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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Dresden Nuclear Power Station, Units 2 and 3
Facility Operating License Nos. DPR-19 and DPR-25
NRC Docket Nos. 50-237 and 50-249

Quad Cities Nuclear Power Station, Units 1 and 2
Facility Operating License Nos. DPR-29 and DPR-30
NRC Docket Nos. 50-254 and 50-265

Subject: Additional Information Supporting the Request for License Amendment Related to Application of Alternative Source Term

Reference: Letter from K. R. Jury (Exelon Generation Company, LLC) to U. S. Nuclear Regulatory Commission, "Request for License Amendments Related to Application of Alternative Source Term," dated October 10, 2002

In the referenced letter, Exelon Generation Company, LLC (EGC) requested an amendment to the facility operating licenses for Dresden Nuclear Power Station, Units 2 and 3, and Quad Cities Nuclear Power Station, Units 1 and 2. The proposed changes support application of an alternative source term (AST) methodology. To support the proposed changes, EGC evaluated the four design basis accidents (i.e., loss-of-coolant, main steam line break, fuel handling, and control rod drop accidents) that could potentially result in main control room or offsite doses.

On May 16, 2003, the NRC requested additional information related to meteorological data and atmospheric dispersion factor (X/Q) calculation assumptions. The Attachment provides the requested information. In addition, a CD-ROM containing electronic files of input files requested by the NRC is enclosed.

EGC has reviewed the information supporting a finding of no significant hazards consideration that was previously provided to the NRC in Attachment C of the referenced letter. The supplemental information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration.

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If you have any questions or require additional information, please contact Mr. Kenneth M. Nicely at (630) 657-2803.

I declare under penalty of perjury that the foregoing is true and correct.

Respectfully,

4th August 2003
Executed on

Patrick R. Simpson
Manager – Licensing
Mid-West Regional Operating Group

Attachment:
Response to Request for Additional Information

Enclosure:
CD-ROM Containing Input Files

cc: Regional Administrator - NRC Region III
NRC Senior Resident Inspector - Dresden Nuclear Power Station
NRC Senior Resident Inspector - Quad Cities Nuclear Power Station
Office of Nuclear Facility Safety - Illinois Department of Nuclear Safety

**ATTACHMENT**
**Response to Request for Additional Information**

**NRC Request 1 – Meteorological Measurement Program**

Confirm that, overall, the 1995 through 1999 meteorological data used in the assessment are of high quality, representative of long term conditions, and suitable for use in the assessment of atmospheric dispersion to which they were applied. The intent of these questions is to assess the overall quality of the meteorological data as collected and as processed for use in the atmospheric dispersion calculations.

During the period of data collection did the measurement program meet the guidelines of Regulatory Guide 1.23, "Onsite Meteorological Programs?" Was the tower base area on the natural surface (e.g., short natural vegetation) and tower free from obstructions (e.g., trees, structures) and micro-scale influences to ensure that the data were representative of the overall site area? In the case of possible obstructions, were trees, structures, etc., at least 10 times their height away from the meteorological tower? Were calibrations properly performed and systems found to be within guideline specifications? What types of quality assurance audits were performed on the meteorological measurement systems to ensure that data were of high quality, to identify any problems and questionable data, and correct problems in a timely manner? What additional checks and at what frequency were the checks performed on data following collection and prior to archival? If deviations occurred, describe the deviations and why the data are still deemed to be adequate. A detailed response for each individual data point is not expected. Were the data compared with other site historical or regional data? If so, what were the findings?

What additional reviews of the data were performed prior to its input into the atmospheric dispersion calculations? What checks were made between the reformatted data (e.g., data in PAVAN or ARCON96 formats) and the raw data to ensure that reformatting, conversions, etc., were properly performed?

**Response**

The meteorological measurement program used at Dresden Nuclear Power Station (DNPS) and Quad Cities Nuclear Power Station (QCNPS) during the period of data collection met the guidance of Safety Guide 23 (i.e., Reference 1). Additionally, as stated in Reference 2, the meteorological tower is equipped with instrumentation that conforms with the system accuracy recommendations of Reference 1.

Onsite calibrations of measurement equipment were routinely performed every other month through the middle of 1997 and quarterly thereafter. The calibrations were performed by experienced technicians using approved procedures and challenged the total system from sensors to data loggers.

The data were collected daily by remotely accessing the onsite data logger. As part of the daily collection procedure, the computer flagged suspect data on a printout that was then reviewed by an experienced meteorologist. As part of this daily review, the data were evaluated for consistency within the tower and to assure that the data reported were reasonable with respect to local conditions. Suspect data were reported to the field crew for investigation and/or corrective action. The average response by the field crew to a situation was within 24 to 48 hours.

A technician visited each site to verify operation of the instrumentation. The frequency of the visits at DNPS was weekly until July 1997, then biweekly until June 1998, and monthly thereafter. The frequency of the visits at QCNPS was weekly until 1997, and monthly thereafter.

When chart data were received or data were downloaded from the digital recorder, it was inspected and reviewed for indications of instrumentation problems. Any abnormalities were logged, evaluated, and corrective actions taken as appropriate.

After the initial review and edits had been made, a second more refined computer scan was performed to identify unusual occurrences. The flagged data were evaluated on a case-by-case basis. As an additional check, an environmental meteorologist independently compared at least one day in every five to local National Weather Service reported data.

An environmental meteorologist also reviewed the data in light of reported actions by the field technicians, logged comments from the strip chart or digital recorder review, and any other relevant sources of information concerning the site or its equipment. Final decisions concerning validity of the data were made at that time.

Both DNPS and QCNPS have always had either a strip chart recorder or digital chart recorder. The digital recorders replaced the strip chart recorder at QCNPS in June 1997 and at DNPS in June 1998. These digital recorders also had the capability to record and store 10-second data for later retrieval. Strip charts were replaced biweekly and the data from the digital recorders were downloaded on a weekly basis. Strip charts or digital recorder traces were used to validate or replaoe suspect hourly values obtained from the data logger. When strip charts were used, one day of data (i.e., all recorded parameters) each week was manually digitized and compared to the data from the data logger. Any discrepancies were investigated and resolved by the environmental meteorologist. With the introduction of the digital recorders, the 10-second data were processed into hourly values and all data in the period were compared to verify that both the data logger and digital recorder systems were working in tandem. Again, any discrepancies were evaluated and resolved.

The meteorological tower at DNPS is located within a fenced compound (i.e., approximately 40 feet x 40 feet) that houses both the meteorological instrument shelter and a communications shelter. The meteorological tower at QCNPS is also located within a fenced compound (i.e., approximately 10 feet x 20 feet) that houses the instrument shelter.

For both DNPS and QCNPS, the base area of the towers is bare earth and gravel. Natural vegetation surrounds the fenced compounds. The meteorological towers were sited to meet the guidance of Reference 1 (i.e., in an area where plant structures have little or no influence on the meteorological measurements) to ensure that the data were representative of the overall site areas.

The reformatted data for use in the ARCON96 model are checked against the raw data to ensure that the parameter values and units have been properly converted and to ensure that the proper format has been developed.

NRC Request 2 – Meteorological Data

Provide an electronic copy of the meteorological data used to calculate the relative concentration (X/Q) values. Data should be provided either in the format specified in Appendix A to Section 2.7, "Meteorology and Air Quality," of NUREG-1555, "Environmental Standard Review Plan," or in the ARCON96 format described in NUREG/CR-6331, "Atmospheric Relative Concentrations in Building Wakes." Data may be provided in a compressed form, but a method to decompress the data should be provided. Invalid data should be designated by completely filling the field for that parameter with 9's.

Page 20 of Attachment A of the October 10, 2002 submittal states that when data using the delta-T method were not available, the sigma theta method was used instead. About how much sigma theta data were used? Was its use during certain periods of time and, if so, when? When estimating the stability category using the sigma theta data, were adjustments made in the selection to account for enhanced fluctuations in wind direction under light wind conditions? For example, a large sigma theta value at night more likely represents stable conditions with meander than the unstable conditions defined by some sigma theta tables.

Response

An electronic copy of the meteorological data used to calculate the X/Q values for DNPS and QCNPS is included in the files labeled arcondrs.met and arconqud.met, respectively on the enclosed CD-ROM. The data is provided in the ARCON96 format.

The following table summarizes the periods when delta-T data was not available (i.e., delta-T losses) during the data collection period from 1995-1999. This information is provided for both DNPS and QCNPS.

| Delta-T Losses from 1995-1999 | | | |
|---|---|---|---|
| Site | Interval (feet) | Loss (Hours) | Loss (%) |
| DNPS | 150-35 | 137 | 0.31 |
| DNPS | 300-35 | 195 | 0.44 |
| QCNPS | 196-33 | 297 | 0.68 |
| QCNPS | 296-33 | 385 | 0.88 |

This shows that during the period from 1995-1999, less than 1% of the delta-T data was lost. Therefore, very few hours of stability could have been computed using sigma-theta data. The recorded sigma-theta values were calculated directly from 1-second wind directions. Since Murray and Trettel did not use sigma-theta data in their dispersion calculations, this parameter did not receive the same scrutiny as the delta-T data. Only sigma-theta values exceeding 40-50 degrees were investigated further. They were replaced either with a manual reading from strip charts or digital charts or with a value derived from 10 second digital recorder data by the Yamartino (1984) formula.

## NRC Request 3 – EAB and LPZ Relative Concentration Estimates

Provide a copy of the input joint frequency distribution(s) and other inputs and assumptions used in the PAVAN, fumigation, and main steam line break calculation.

Why are ground level exclusion area boundary (EAB) and low population zone (LPZ) X/Q values calculated for each accident individually for the 0 - 2 hour time period? What are the differences in the inputs and assumptions that result in the differences in the X/Q values?

### Response

The PAVAN code was not used for the main steam line break (MSLB) assessment. The X/Q for the MSLB assessment is based on the more conservative X/Q model (i.e., stability class F and a wind speed of 1 meter per second) of Regulatory Guide 1.5 (i.e., Reference 3), which was used in past assessments.

The PAVAN input files used to determine the EAB and LPZ X/Q values for the fuel handling accident (i.e., reactor building stack release) are included on the enclosed CD-ROM (i.e., files 2pdfgel.inp and 2pqfgel.inp for DNPS and QCNPS, respectively). These input files contain the joint frequency distributions determined from the hourly meteorology data used in the ARCON96 calculations.

The X/Q values for the loss-of-coolant accident and control rod drop accident are based on releases from the turbine area and are based on methodology similar to, but not identical to, that used in the PAVAN code. The fuel handling accident (FHA) X/Q was determined using the PAVAN code and assumes a release from the reactor building stack. The difference between these two release points is small, so the X/Q values are negligible.

## NRC Request 4 – Control Room Relative Concentration Estimates

What specific inputs were used in each of the ARCON96 calculations? Was any stack flow or buoyancy assumed? Are all directions input into the calculations, including wind direction, based upon true north?

If more than one release scenario to the environment could occur for a postulated design basis accident (e.g., due to lose of offsite power or single failure) were the limiting atmospheric dispersion factors used in the dose calculations?

What release/receptor location pairs are assumed to be the most limiting for each of the design basis accidents?

Figures 1a and 1b of Attachment A to the October 10, 2002 submittal cites the main steam line break release pathway as a steam cloud. From where is this cloud postulated to originate when released to the environment? Were X/Q values calculated for the control room dose assessment and, if so, what are the values and how were they calculated?

## Response

Electronic data files used in the ARCON96 calculations for main steam isolation valve (MSIV) leakage and the FHA are provided on the enclosed CD-ROM. The following files are included.

| Description | Filename |
|---|---|
| Dresden-2, MSIV leakage | dre2msiv.rsf |
| Dresden-3, MSIV leakage | dre3msiv.rsf |
| Quad Cities-1, MSIV leakage | qud1msiv.rsf |
| Quad Cities-2, MSIV leakage | qud2msiv.rsf |
| Dresden, FHA | 2adfvcr.rsf |
| Quad Cities FHA | 2aqfvcr.rsf |

No credit was taken for momentum or buoyant plume rise. All directions input into the calculations are reckoned from true north.

Only one release scenario was considered for each of the design basis accidents.

Figures 1a and 1b in Attachment A of Reference 2 identify the release location for each of the design basis accidents. The DNPS and QCNPS control rooms have only a single receptor location.

Figures 1a and 1b in Attachment A of Reference 2 cites the main steam line break release pathway as a steam cloud. New X/Q values were not calculated for the control room dose assessment. Rather, the X/Q model for the MSLB accident is that which has been used for previous MSLB assessments. The model assumes that the steam and water released in a MSLB expands to a hemispheric volume at atmospheric pressure. This hemisphere then moves past the control room intake at a speed of one meter per second. This steam cloud is assumed to stay at ground level during its passage.

## References

1. U. S. Nuclear Regulatory Commission Safety Guide 23, "Onsite Meteorological Programs," February 17, 1972

2. Letter from K. R. Jury (Exelon Generation Company, LLC) to U. S. Nuclear Regulatory Commission, "Request for License Amendments Related to Application of Alternative Source Term," dated October 10, 2002

3. U. S. Nuclear Regulatory Commission Regulatory Guide 1.5, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Steam Line Break Accident for Boiling Water Reactors," March 1971