = \Delta P_{SS} = \frac{K\rho v^2}{2gc} \quad (1)$$

where K = total head loss coefficient from the upstream condition through the airlocks to the stagnation condition within the containment.

ρ = density of air

v = air flow velocity at the throat condition (minimum flow area) within the airlocks

gc = English unit gravitational conversion, 32.2 $\frac{ft - lbm}{lb_f - sec^2}$

The geometric configuration of the airlock has been assessed to produce a head loss coefficient of at least 2.36.

The component of external air pressure acting parallel to the axis of the airlock can be defined by Bernoulli's equation (conservation of energy for incompressible isentropic flow of a fluid)

$$P_{ext} = P_{atmos} + \frac{\rho u^2}{2gc} - \frac{\rho V^2}{2gc} \quad (2)$$

where Patmos = Atmospheric (Barometric) pressure taken as invarient for this short transient case.

u = Free stream wind speed

V = Local air speed in the vicinity of the airlock

Three cases need to be considered to envelop the potential for outflow due to transients in the external air velocity vector.

Case 1 External wind velocity changes instantaneously from a finite value directed into the airlock parallel to the airlock axis to zero.

In this case, the local velocity vector, V, prior to the transient is zero since the local air flow at the door is transitioning by 90°. Equation (2) thus gives, prior to the transient,

$$P^{o}ext = Patmos + \frac{\rho u^2}{2gc} \tag{3}$$

Following the transient, equation (2) gives

$$P^{f}ext = Patmos \tag{4}$$

The condition to assure inflow is

$$P^{f}ext - P\ cont > 0 \tag{5}$$

Equations (1) and (3) give

$$P^{o}ext = \frac{K\rho v^2}{2gc} + P\ cont \tag{6}$$

Using equations (3) and (6) gives

$$Patmos + \frac{\rho u^2}{2gc} = \frac{K\rho v^2}{2gc} + P\ cont \tag{7}$$

Using eqns. (4) and (5) gives

$$Patmos - P\ cont > 0 \tag{8}$$

Eqns. (8) and (7) yield

$$u < \sqrt{K} \left(v\right) \qquad (9)$$

For case 1, equation (9) thus defines the condition to assure inflow.

Case 2: External wind velocity changes instantaneously from zero to a finite value directed normal to the airlock axis.

In this case, both the local air velocity, V, and the wind velocity, u, are zero for the initial condition prior to the transient. Eqn (2) then gives

$$P^{o}ext = Patmos \qquad (10)$$

Following the transient, the local air speed at the airlocks, V, can be related to the wind speed, u, by potential flow theory for a cylinder in a free stream, as follows:

$$V = 2u \qquad (11)$$

Equation (2) then gives

$$P^{f}ext = Patmos + \frac{\rho(\frac{V}{2})^2}{2gc} - \frac{\rho V^2}{2gc}$$

or

$$P^{f}ext = Patmos - \frac{3}{8}\frac{\rho v^2}{gc} \qquad (12)$$

Using eqn. (5) gives

$$Patmos - \frac{3}{8}\frac{\rho V^2}{gc} - p\ cont > 0 \qquad (13)$$

Using eqns. (1) and (13) gives

$$Patmos - \frac{3}{8}\frac{\rho V^2}{gc} - \overset{o}{P}ext + K\frac{\rho v^2}{2gc} > 0 \quad (13)$$

Eqvs. (10) and (13) yield

$$V < \sqrt{\frac{4K}{3}}\,(v) \quad (14)$$

Equation (14) then defines the limiting condition to assure inflow for case 2.

Case 3: The wind velocity switches instantaneously from a finite value directed inward parallel to the airlock axis to a finite value directed normal to the airlock axis. Assume here that the initial and final wind speeds are the same.

The initial condition becomes, from eqn. (2)

$$\overset{o}{P}ext = Patmos + \frac{\rho u^2}{2gc} \quad (15)$$

And the post-transient condition becomes

$$\overset{f}{P}ext = Patmos + \frac{\rho u^2}{2gc} - \frac{\rho (2u)^2}{2gc} \quad (16)$$

Using eq. (5) gives

$$Patmos + \rho\frac{u^2}{2gc} - \rho\frac{(2u)^2}{2gc} - Pcont > 0 \quad (17)$$

Using (1) gives

$$Patmos + \rho\frac{u^2}{2gc} - \rho\frac{(2u)^2}{2gc} + \frac{K\rho v^2}{2gc} - \overset{o}{P}ext > 0 \quad (18)$$

Using (15) with (18) yields

$$u < \sqrt{K} \left(\frac{v}{2}\right) \tag{19}$$

Equation (19) then defines the wind speed to assure inflow for case 3.

The limiting instaneous changes in wind and local air velocity to assure continuous inflow can be summarized in the following table for either the condition of both purge exhaust trains running with supply dampers closed or with one train running with the flow area of the airlock restricted to 1/2 the full area of the airlock doors.

Case	Postulated Change in Wind Velocity	Allowable Wind Velocity Change	Allowable Local Air Velocity Change
1	Instantaneously from directly into airlock to zero	31.6 mph	N/A
2	Instantaneously from zero to directly perpendicular to airlock axis	18.3 mph	36.6 mph
3	Instantaneously from directly into airlocks to perpendicular to airlock axis	15.8 mph	31.6 mph

If the wind velocity changes noted above do not occur instantaneously, then fan recovery time becomes a factor in the analysis and increases the magnitude of acceptable wind velocity variations.

The airlock doors will be opened only for short periods of time. The probability of any of the extreme wind velocity shifts listed above occuring concurrently with a short-term opening of both airlock doors is deemed negligible, thus precluding any credible condition whereby air inflow through the airlocks can not be assured.

When the airlock doors are opened, there may be a small release of radioactivity to the environment from the airlock volume due to the containment purge exhaust fan being shut off to equalize containment pressure. When the inner airlock door is opened, the containment purge exhaust will be reestablished immediately. Communication will be maintained between the Command Center and the airlock throughout opening operations and while both airlock doors are open. The release during this period has been conservatively calculated based on past containment airborne concentrations (first quarter of 1982) to be 0.3 microcuries of cesium-137, 0.03 microcuries of cesium-134, 0.2 microcuries of strontium-90, and 30.5 microcuries of tritium. Using annual average site meteorology, the release concentrations at the site boundary will be 2×10^{-13} microcuries/ml of cesium-137, 2×10^{-14} microcuries/ml of cesium-134, 1.4×10^{-13} microcuries/ml of strontium-90, and 2×10^{-11} microcuries/ml of tritium. These releases are based on the total volume of air in the airlock being released in 10 seconds. These concentrations are well within the limits of the Technical Specifications. Doses associated with these releases are bounded by the calculations discussed below.

A bounding analysis was performed to quantify the release of radioactive material and determine the offsite radiological consequences of any credible accident. Using the containment airborne concentrations from the first quarter of 1982, the quantity of airborne radioactive material in the containment was estimated to be 8.92×10^{-4} Ci of cesium-137, 8.92×10^{-5} Ci of cesium-134, 5.95×10^{-4} Ci of strontium-90, and 0.089 Ci of tritium. The analysis assumed that the containment purge exhaust system failed and the entire quantity of airborne radioactive material in the containment is released to the environment through the open personnel airlock over a time period of 30 minutes. This scenario is not considered credible but is presented here to bound any credible event. Using the atmospheric dispersion parameter from the Offsite Dose Calculation Manual for a ground level release inhalation dose at the nearest residence was determined to be:

Organ	Dose (mrem)
Total Body	0.36×10^{-2}
Bone	0.53×10^{-1}
Lung	0.82×10^{-2}
Liver	0.7×10^{-3}

The limiting age group was the teenage group. Considering the extreme unlikelihood of releasing the entire quality of airborne radioactivity through the airlock over the 30 minute time, and the resulting small dose, the results of the analysis are considered acceptable.

The analysis is considered bounding for the following reasons. Procedures will require that containment integrity be reestablished whenever the containment purge exhaust system fails. The 30 minutes to close an airlock door will allow sufficient time to remove any materials being transported into or out of containment that may be preventing the closure of an airlock door. The release of the entire quantity of airborne radioactivity in the containment will envelop any release due to a credible event because no credible event would result in releasing all the airborne radioactivity and there are only a few ways to increase the concentration of airborne contamination in the containment and increase the release. The credible event that could cause the greatest increase in airborne contamination is a fire in the containment in which contaminated surfaces, for example, cables and coatings, are involved. Fires involving materials of this type are slow developing and would not contribute significantly to the concentration of airborne contamination in the containment over the short period of time required to close one of the airlock doors. In addition, during periods of time when the airlock doors are both open, activities that could cause a fire will be minimized, thereby minimizing any potential for a release of radioactivity greater than that assumed in the analysis.

Additionally, the following measures will be taken during the period when both airlock doors are open to help minimize any releases to the environment:

1. When both airlock doors are open there will be at least one person in the immediate vicinity of the airlock at all times.

2. Communications will be maintained between the airlock and the Command Center.

3. The containment and all activities will be monitored from the Command Center.

4. The containment exhaust fans will be operating at all times (except when necessary to shut off to equalize pressure).

5. An alarming particulate detector and tritium bubbler will be in the immediate vicinity of the airlock. The particulate detector will be adjusted to alarm if airborne concentrations exceed a predetermined value above background. The alarm will help to ensure a quick response (door closure) should a situation arise where there is a significant release of particulate to the atmosphere.

The combination of these factors coupled with the ability to rapidly close the airlock doors will minimize any potential release of radioactive material to the environment resulting from any credible accident when both airlock doors are open.

Based on the above, having both doors of Airlock No. 1 open at the same time can take place without endangering the health and safety of the public.