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U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Gentlemen:

Subject: Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
Control Room Habitability Evaluation - Additional Information

This letter responds to NRC's request for additional information as discussed at the May 27, 1998 GPU Nuclear/NRC TMI-1 Control Room Habitability meeting. The attachments provide additional information regarding meteorological data and atmospheric dispersion factors, and a detailed description of the tests and inspections committed to in the March 24, 1998 GPU Nuclear submittal (1920-98-20145).

If additional information is required, please contact Mr. David J. Distel, Nuclear Safety & Licensing at (973) 316-7955.

Sincerely,

James W. Langenbach

James W. Langenbach
Vice President and Director, TMI

/DJD
Attachments
cc: Administrator, Region I
TMI Senior Resident Inspector
TMI-1 Senior Project Manager

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ATTACHMENT I

Response to NRC Request for Additional Information

Question 1:

Provide a copy of the meteorological data used to calculate the X/Q values. Data should be provided in the format specified in Appendix A to Section 2.7, "Meteorology and Air Quality", of draft NUREG-1555, "Environmental Standard Review Plan". A copy of this format is attached.

Response:

The meteorological data utilized in the Control Room Habitability re-analysis effort is not readily available in the format requested above. Per agreement during a conference call held on June 5, 1998 the meteorological data will be provided in the format utilized by the ARCON96 (Ref. NUREG/CR-6331 Rev.1) code. This format consists of the following:

(1x, A5, 3x, I3, I2, 2x, I3, I4, 1x, I2)

In record field sequence:

A5 – represents a location identifier for which it is defined as TMIxx, where xx is last two digits of respective year of interest

I3 – represents Julian Day

I2 – represents hour of the day staring with 0 for midnight

I3 – represents wind direction taken at 100 Ft. height on met tower. Readings in degrees from true north

I4 – represents wind speed taken at 100 Ft. height on met tower. Values represent speed in meters per second without the decimal point (i.e. 15 equals 1.5 m/s)

I2 – represents stability class numbered 1 through 7. A stability class of 1 represents extremely unstable conditions, and a stability class of 7 represents extremely stable conditions. Stability determined from vertical temperature difference.

1x, 2x, 3x … - represents blank spaces

Data has been provided for the years 1976, 1978, 1980, 1981, 1982, and 1996.

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The files are provided on floppy disk media and are compressed utilizing a shareware utility by PKWARE. The following files are included:

TMIMET76.ZIP
TMIMET78.ZIP
TMIMET80.ZIP
TMIMET81.ZIP
TMIMET82.ZIP
TMIMET96.ZIP
PKUNZIP.EXE
README.TXT

Question 2:

Based on the input to ARCON96 computer calculations, it appears that the meteorological data were measured at the 30.5 and 46 meter levels. Typically measurements are made at approximately 10 meters. Were the lower measurements made at 30.5 meters and, if so, why? Are the data used in the calculation based on the delta – T method of atmospheric stability categorization described in Regulatory Guide 1.23, "Onsite Meteorological Programs"? If so, between what levels are the temperature differences measured? If another methodology was used, what is the methodology and why is it appropriate for this assessment?

Response:

The measurements for wind direction and wind speed were made at 30.5 (100 Ft.) meter level. These measurements are based upon the original design of the meteorological tower which considered interferences from trees along the island's bank and the elevation of the access road to the plant. The access road has an approximate 10 to 15 feet height above the base elevation of the meteorological tower and is located approximately 50-75 yards from the tower. The trees located along the island's north and northwesterly bank are required for stability of the bank. The shortest distance to any tree line is approximately 250 Ft. Location of the instrumentation at the 100 Ft level provides for the minimum effect of interference from the above items. The 46 (150 Ft) meter value was a parameter utilized to allow the ARCON96 code to function. Wind speed and direction measurements are not associated with this level. The 46 meter basis is the instrument height for which one set of temperature measurements is collected. Use of the 30.5 meter level measurements is acceptable per ARCON96 as it corrects this speed to a height of 10 meters using a power law relation.

The data collected is categorized for stability using the delta – T method as described in Regulatory Guide 1.23. Delta temperature measurements are made from instrumentation at 150 Ft. and 33 Ft. Another methodology for stability classification was not used for this analysis.

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Question 3:

Were all data used in the analysis collected under Regulatory Guide 1.23 guidelines? If not, how were the data collected that did not meet the recommendation of Regulatory Guide 1.23 and why are the collection methodologies/conditions acceptable?

Response:

All data utilized in the analysis was collected under the guidelines of Regulatory Guide 1.23. Data recorders consist of both analog and digital devices. The raw data is stored on a personal computer and on strip charts. Instrument readout is available in the unit's main control room. Data is collected by redundant (primary and secondary) sensors. The instrument accuracy meets the requirements per the regulatory guide. Calibrations are performed twice per year. Maintenance and servicing assures collection in excess of 99 percent. Missing data, regardless of the percent recovered is digitized from the strip charts. Data reduction and compilation includes statistical comparisons between primary and secondary sensors to track potential instrument malfunctions or deficiencies. This is performed daily.

Question 4:

During the periods of data collection, was the tower area free from obstructions (e.g., structures trees) to a distance of at least 10X the height of any potential obstructions? Was the tower retained as a "transpiring area" and reasonably free from micro scale influences to ensure that the data collected were representative of the overall site area?

Response:

The tower location is not located at distances of 10 times the height for all nearby structures such as the cooling towers. For other structures adequate distance is maintained. Instruments were located at the 100 Ft. height so they would be above the tree line elevation. The area surrounding the tower is maintained free of growth which could potentially impact tower instrument measurements. The tower location and instrument heights were selected so as to minimize the impact from structures and trees. Island geometry, land availability, and obstruction impact on the tower were evaluated for placement of the tower and location instrumentation during the design phase of the tower. This effort has resulted in the most suitable location which affords reliable data measurement and collection.

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Question 5:

A further description of the details related to the methodology, inputs, assumptions and the bases used to calculate the TMI ventilation system exhaust X/Q's would be helpful, including a discussion of the figures and tables provided in the March 24, 1998 submittal.

Response:

GPU Nuclear provided a presentation on May 27, 1998 in which Dr. James Halitsky summarized the methods, inputs and assumptions utilized in determining X u / Q values at the ventilation exhaust location. GPU Nuclear also provided a discussion on how X/Q was determined using the values (X u /Q) at that presentation. Additional discussion was held on June 5, 1998 per conference call to elaborate on the X u / Q determination.

As response to the above question in addition to the above presentations and discussions, the following information is provided:

The X u / Q evaluation at the ventilation exhaust provides a conservative assessment of concentration brought into the ventilation system. The analysis evaluates four modes of dispersion correlating physical geometry with results of experimental testing on simple shapes such as an isolated containment shell so that meaningful predictions of concentrations can be made. The conservatisms are reiterated here as part of this response.

- The analysis of dispersed material from the reactor building does not consider the enhanced dispersion affects created by other structures on the site such as cooling towers, buildings, and the Unit 2 reactor complex. These structures will create additional turbulence that will enhance the dispersion of released material from the reactor building and result in lower concentrations at the ventilation exhaust point.

- Mode 1 dispersion consists of releases from the roof of the containment where all activity is assumed to be entrained in the cavity flow area where return to the exhaust point is evaluated. In reality some portion of the activity will pass into the downwind region above the cavity boundary and be dispersed within the wake zone. This yields an overprediction of material available for entry into the ventilation exhaust point. Conservative values for concentration coefficients (K = 2) have been utilized for this mode to introduce additional conservatism into the analysis.

- Mode 2 dispersion considers all seepage from the containment building into internal areas of adjacent buildings physically connected to the reactor building. Seepage into these buildings will be dispersed within the building and released to the environment through other pathways exist for these structures. Once released to the environment some of this material will be carried downwind into the wake zone. For additional conservatism in the analysis all of this release is assumed to be entrained within the cavity and evaluated at the exhaust point. As with Mode 1 this is an overprediction of material available for entry into the ventilation exhaust point. As with Mode 1 a conservative concentration coefficient (K = 2) has been used.

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- Mode 3 dispersion considers releases from side panel surfaces of the containment building exposed directly to the environment. A well is formed by the intersection of reactor building and the fuel handling building where the ventilation exhaust opening is located. Panel releases are evaluated based upon observed flow patterns entering the well. Two types of side panel releases have been considered; (A) those releases which pass along the reactor surface directly to the well, and (B) those which bypass the well and return via the cavity flow. Each release has been evaluated for the sixteen wind directions. Panel releases have been conservatively developed by considering them as point source releases at panel centers. This allows for the direct correlation to experimental reactor shell tests for determination concentration coefficients and results in an overprediction of concentrations for flows into the well. For all side panel sources activity will eventually enter the cavity zone where it is returned to the lee side of the reactor building and capable of entering the well area. For those panel sources upwind of the well area the analysis models activity into the well from these point sources based upon a determination of concentration coefficients from reactor shell tests. The K factors range from 1 to 10 dependent upon direction and panel considered. For those panel sources that release directly into the cavity area (B), concentration factors have conservatively been evaluated as in Mode 1 and Mode 2 releases (K= 2).

- Mode 4 dispersion evaluates releases directly into the well from reactor surfaces washed by the flow stream generated for a given wind direction. Conservatism is provided for this mode assessment by assuming the release is well mixed within the well and that layering of the gas adjacent to the reactor building surface does not exist. Additional conservatism is provided for by the assumption of low velocities for local flow within the well. Since concentration varies as the inverse of velocity assuming a low velocity yields higher concentrations than would actually exist. To assess the flow streams into the well area, observations were made of a scale model within a simulated windstream representing all sixteen wind directions. From these observations conservative seepage areas washed by the flow were generated. These areas represent releases which could enter the ventilation exhaust opening. This coupled with the assumed local flow velocity allows the determination X u / Q values for this mode of release.

Values of X u / Q determined from the above method were determined for each wind angle and applied to all wind stabilities. With these values X/Q was determined for each hour of meteorological data utilized. This was accomplished by dividing the X u / Q value by each wind speed for that hour. The X/Q data set was then ranked statistically to determine the respective percentiles used for dose assessment.

Question 6:

Other than attempting to follow the example given in NUREG/CR-6331, Revision 1, "Atmospheric Relative Concentrations in Building Wakes", were there other bases for the assumptions used to calculate the "yard intake" X/Qs?

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Response:

The basis for assumptions used in determination of yard intake X/Q's were developed from several sources. Principal assumptions for the use of ARCON96 and determination of initial diffusion coefficients were obtained through correspondence with the code's author Dr. Ramsdell. Other assumptions were established per the above correspondence, NUREG/CR-6331, Revision 1, discussion with the regulatory staff, and literature review. Literature review consisted of the following publications:

1. "Recommended Guide for the Prediction of the Dispersion of Airborne Effluents" – Third Edition, ASME , 1979
2. "Meteorology and Atomic Energy 1968" – Slade, 1968
3. "Nuclear Power Plant Control Room Ventilation System Design for Meeting General Criterion 19" – Murphy and Campe

As stated above initial diffusion coefficients were determined from the reactor building cross sectional area simulating the diffuse release with guidance from Dr. Ramsdell. This relationship is consistent with previous methods used to determine the influence of building wake as described in the above publications for volume sources (i.e. diffuse releases). The concept employs a simulation of a point source (ground level) located at some virtual distance upstream of the structure creating the wake. The virtual distance is equivalent to that which will create a plume spread approximately equal to the cross sectional area of the structure. Dimensions of the plume are equal to width, α W and height, α H. Given the plume to be representative of a Gaussian distribution, $\alpha W = 4.3\ \sigma yo$ and $\alpha H = 2.15\ \sigma z$. These dimensions are consistent with plume dimension criteria established by Pasquill (Reference 2, Section 3-3.4 above) in which the visible edge of the diffusing cloud has been assumed to coincide with the lateral point at which concentration falls to 10 % of the axial value. The value α has been assigned a value equal to 1.0 for round buildings per publication 1 above. The ARCON96 code uses a similar approach.

Other assumptions utilized consisted of code defaults and were determined to be conservative. These consisted of items such as surface roughness length, minimum wind speed, and sector averaging constant. Reference 2 above conformed that these values were conservative.

ATTACHMENT II

TMI-1 Control Room Habitability Testing - Additional Information

TESTS AND INSPECTIONS COMMITTED TO IN THE MARCH 24, 1998 SUBMITTAL

The TMI-1 Control Building Ventilation System will be periodically tested to verify the ability to maintain design basis positive pressurization during Emergency Recirculation operations. This testing will be performed using the same procedural guidance as that utilized for the February 1998 testing which was used to support the March 24, 1998 TMI-1 control room habitability submittal. The ventilation system will be tested in its emergency configuration, and also in the single active failure modes (damper and damper control failure). GPU Nuclear plans to test the emergency envelope for design basis pressurization on a 2-year frequency. While the Control Building Ventilation System is in the emergency recirculation mode, differential pressure will be measured and recorded across eight doorways on the three floors of the envelope. Taking into account instrument inaccuracies, the acceptance criteria will be the design basis requirement of at least 0.1-inch w.g. positive pressure for the Main Control Room elevation, and a non-negative pressure requirement for the remaining floors of the Control Building Emergency Envelope. If the criterion is not met, then appropriate maintenance actions are required (repair of door seals, rebalancing of supply/return flows in the room affected), followed by a successful retest.

The Control Building Ventilation System air flow rates will be periodically tested during Emergency Recirculation operations. This testing will be performed using the same procedural guidance as that utilized for the February 1998 testing which was used to support the March 24, 1998 control room habitability submittal. GPU Nuclear plans to measure air flow rates on a two year frequency to ensure the values are acceptable or conservative when compared to the data used in the March 24, 1998 TMI-1 submittal. The following airflow rates will be measured along with direction of flow, and recorded:

- Filtered air flow through supply damper (AH-D39)
- Exhaust air flow or unfiltered infiltration through exhaust damper (AH-D37)
- Flowrate through the 1st floor isolation damper (AH-D28)
- Recirculation flow rate

The acceptance criteria will be based on the flowrate data used in the dose rate calculation for the Control Room Habitability submittal. If the criterion is not met, then appropriate maintenance actions are required (repair of door seals, rebalancing of supply/return flows in the room affected), followed by a successful retest.

Also, as stated in the March 24, 1998 TMI-1 control room habitability submittal, isolation dampers are currently inspected visually on a 24-month frequency to ensure proper position and condition during Emergency Recirculation Operations (Tech Spec Surveillance). Control Building Emergency Envelope door seals are inspected on a 6-month frequency, and replaced as necessary per a Utility Department Preventive Maintenance Procedure.