Nebraska Public Power District
Nebraska's Energy Leader

NLS2002094
September 13, 2002

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Subject: Response to Revised DBA Methodology-Request for Additional Information Cooper Nuclear Station, NRC Docket No. 50-298, DPR-46

References:

1. E-mail to Paul Fleming (Nebraska Public Power District) from Mohan Thadani (Nuclear Regulatory Commission) dated May 28, 2002, TAC # MB4654

2. Letter to U.S. Nuclear Regulatory Commission (NLS2001011) from John H. Swailes (Nebraska Public Power District) dated February 28, 2001, Proposed License Amendment Related to the Design Basis Accident Radiological Assessment Calculational Methodology

The purpose of this letter is to respond to a Nuclear Regulatory Commission Request for Additional Information (RAI) provided in Reference 1. The RAI contained three questions related to the license amendment request to revise the design basis accident radiological assessment calculational methodology (Reference 2). The three questions and the Nebraska Public Power District responses are provided in Attachment 1.

Should you have any questions concerning this matter, please contact Mr. Paul Fleming at (402) 825-2774.

Sincerely,

David L. Wilson

David L. Wilson
Vice President-Nuclear

/wrv

Attachment

A001

cc: Regional Administrator
USNRC - Region IV

Senior Project Manager
USNRC - NRR Project Directorate IV-1

Senior Resident Inspector
USNRC

NPG Distribution

Records

STATE OF NEBRASKA)
)
NEMAHA COUNTY)

David L. Wilson, being first duly sworn, deposes and says that he is an authorized representative of the Nebraska Public Power District, a public corporation and political subdivision of the State of Nebraska; that he is duly authorized to submit this correspondence on behalf of Nebraska Public Power District; and that the statements contained herein are true to the best of his knowledge and belief.

David L. Wilson

Subscribed in my presence and sworn to before me this 13th day of September, 2002.

NOTARY PUBLIC

GENERAL NOTARY-State of Nebraska
B. J. SHUBERT
My Comm. Exp. Sept. 15, 2003

ATTACHMENT 1

Question 1: Nebraska Public Power District (NPPD) has modeled the release from the turbine building as diffuse, occurring over an area of the turbine building wall. Despite discussions with NPPD personnel, staff is not yet convinced that this is the limiting case. If a penetration release would be more limiting, the diffuse area source model should not be used.

Assuming a diffuse release, what is the mechanism assuring that the effluent is homogeneously distributed throughout the turbine building and that the release to the environment will be reasonably constant over the surface of the building? Since leakage is more likely to occur at a penetration, what is the shortest path between the equipment from which the leak is assumed to occur (e.g., condenser), to the most limiting penetration, then to the control room air intake? What are the associated distances and heights? Use of plant drawings may aid in the description. Penetrations to be considered include doors, duct and fan openings, windows, other ventilation inlets and outlets, louvers, openings in building seams, and other openings through which a draft could occur.

Response[1]: NPPD's use of the diffuse release methodology to model the Turbine Building release pathway for the Control Rod Drop Accident (CRDA) and Loss of Coolant Accident (LOCA) is both technically acceptable and consistent with regulatory precedent.

The diffuse release and the point release methodology results converge as the distance between the release location and the receptor increases, and, as described below, it is unlikely that the Turbine Building release will preferentially emanate entirely from the closest potential release pathway to the Control Room air intake. The Control Room X/Q calculation for the Turbine Building release conservatively selects the wall closest to the Control Room air intake as the release pathway wall. The calculation uses the entire surface area of this wall as the area source, in accordance with Section 2.5.7 of NUREG/CR-6331, Rev. 1, for a diffuse source release model in which there are releases from many openings on a face of a building. Since this model was felt to most accurately describe the as-built layout of the plant and leakage openings, it was the one used in the calculation to model Turbine Building releases.

Cooper Nuclear Station (CNS) License Amendment No.183 documents this approach and summarizes the Nuclear Regulatory Commission (NRC) staff discussion and agreement in using a diffuse release methodology. This approach is similar to that used in TMI Unit No.1 License Amendment 215. As recently noted in NRC Regulatory Issue Summary 01-019, and consistent with previous staff guidance, licensees should use atmospheric dispersion values previously approved by the NRC staff and documented in the Final Safety Analysis Report. Thus, the most recent NPPD radiological consequence submittal utilized the previously approved diffuse release methodology for the CRDA and LOCA Turbine Building releases from CNS License Amendment 183, which is referred to in the CNS Updated Safety Analysis Report.

1. The distances and dimensions provided in this response should be considered as approximate values.

During Turbine Building ventilation system operation the Turbine Building exhaust is directed to a common exhaust plenum, located east of the Turbine Building. The discharge of the plenum is at Elevation 938 feet and is 88 meters horizontally from the Control Room air intake. The Turbine Building roof (Elevation 1007 feet) has no vents.

Following a postulated accident resulting in a radioactive release to the Turbine Building, in which there is no loss of offsite power (no LOOP), the Turbine Building exhaust fans continue to run, and the Turbine Building exhaust flow is directed vertically upward. In order for the release to reach the Control Room air intake, the flow would have to rise above the Turbine Building roof and come down to the Control Room intake (Elevation 957 feet). Due to the vertical velocity, elevations, intervening building, and large horizontal distance to the Control Room air intake, it is judged that this case would not yield bounding results for Control Room dose when compared to a postulated accident resulting in a radioactive release concurrent with a LOOP.

For the LOOP case, the Turbine Building ventilation system fans would coast down and come to a stop, leaving no forced mode of ventilation to direct the Turbine Building atmosphere to the Turbine Building ventilation system exhaust points. With the condenser complex being centrally located in the Turbine Building, leakage to the environment could be from any number of possible locations. These include the opening and closing of various doors, openings around doors, unsealed duct penetrations, unsealed conduit penetrations, unsealed piping penetrations, and the Turbine Building insulated metal siding above the 930 foot elevation (below this elevation the Turbine Building sides are concrete). Additionally, leakage to attached appendage buildings is also possible. Building leakage would be determined by factors such as natural convection, wind direction and structure/component leak path resistance. Leakage would therefore be expected to come from any number of locations along the perimeter of the Turbine Building external walls, not from any single location, as in the case of forced ventilation directed to a specific point.

It is highly unlikely that releases from the condenser complex will preferably and solely emanate from the release point which is closest to the Control Room air intake due to the number of factors which affect the condenser complex release into the Turbine Building. The two closest potential leak paths to the Control Room air intake include a Turbine Building north wall personnel access door at the 903 ground elevation northeast of the Control Room air intake, and an 8 ft^2 ventilation intake louver on the Turbine Building west wall, directly east of the Control Room air intake at approximately the same elevation as the Control Room air intake. The personnel access door is 33 meters horizontally from the Control Room air intake and must traverse two normally closed doors in series. The intake louver supplies a ventilation system internal to the Turbine Building for an enclosed work area, and is 32 meters horizontally from the Control Room air intake. This system would not be operating following a LOOP.

The next closest potential release point is on the Turbine Building north wall and is a normally closed double personnel access door located at the 903 elevation, 44 meters horizontally northeast of the Control Room air intake. This is the only remaining pathway on the north

Turbine Building wall that could release directly to the environment. Ductwork, conduit and pipe penetrations are sealed on the north wall.

Two Turbine Building supply ventilation system intakes are located near the northeast side of the Turbine Building at the 934 elevation on the roof of a Turbine Building appendage building. These supply intakes are 80 and 150 ft^2 in size and 75 meters horizontally east-northeast from the Control Room air intake. Reverse flow through these intakes would encounter numerous flow restrictions including an intake roughing filter. One 3 ft^2 exhaust fan vent diffuser is located on the east side of the Turbine Building at the 940 elevation and 65 meters horizontally east from the Control Room air intake. There would be no forced ventilation flow to this diffuser following a LOOP. The remainder of the visible east wall penetrations are sealed conduit, sealed ductwork, or sealed piping. In order for a release emanating from these ventilation supply and exhaust locations to reach the Control Room air intake, the flow would have to either: a) rise above the Turbine Building roof and come down to the Control Room air intake, or b) curl around the north side of the Turbine Building and reverse direction south to the Control Room air intake.

The largest Turbine Building potential release pathway opening is the Turbine Building west wall railroad door that is 415 ft^2 in area and located 75 meters horizontally southeast from the Control Room air intake at the 903 foot elevation.

A third 70 ft^2 Turbine Building supply ventilation system intake is located 80 meters horizontally southeast from the Control Room air intake on the south side of the Turbine Building at the 948 elevation. Again, reverse flow through this intake would encounter numerous flow restrictions including an intake roughing filter. Numerous other doorways, conduit and pipe penetrations from the west, south and east sides of the Turbine Building lead directly into attached appendage buildings.

Question 2 Part 1: During the 1994 through 1998 meteorological measurement period, data recovery appears to be relatively good in 1994, 1997 and 1998, although during the entire five year period there was some occurrence of wind data remaining unchanged for two or more consecutive hours. To what is this attributed?

Response: It is agreed that there are occurrences in the 1994-1998 hourly CNS meteorological data where the wind speed and direction at the 10-, 60-, and 100-meter levels remained unchanged for two or more consecutive hours. These instances can be divided into three categories: those instances where individual parameters (e.g., 100-meter wind direction) were constant, those where the wind speed was calm during overnight hours, and those where all of the wind parameters at all levels were constant.

In the first category, there were many occurrences where an individual parameter was unchanged for two consecutive hours, and on a few occasions, three hours. Most of these occurred with wind speed, where the statistical chances of this occurring are higher. However, there were several larger blocks of data in 1994 and 1995 where there were 2 or 3 consecutive hours of constant wind speed or direction. In these instances, the data was reduced from strip charts and rounded to the nearest five degrees of wind direction and one mile per hour for wind speed, thus increasing the frequency of consecutive hours for the same wind data. Those periods are shown in Table 1.

Table 1

1994
2/11 1100 through 2/14 2400
4/19 1000 through 2300
5/15 0100 through 2400
8/28 0600 through 8/30 2300
12/3 1200 through 12/4 1100
1995
10/16 0400 through 1600
10/28 1700 through 10/31 2400
11/3 1100 through 11/4 1000
11/14 1600 through 11/15 0900
11/30 0200 through 1600
12/21 0100 through 12/24 2000
12/26 1000 through 1900

In these instances, the data was consistent with the meteorological conditions at the time and determined to be valid.

In the second category, there were many periods where the 10-meter wind speed was recording calm (i.e., 0.0 mph) for more than two consecutive hours during overnight periods. This is a frequently encountered meteorological pattern at CNS. During two of the longer periods, the calm winds occurred for six hours overnight on July 14, 1997 and again on August 6, 1997. In these instances, the calm winds occurred during the overnight hours at the 10-meter level and were consistent with the meteorological conditions at the time. However, in a third instance, the 10-meter wind speed was recorded as calm for 12 hours during the overnight hours from October 16-17, 1997. This period is longer than normal, but considering the increased night time length for that time of year, and that it was the 10-meter level, a determination was made to consider the data as valid as no problems were noted with the data sensor.

The third category includes the instances where all of the wind parameters at all levels were recording the same value for two of more hours, i.e., persistence. There were seven periods discovered where this was the case, affecting a total of 30 hours out of the 43,800 hourly records in the 1994-1998 data set. Individual hours included a total of 2 hours in 1995, 17 hours in 1996, 6 hours in 1997, and 5 hours in 1998. These periods were likely caused by an electrical spike during transmission of the hourly files from the meteorological tower sensors to the data recording system. The files could have been deleted from the data set. However, since these periods were very small, and represent actual meteorological data from the site (i.e., there were no out of range values in any of the occurrences) the periods had little to no impact on the overall data quality. The data periods are listed in Table 2.

Table 2

1995
9/18 0900 through 1000
1996
6/6 0900 through1700
10/31 1200 through 1400
11/4 1000 through 1400
1997
9/22 0900 through 1000
10/23 0900 through 1200
1998
10/21 1100 through 1500

Question 2 Part 2: With respect to temperature difference measurements, there appears to be a relatively higher occurrence of stability category D in 1994 and 1996 and stability category A in 1997 and 1998. As noted in a prior request for additional information, there appears to be more than, at most, a few occurrences of extremely unstable measurements at night which was attributed to factors such as wind shifts and minor temperature fluctuations. Provide a more detailed description of this phenomenon as experienced at the Cooper site.

Response: The distribution of annual stability at the CNS was reviewed to determine whether any bias exists in the 1994-1998 meteorological data and whether fluctuations in any given year are outside of the expected range of normal meteorological variances.

For comparisons both before and after the 1994-1998 period, as well as to establish a site average stability distribution, CNS has compiled the annual stability class distribution for the past 16 years. Table 3 includes the annual stability class distributions for CNS from 1986 through 2001 for the 60-10 meter temperature difference.

Table 3

PERCENTAGE OCCURRENCE OF STABILITY CLASSES
Cooper Nuclear Station

10 m wind vs. 60 - 10m Delta T (Jan Dec)									
YEAR			*STABILITY CLASS*						
	A	B	C	D	E	F	G	ABC	EFG
1986	7.7	5.9	7.4	40.4	25.7	8.5	4.4	21.0	38.7
1987	7.7	5.7	6.4	36.1	27.9	10.1	6.0	19.9	44.0
1988	8.2	4.6	6.2	31.3	31.0	11.4	7.4	18.9	49.8
1989	5.2	4.7	6.5	38.3	27.8	11.0	6.6	16.4	45.3
1990	7.5	6.6	10.1	35.2	25.1	10.0	5.4	24.3	40.6
1991	9.6	7.6	8.8	31.3	26.6	10.5	5.7	25.9	42.8
1992	8.1	6.0	6.1	40.2	24.5	9.0	6.0	20.3	39.6
1993	6.8	4.9	7.3	46.3	23.2	7.6	4.0	18.9	34.8
1994	7.5	6.5	8.2	39.4	23.2	9.5	5.9	22.1	38.5
1995	0.9	3.5	7.6	46.4	27.1	11.1	3.5	12.0	41.6
1996	2.0	4.7	8.6	49.2	25.3	8.9	1.3	15.3	35.5
1997	14.3	7.2	10.0	34.8	22.5	7.7	3.6	31.4	33.8
1998	15.0	6.5	7.8	34.2	23.2	8.5	4.8	29.3	36.4
1999	8.8	6.5	8.5	36.8	24.2	9.6	5.6	23.8	39.4
2000	8.0	5.5	7.7	39.2	25.3	9.7	5.1	21.2	40.1
2001	3.9	3.2	5.2	32.7	34.4	13.2	7.5	12.3	55.1
AVG	7.6	5.6	7.6	38.2	26.1	9.8	5.2	20.8	41.0

Note that the stability category D in 1994 is only slightly above the 16-year site average. However, in 1996, the D category is considerably higher than average (49.2% versus 38.2%) and is attributed to the poor data recovery due to the failure of the 10 meter wind direction sensor in the 2^{nd} and 3^{rd} quarter that year. Therefore, the neutral D stabilities, common in the fall and winter months, result in a higher annual percentage of the total for the year.

In 1997 and 1998, there is a noticeable increase in the percent frequency of stability category A when compared to surrounding years and the 16-year site average. After reviewing these two years in detail, two reasons for this increase are noted. First, CNS has a higher than expected number of category A stabilities at night than is typically seen because of the proximity of the Station (and the Meteorological Tower) to the Missouri River. This is particularly true in the winter and summer. In many instances, when the winds are from the north through east sectors from 5-10 mph at night, the 10-meter temperature stays constant for several hours. In fact, when the winds shift into these sectors, frequently the 10-meter temperature will jump as much as 1.5 degrees F. This is a low elevation impact of the warmer river on the 10-meter temperature measurement and is real. The same pattern is not evident at the temperatures at the 60- or 100-

meter levels. In fact, they continue to cool at the normal rate. As a result, during these conditions, category A stabilities occur for several hours at night. Note that the 10-meter temperature does not usually fluctuate with winds less than 5 mph or greater than 10 mph. During 1997 and 1998, there were an abundance of northeast winds between 5-10 mph at night during the winter and summer months that impacted the data.

The second impact on the category A stability frequency was equipment related. There were numerous equipment problems with the 10-60 meter temperature system from the Fall of 1997 through the Fall of 1998 where category A stabilities were present several hours before and after the system failed. These hours were considered valid because they appeared consistent with the meteorological conditions at the time and there was not enough information to consider them invalid. The cumulative effect of these equipment failures was to slightly over-bias the category A stability by several percent. Overall, the average category A stability distribution during the 1994-1998 period was 7.9% which is consistent with the 16 year average of 7.6%.

Question 2 Part 3: During 1995 and 1996, recovery of temperature difference (@T) measurements and some of the wind direction measurements were less than 90 percent. Thus, the joint wind speed, wind direction and @T data recovery rate was less than 90 percent during these two years. To what is this reduced recovery rate attributed?

Response[2]: Upon review of the data for year 1995 and 1996, numerous incidences of unavailable data were confirmed. The unavailability of the meteorological data was primarily attributable to various mechanical problems and timeliness of meteorological equipment repairs.

Question 2 Part 4: What changes, if any, have been made to ensure continuing good recovery of high quality meteorological data, particularly with respect to the @T measurements?

Response[2]: The following outlines steps taken to increase the availability and reliability of the meteorological data monitoring system.

A vendor was hired by NPPD in 1998 to review issues associated with meteorological data recovery. They determined that the existing sensor technology could be retained, but that a stronger focus was necessary in the area of meteorological data monitoring processes, procedures, and ownership to ensure compliance with licensee commitments.
In 1998, NPPD stationed a full-time environmental coordinator at CNS, in part, to address the poor meteorological data recovery issues. The coordinator worked with CNS and Corporate Office personnel to review and address the problems associated with the meteorological monitoring system, and to implement processes to improve corrective action efforts regarding meteorological system maintenance. Additionally, in 1999, efforts were focused on transferring the meteorological program responsibilities from the Corporate Office to CNS for better communication and closer oversight.

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2. NPPD assumes that the "@T" term electronically received in Reference 1 should be "ΔT."

A system engineer was assigned to the meteorological monitoring system in 2000. The engineer has performed a review of issues associated with the meteorological monitoring system including licensee requirements, emergency preparedness requirements, maintenance procedures, monitoring equipment, and vendor reviews. Personnel safety issues associated with the meteorological tower impacted the amount of maintenance performed on the tower's meteorological monitoring equipment in 2000. A tower inspection and evaluation was subsequently completed to ensure the physical tower would be safe to climb and able to accept new or updated instrumentation.

A second vendor was hired by NPPD in 2001 to assist in Annual Radiological Effluent Release Report and Annual Meteorological Report development, meteorological data analysis services, and calibration and maintenance of the meteorological monitoring system.

In 2001, the system engineer created a CNS Meteorological System Health Team. One of the team's primary goals is to increase the reliability and availability of meteorological monitoring system data.

In 2002, the CNS Meteorological System Health Team identified several improvements associated with the meteorological tower that should be addressed to improve meteorological system data availability and reliability. The Team is developing a proposed action plan for these items. Finally a Meteorological Instrumentation Corrective Maintenance Classification and Prioritization Agreement was signed in 2002 by the Radiological Protection Manager, Maintenance Manager, Operations Manager, Work Control Manager, Plant Engineering Manager and the Plant Manager. This agreement prioritizes maintenance activities on the meteorological tower and should allow for more timely and responsive maintenance to meteorological tower equipment issues, ensuring better data availability and reliability.

Question 3: In evaluating the offsite radiological consequences of a design basis Main Steam Line Break (MSLB) accident, you have calculated projected doses for both the Technical Specification (TS) reactor coolant equilibrium activity concentration of 0.2 mCi/gm I-131 dose equivalent and a pre-accident iodine spike at the TS maximum activity concentration of 4.0 mCi/gm I-131 dose equivalent. However, in projecting the control room dose due to an MSLB, you have analyzed only for a reactor coolant activity concentration of 0.2 mCi/gm I-131 dose equivalent. Why was the iodine spike not considered for the control room dose analysis? How does this meet the intent of 10 CFR 50, Appendix A, General Design Criterion 19, "Control Room," which requires the control room be habitable under accident conditions?

Response[3]: The CNS Licensing Basis for determining that Control Room dose is maintained within the limits of General Design Criterion (GDC) 19 of 10CFR50, Appendix A, is based on the TS Limiting Condition for Operation (LCO) value for continuous operation, which is 0.2 μCi/gm Dose Equivalent I-131. As such, a calculation to determine the Control Room

3. NPPD assumes that the "mCi/gm" term electronically received in Reference 1 should be "μCi/gm."

operator dose using the reactor coolant activity spike of 4.0 μCi/gm Dose Equivalent I-131 is not required by the CNS Licensing Basis.

The most recent revision to the CNS licensing basis, involving the Dose Equivalent I-131 values, was associated with the conversion of the CNS Technical Specifications to Improved Technical Specifications (CNS License Amendment #178, TAC NO. M98317). As a result of this Amendment, the Bases for LCO 3.4.6, "Reactor Coolant System Specific Activity," states:

> The limits on the specific activity of the primary coolant also ensure the thyroid dose to the Control Room operators resulting from a main steam line break outside containment during steady state operations will not exceed the limits specified in GDC19 of 10CFR50, Appendix A.

This limit provided in LCO 3.4.6 requires that specific iodine activity is limited to less than or equal to 0.2 μCi/gm Dose Equivalent I-131.

In contrast, the evaluations associated with offsite doses and compliance with 10CFR100 are performed with both the continuous steady state value for reactor coolant specific activity (0.2 μCi/gm Dose Equivalent I-131), as well as with a spike of 4.0 μCi/gm Dose Equivalent I-131.

- Per Standard Review Plan (SRP) 15.6.4 (Section II.1), Rev 2, for a MSLB with an assumed pre-accident spike iodine concentration corresponding to the maximum value allowed in the Technical Specifications (4.0 μCi/gm Dose Equivalent I-131 in CNS LCO 3.4.6, Action A) the calculated doses should not exceed the guideline values of 10CFR100.

- Per SRP 15.6.4 (Section II.2), Rev 2, for a MSLB with an assumed iodine concentration corresponding to the equilibrium value for the continued full power operation the doses should not exceed a small fraction (i.e. 10%) of 10CFR100 dose limits.

Consistent with the above, the TS Bases for LCO 3.4.6 states that the limits on the maximum allowable level of radioactivity in the reactor coolant (i.e., 4.0 μCi/gm Dose Equivalent I-131 in CNS LCO 3.4.6, Action A) is established to ensure that in the event of a release of any radioactive material to the environment during a Design Basis Accident (DBA), radiation doses are maintained within the limits of 10CFR100. Additionally, the Bases state that the limits on specific activity of the primary coolant during steady state operation ensure that the 2 hour thyroid and whole body doses at the site boundary, resulting from a MSLB outside containment during steady state operation, will not exceed 10% of the dose guidelines of 10CFR100.

ATTACHMENT 3 LIST OF NRC COMMITMENTS

Correspondence No: NLS2002094

The following table identifies those actions committed to by the District in this document. Any other actions discussed in the submittal represent intended or planned actions by the District. They are described to the NRC for the NRC's information and are not regulatory commitments. Please notify the NL&S Manager at Cooper Nuclear Station of any questions regarding this document or any associated regulatory commitments.

COMMITMENT	COMMITTED DATE OR OUTAGE
None	N/A