Dominion Energy Kewaunee, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060

Dominion®

August 9, 2012

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

Serial No. 12-360
LIC/CDS/R4
Docket No. 50-305
License No. DPR-43

DOMINION ENERGY KEWAUNEE, INC.
KEWAUNEE POWER STATION
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION:
LICENSE AMENDMENT REQUEST 244, PROPOSED REVISION TO RADIOLOGICAL ACCIDENT ANALYSIS AND CONTROL ROOM ENVELOPE HABITABILITY TECHNICAL SPECIFICATIONS (TAC NO. ME7110)

By application dated August 30, 2011 (Reference 1), Dominion Energy Kewaunee, Inc. (DEK), requested an amendment to Facility Operating License Number DPR-43 for Kewaunee Power Station (KPS). This proposed amendment (LAR 244) would revise the KPS Operating License by modifying the Technical Specifications (TS) and the current licensing basis (CLB) to incorporate changes to the current radiological accident analysis (RAA) of record. This amendment would also fulfill a commitment made to the NRC in response to Generic Letter 2003-01, "Control Room Habitability" (Reference 2) to submit proposed changes to the KPS TS based on the final approved version of TSTF-448, "Control Room Habitability."

Subsequently, on April 13, 2012 the Nuclear Regulatory Commission (NRC) staff transmitted a request for additional information (RAI) regarding the proposed amendment (Reference 3). The following RAI questions and associated DEK responses are provided in Attachment 1 to this letter.

- ME7110-RAII-AADB-Brown-001-2012-05-13
- ME7110-RAII-AADB-Brown-002-2012-05-13
- ME7110-RAII-AADB-Brown-003-2012-05-13
- ME7110-RAII-SCVB-Brown-004-2012-05-13

ADD1
NRR

If you have any questions or require additional information, please contact Mr. Craig Sly at 804-273-2784.

Sincerely,

J. Alan Price
Vice President – Nuclear Engineering

VICKI L. HULL
Notary Public
Commonwealth of Virginia
140542
My Commission Expires May 31, 2014

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and State aforesaid, today by J. Alan Price, who is Vice President – Nuclear Engineering, of Dominion Energy Kewaunee, Inc. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 9TH day of August, 2012.

My Commission Expires: May 31, 2014. Vicki L. Hull
Notary Public

Attachment:

1. NRC Request for Additional Information Questions and Dominion Energy Kewaunee Responses

Enclosure:

1. Enclosed with this letter is a compact disk (CD) which is labeled:

Dominion Energy Kewaunee, Inc.
Kewaunee Power Station
Response to Request for Additional Information
LAR 244 Proposed Revision to Radiological Accident Analysis and
Control Room Envelope Habitability Technical Specifications
Serial No. 12-360
Docket No.: 50-305
License No.: DPR-43

The enclosed CD contains the following files: (Please note that files 001-003 below are data files for use by the NRC staff in reviewing this amendment request).

	File Name	Description	File Size	Sensitivity
001	ARCON96RevisedData.txt	ARCON96 formatted 2002-2006 met data input file	1584 KB	publicly available
002	JFDRevised.doc	Joint Frequency Distribution (JFD) based on File 001	93 KB	publicly available
003	PAVANDRevisedInput.txt	PAVAND Input file revised to include JFD	8 KB	publicly available

References:

1. Letter from J. A. Price (DEK) to Document Control Desk (NRC), "License Amendment Request 244, Proposed Revision to Radiological Accident Analysis and Control Room Envelope Habitability Technical Specifications," dated August 30, 2011. [ADAMS Accession No. ML11252A521]
2. Letter from Craig W. Lambert (NMC) to Document Control Desk (NRC), "Generic Letter 2003-01; Control Room Habitability – Supplemental Response," dated April 1, 2005. [ADAMS Accession No. ML050970303]
3. E-mail from Karl D. Feintuch (NRC) to Craig D. Sly and Jack Gadzala (DEK), "ME7110 Kewaunee - Request for Additional Information (RAI) AADB and SCVB 2012-04-12," dated April 13, 2012. [ADAMS Accession No. ML12107A144]

Commitments made in this letter: None

cc: Regional Administrator, Region III
U. S. Nuclear Regulatory Commission
2443 Warrenville Road
Suite 210
Lisle, IL 60532-4352

Mr. K. D. Feintuch
Project Manager
U.S. Nuclear Regulatory Commission
One White Flint North, Mail Stop O8-H4A
11555 Rockville Pike
Rockville, MD 20852-2738

NRC Senior Resident Inspector
Kewaunee Power Station

Public Service Commission of Wisconsin
Electric Division
P.O. Box 7854
Madison, WI 53707

ATTACHMENT 1

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION: LICENSE AMENDMENT REQUEST 244, PROPOSED REVISION TO RADIOLOGICAL ACCIDENT ANALYSIS AND CONTROL ROOM ENVELOPE HABITABILITY TECHNICAL SPECIFICATIONS

NRC REQUEST FOR ADDITIONAL INFORMATION QUESTIONS AND DOMINION ENERGY KEWAUNEE RESPONSES

KEWAUNEE POWER STATION

DOMINION ENERGY KEWAUNEE, INC.

NRC REQUEST FOR ADDITIONAL INFORMATION QUESTIONS AND DOMINION ENERGY KEWAUNEE RESPONSES

On April 13, 2012 the Nuclear Regulatory Commission (NRC) staff transmitted a request for additional information (RAI) (Reference 3) regarding Dominion Energy Kewaunee, Inc. (DEK) proposed amendment LAR 244 (Reference 1). The following RAI questions and associated DEK responses are provided in Attachment 1 to this letter.

- ME7110-RAII-AADB-Brown-001-2012-05-13
- ME7110-RAII-AADB-Brown-002-2012-05-13
- ME7110-RAII-AADB-Brown-003-2012-05-13
- ME7110-RAII-SCVB-Brown-004-2012-05-13

PREFACE:

In the process of developing responses for these RAI questions, DEK discovered that a subset of stability data included within the meteorological data file used to develop new X/Qs contain instantaneous values, instead of hourly average values. The 2005-2006 stability class values in the 2002-2006 data file were determined to be instantaneous one-second values. This issue was entered into the Kewaunee Power Station (KPS) Corrective Action System.

DEK has corrected the meteorological data file to contain stability classes based on hourly averaged meteorological parameters for 2002-2006. Descriptions of how the new data compares with the old, how some peculiar data trends observed in the old data file are now no longer apparent, and what effects the new data has on calculated X/Q values are provided in the RAI responses below.

A copy of the corrected data file is provided in Enclosure 1 for NRC staff review and use in confirmatory X/Q calculations. DEK is confident that the new data file is pertinent to the KPS site for its intended purpose and that the NRC staff questions regarding the meteorological data have been addressed. Sensitivity studies performed on the major release pathway X/Qs using the new data indicate minimal (or negligible) differences in calculated X/Q values compared to those originally submitted in LAR 244 (see X/Q comparisons in response to RAI ME7110-RAII-AADB-Brown-003-2012-05-13). Rather than revise documentation, analyses, and results to incorporate insignificant changes in X/Qs as a result of this new data file, DEK proposes to maintain the original values and results as submitted in LAR-244. The conservative methods employed in the calculation of control room X/Q values for every source-to-receptor pair more than compensate for the minimal changes noted in new X/Q values.

ME7110-RAII-AADB-Brown-001-2012-05-13

Section 3.1, "Determination of Atmospheric Dispersion Factors (X/Q)," of Attachment 4 states that, during review of the meteorological data, the meteorologists observed that there was a change in the distribution of the atmospheric stability classes in the data during early January of 2005 and noted that the Kewaunee plant process computer was replaced in January 2005. An effort was made to determine the cause of this shift in stability class distribution. The algorithm used to calculate the stability classes was examined and found to comply with requirements and methods. The conclusion reached was that the change in stability class distribution was tied to the replacement of the plant process computer, but no conclusion could be reached on whether the stability class distribution, before the plant process computer change, was necessarily incorrect. The LAR also stated that stability classes since January 2005 were found to compare well with data from the Point Beach Nuclear Plant site which is located a few miles south of Kewaunee.

a. Please describe any changes in the Kewaunee meteorological measurement and data processing program from 2002–2006 other than the change in the plant process computer.

b. Provide a description of the requirements and methods to which the plant process computer algorithm was found to comply.

c. Describe any revisions that were made to the requirements and methods of the plant process computer algorithm since 2001.

d. Select a representative hour of data between January 2002 and December 2004 and a second hour between February 2005 and December 2006. Provide a step-by-step numerical explanation of how each of the temperature difference measurements were converted to each associated atmospheric stability category.

e. In general, unstable conditions are expected to occur very infrequently at night and were reported to occur at Kewaunee only a few times at night in 2002–2004. Explain the noticeable increase in occurrence of unstable conditions at night in 2005–2006 and the increase in stability class A conditions overall from an average of approximately 1.8 percent in 2002–2004 to an average of approximately 13.8 percent in 2002–2004. In addition, discuss the occurrence of stability category A for periods longer than 12 consecutive hours in 2005–2006 (maximum length of 41 consecutive hours) as compared with the maximum length of occurrence in 2002–2004 of 10 hours.

f. Discuss the decrease in the frequency of occurrence of stability class E from approximately 35 percent in 2002–2004 to approximately 20 percent in 2005–2006.

g. Were any sigma theta wind measurements used to determine the atmospheric stability category?

Response:

a. The wind sensors (mechanical wind vane for direction and anemometer for wind speed) were replaced by an ultrasonic sensor that measures both wind direction and speed.

   Local computers were added in the meteorological tower sheds and in the plant, replacing the old chart recorders. These computers have no affect on the signals to the PPC (Plant Process Computer) and the signal loops from the meteorological tower sheds to the PPC remained unchanged.

b. The Kewaunee Plant Process Computer System (PPCS) was upgraded in 2005. The older Honeywell PPCS was replaced with a system from Scientech. The Scientech PPCS was a significant improvement over the old Honeywell PPCS in that it provides archiving capabilities. Prior to 2005, plant data was stored on a Plant Information (PI) system which was installed in the early 1980s. The PPCS sends specified data to the PI to be recorded and archived. It was not practical, with the limitations of the technology at the time the PI was designed, to record vast amounts of data. Because of this, the PI system was configured to only record new data points when the input signals changed by a pre-determined amount. This exception/deviation criterion was established for each point, and is apparent in the 2002-2006 data file when archived points displayed show the exact same value for a period of time. The PI system continues to store meteorological data today, as it has done since its installation.

   An application in the PPCS called Meteorological Monitoring calculates "sliding" 15-minute averages of ambient temperature, delta temperature, wind speed, and wind direction. The averages are recalculated every one second and stored in the database as composed analog points. Historical arrays maintain 15 minutes of value and data quality. Investigation has determined that a special variable called 'Stability Class' in the PPCS is uniquely calculated using a data hierarchy between good quality <u>instantaneous</u> measurements of Delta Temperature readings or measured Sigma Theta. The primary method for stability determination uses Delta Temperature converted to a stability class using the following conversion logic that complies with the classification criteria provided in Regulatory Guide 1.23:

Pasquill Stability Category	Ambient Temperature Change with Height (°F/50 m)
A	DT≤ -1.71
B	-1.71 < DT ≤ -1.53
C	-1.53 < DT ≤ -1.35
D	-1.35 < DT ≤ -0.45
E	-0.45 < DT ≤ 1.35
F	1.35 < DT ≤ 3.60
G	DT > 3.60

If data quality is bad for delta temperature, a secondary method for stability determination uses Sigma Theta converted to a stability class. The following criteria are used in the conversion of Sigma Theta:

Pasquill Stability Category	Sigma Theta (°)
A	SIGMA θ ≥ 22.5
B	17.5 ≤ SIGMA θ < 22.5
C	12.5 ≤ SIGMA θ < 17.5
D	7.5 ≤ SIGMA θ < 12.5
E	3.8 ≤ SIGMA θ < 7.5
F	2.1 < SIGMA θ < 3.8
G	SIGMA θ < 2.1

As described in the preface above, the original data file provided to calculate new station control room and offsite X/Qs was an extract from both the PI system for 2002-2004 data and the PPCS for 2005-2006 data. The data point requested for 'Stability Class' within the PPCS data has been discovered to be a single one-second instantaneous value rather than an average value representative for each hour of data requested.

DEK has eliminated all instantaneous values in a new data file created from one historical archive source at Kewaunee. A new data file was created from data extracted from only the PI system for 2002-2006. PI receives data from the PPCS after any data processing or averaging has been performed (as described above). PI does not store the 'Stability Class' variable or any instantaneous values from the meteorological tower. The data extracted from PI was hourly ambient temperature, hourly wind speeds (10 meter and 60 meter), hourly wind directions (10 meter and 60 meter), hourly Sigma Theta (10 meter), and hourly Delta Temperature.

Conversion of Delta Temperature values to a stability class were performed using Excel, following the same logic as shown above for DT conversion. Stability class substitutions using hourly Sigma Theta values for missing or bad DT values were included in the new data file, consistent with the existing program and logic within the Meteorological Monitoring application.

c. The Meteorological Monitoring application on the PPCS that performs calculations for the meteorological data has not been revised since 2001. There are no entries in the electronic change log or in the controlled software documentation indicating this application has been changed. When the new Scientech PPCS was installed in late 2004, this application was duplicated from the old PPCS with no changes.

d. The basic process for data measurement did not change during the entire period of interest (January 2002 through December 2006). Measurements from the meteorological tower were collected in a data logger, which transfers information every second to the PPCS. The PPCS would perform any calculations, and the data then archived into the Plant Information (PI) system. The primary difference between the period from January 2002 through December 2004 and the period from January 2005 through December 2006 was how the data was archived. Prior to the PPCS upgrade in late 2004, all meteorological data was archived only in the PI system. As previously discussed, the PI system uses a compression routine based on persistence and data change criteria to limit data storage. The PI system is not configured to store the calculated stability class from the PPCS; it stores the average Delta Temperature. Since the PPCS upgrade, data is archived both by the PPCS and the PI system.

The original data file used to calculate new X/Qs was a merging of PI archived data from 2002-2004 and PPCS archived data from 2005-2006. The stability class was manually calculated from recorded Delta Temperature readings for the 2002-2004 subset of data, whereas stability class was a stored data point for the 2005-2006 data extracted from the PPCS. As previously discussed, that data file has been replaced because the 2005-2006 stability class values taken from the PPCS were based on instantaneous values. Therefore, as requested, a representative hour of data from both data subsets will be represented from the new data file.

Example 1:

On 06/01/2003 at 12:00, the value of the Delta Temperature data point from the data logger was -1.280. Manually converted to a stability class using the criteria shown in the response to question 1.b, the stability was determined to be "D".

Example 2:

On 5/15/2005 at 12:00, the value of the Delta Temperature data point from the data logger was -2.50061. Manually converted to a stability class, the stability was determined to be "A".

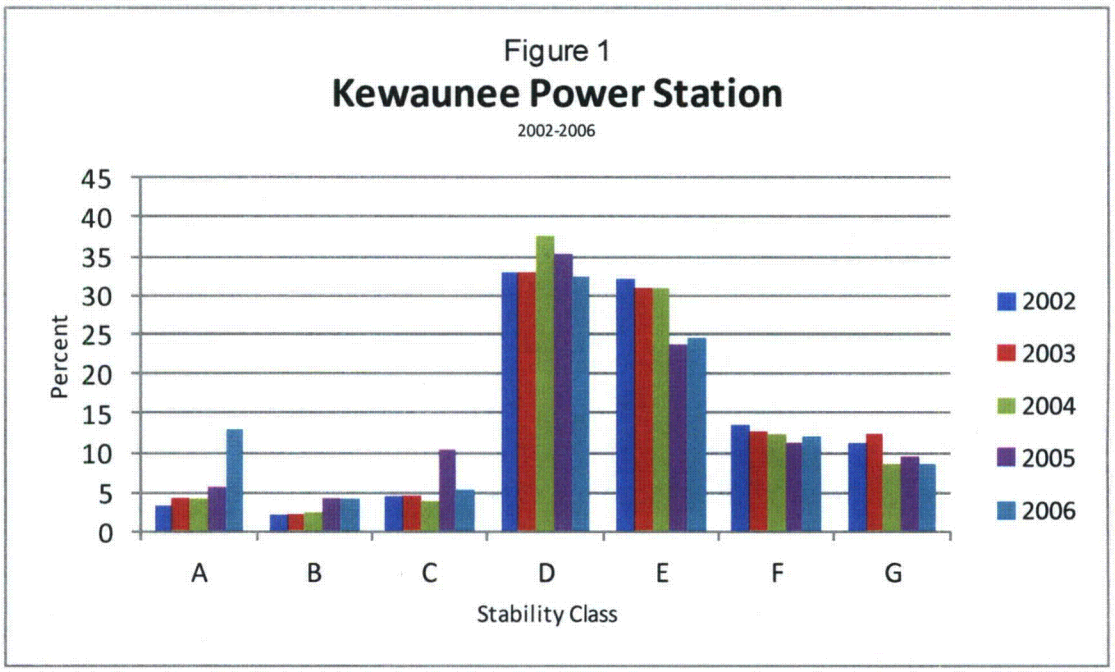
e. Examination of the original 2002-2006 meteorological data determined that a conversion error was introduced in the 2002-2004 data when converting Delta Temperature (DT) values into stability class. When the original 2002-2006 data was requested, it was constructed by merging of data from both the PI and PPCS data files. The raw DT values recorded in the PI 2002-2004 data had to be converted to stability class. An error occurred in that conversion process. The conversion of DT to stability class considered a height differential between the upper and lower tower elevations of 60 meters, when in fact the height differential is 50 meters. The result of this error changes the frequency of stability classes for 2002-2004, as shown below:

Stability Class Distribution 2002 – 2004
(Percent of Year)

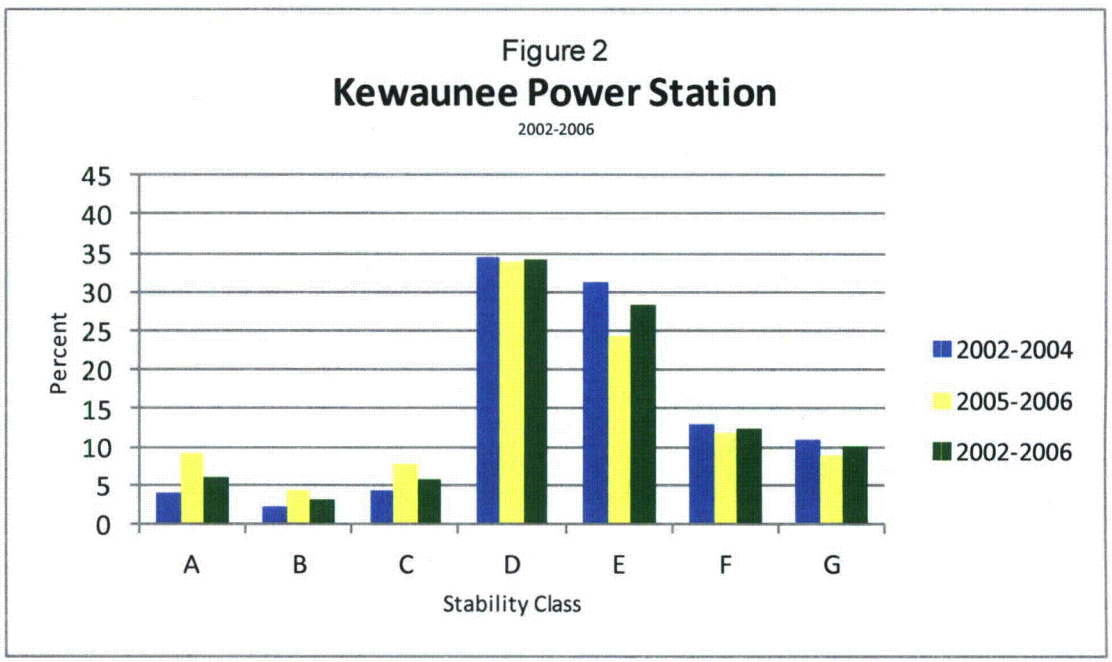
	A		B		C		D		E		F		G	
Year	**Old**	**New**	**Old**	**New**	**Old**	**New**	**Old**	**New**	**Old**	**New**	**Old**	**New**	**Old**	**New**
2002	1.4	3.5	1.1	2.2	2.0	4.6	35.2	32.9	37.6	32.0	14.0	13.7	8.7	11.2
2003	2.2	4.3	1.3	2.2	2.3	4.4	34.2	33.0	36.7	30.9	13.1	12.7	10.2	12.5
2004	1.8	4.2	1.4	2.4	2.4	3.9	38.6	37.6	36.5	30.9	12.9	12.4	6.5	8.6

Based on corrections made to the data, the average 'A' stability class occurrence increased to approximately four percent for 2002-2004.

In addition to the conversion error that affected the 2002-2004 data, DEK further determined that the stability class values for 2005-2006 were based on single instantaneous DT values. This prompted the creation of a completely new 2002-2006 data file to replace the original file. The comparison of stability class frequencies in the data sub-sets from 2002-2006 no longer show dramatic differences. In fact, only 2006 data shows any noticeable increase in 'A' stability class frequency when compared to the other four years (see Figure 1 below). Additional review of more recent data indicates varying occurrences of unstable meteorology at percentages comparable to 2006, as well as to values seen before 2006.



To compare stability class occurrence between the two subsets of data within the 2002-2006 data, Figure 2 was created to display the percent of stability occurrence for 2002-2004, 2005-2006, and the combined percentage of occurrence over 2002-2006. The stability occurrences in the new data file show no significant difference between the frequencies in each sub-set of data or to the overall frequency of the entire data file.



Taking into consideration the new data file that was created, DEK has addressed each of the NRC additional requests pertaining to this question below.

Request: "Explain the noticeable increase in occurrence of unstable conditions at night in 2005–2006."

The occurrence of unstable atmospheric conditions at night at KPS is not that uncommon. In fact, when compared to corresponding data from the Point Beach Nuclear Plant, similar occurrences are noted. One probable cause for this occurrence is during cold periods when warmer air off the surface of Lake Michigan flows onshore causing the 10-meter temperature reading to be warmer than the upper level temperature reading. Onshore winds occur more than 20% of the time every year.

Examination of the new data file found that there is no longer a noticeable increase in the occurrence of unstable conditions at night for the 2005-2006 data subset. Occurrences for 2002-2004 were about five percent and for 2005-2006 were about nine percent. In comparison, Point Beach Nuclear Plant data shows about eight percent for 2002-2004 and about 15 percent for 2005-2006.

Request: "Explain the increase in stability class 'A' conditions overall from an average of approximately 1.8 percent in 2002–2004 to an average of approximately 13.8 percent in 2002–2004."

As discussed, the new data file that was created to correct the stability class calculation error and eliminate stability classes based on instantaneous one-second readings shows a significantly different distribution of stability occurrences. Based on the comparison shown in Figure 2, the new data file indicates normal annual variability in observed stability occurrences.

Request: "Discuss the occurrence of stability class 'A' for periods longer than 12 consecutive hours in 2005–2006 (maximum length of 41 consecutive hours) as compared with the maximum length of occurrence in 2002–2004 of 10 hours."

Review of the original data file indicates some instances where bad DT data was not identified and flagged and as such, the data was inadvertently included. This resulted in wholly artificial prolonged periods of 'A' stability class. The most significant period occurred between January 13, 2005 and January 19, 2005.

A second and more difficult source of prolonged very unstable DT measurements was found to occur mainly between the second week of August and the third week of September of 2005. While reviewing these periods, recorded DT values from August 17, 2005 to September 1, 2005 were considered extremely questionable, yet

it was not clear that instrument failure was the cause. The decision was made to conservatively mark this period of DT values invalid.

DEK subsequently learned that there had been land-use and land-cover (LULC) changes to the area surrounding the meteorological towers starting in 2005. Some things that have changed (since September 2004 / early 2005) were Parking Lot C was paved and a new gravel storage lot was created. Both lots are located to the North of the primary meteorological tower (see Figure 3 below).

Figure 3

Parking Lot C was previously a gravel lot before being blacktopped. Small shrubs and tall grasses existed in the area where the new gravel lot now exists as well as across the surrounding area. Since 2005, the station maintains vegetation growth in the area surrounding the meteorological towers with periodic mowing. It is believed that the prolonged occurrence of very unstable conditions during the last two weeks of August 2005 are a probable result of the LULC changes. As previously discussed, the DT values during this period were marked invalid. Focused review of further data in 2005 did not uncover similar questionable periods that required data to be marked as invalid. Review of the DT values in subsequent years, 2006 and beyond, did not indicate the extreme conditions that were found in 2005, the first year immediately following the LULC changes. It is likely that the surrounding area affected by the LULC changes has matured with re-growth of ground cover, moderating the impact of the LULC changes to the meteorological data relative to the 2002-2004 timeframe.

Figure 4 shows the location of the meteorological tower on the Kewaunee site and Figure 5 provides a prospective of Kewaunee located approximately four miles from Point Beach Nuclear plant on Lake Michigan.

Figure 4

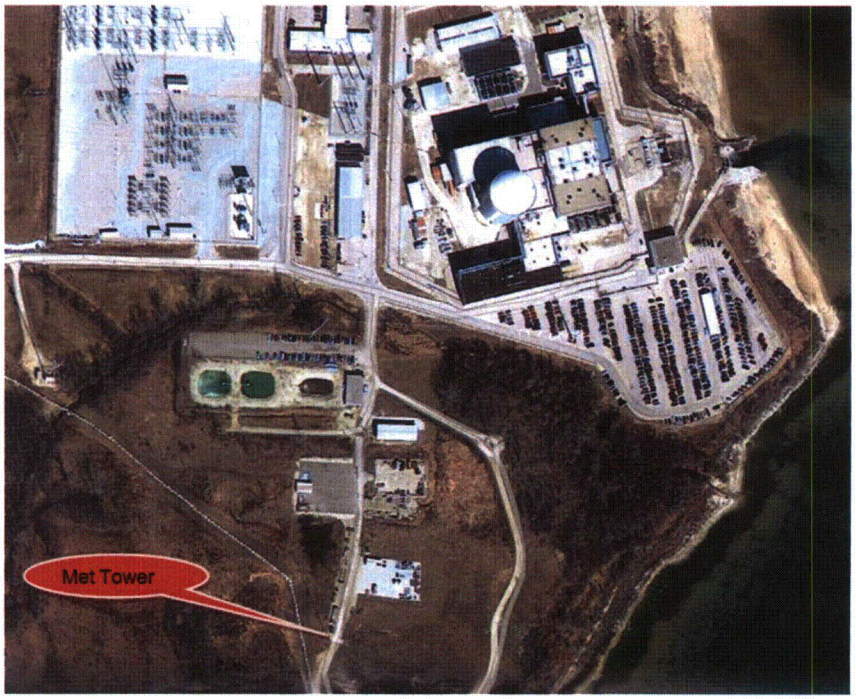


Figure 5

f. As shown in Figure 2, the differences noted in the frequency of occurrence of stability class 'E' is much less in the new data file between the two sub-sets of data. From annual data displayed in Figure 1, average stability occurrence fluctuations from year to year are not uncommon. In fact, stability fluctuations for 2002-2006 compared to 2008-2011 data are similar. DEK is confident that the new data file used to perform X/Q analyses in support of LAR-244 is appropriate and provide adequate representation of local atmospheric dispersion.

g. In the original data file previously provided, Sigma Theta wind measurements were used to supplement atmospheric stability determination at Kewaunee. As discussed in the response to question 1.b, Sigma Theta is normally a secondary method to Delta Temperature when determining stability class. Only when Delta Temperature data quality is bad will Sigma Theta be used. Less than six percent of the total stability class determinations are the result of Sigma Theta measurement conversions.

ME7110-RAII-AADB-Brown-002-2012-05-13

Please provide a detailed description of how measurements were made to obtain the raw meteorological data and the subsequent technical review and data validation process to generate the "008 ARCON96MetData.txt" input file. Discuss instrument calibrations with respect to Regulatory Guide 1.23, "Onsite Meteorological Programs," specifications, and data substitutions or modifications, if any were made. Include a chronology, the specific criteria used to determine the validity of the data, and general qualifications of personnel who performed the review and processing of the data.

In addition, please discuss the following:

a. Calendar years 2002, 2003 and 2004 each end with 3 days of invalid upper wind data, but the first hour of each subsequent calendar year does not begin with invalid data,

b. Blank fields,

c. Data fluctuations between reported valid and invalid observations over a relatively short period of time, (e.g., 2002 upper wind direction data, day 68, hour 8, through day 69, hour 21, being generally invalid data but, 10 hours in three clusters, identified as valid) and basis for confidence in data validity,

d. For wind data, the same or essentially same value repeated for a series of consecutive hours (e.g., 2004, a lower level wind speed of 24 from day 178, hour 21, through day 179, hour 12, and in 2005, a lower level wind direction of 316 and upper level wind direction of 326 for day 79, hour 9, through day 79, hour 23),

e. Wind speeds in 2004 that result in a reported decrease with height approximately 6 percent of the year compared with the reported average frequency of wind speed decrease with height wind of about 2 percent during years 2002, 2003, 2005, and 2006, and

f. The relatively high frequency of reported light wind speeds at the lower measurement level in 2005 (e.g., day 218, hour 19, through day 219, hour 9; day 248, hour 19, to day 250, hour 9), in comparison with the other years, with light wind speed occurrence at the upper level appearing to be relatively similar all five years.

Response:

The meteorological data contained in the new data file provided in Enclosure 1 is an extract of 2002 through 2006 data from the Plant Information (PI) system. The data stored in the PI system is an accumulation of meteorological data collected, processed, and screened, before being permanently archived within PI storage memory.

Meteorological measurements are continuously collected from instruments on the primary and backup meteorological towers. Data is processed in real time by a processing card which sends data to a data logger and directly to the Plant Process Computer System (PPCS). Computers in the primary and backup meteorological tower sheds and in the Technical Support Center retrieve the data logger data in digital format and store the information in files that can be computer displayed. As discussed in the response to Question 1.b, an application in the PPCS called "Meteorological Monitoring" calculates "sliding" 15-minute averages of ambient temperature, delta temperature, wind speed, and wind direction. The averages are recalculated every second and stored in a database as composite analog points. Historical arrays maintain 15 minutes of value and data quality. The PI system receives updates of the PPCS averaged data and screens the data against compression/deviation criteria to determine if each individual value needs to be stored permanently in the PI archives. This screening is performed to record values when the values show enough change (this is done to save space in the database).

Meteorological instrumentation is maintained and calibrated per the guidance of Regulatory Guide 1.23. Data recovery of at least 90 percent was achieved on an annual basis. Channel operability checks on the wind speed, wind direction, temperature zero and span are performed daily from the processer to the PPCS. Channel calibrations are performed semiannually. Wind sensors are swapped during the channel calibration and sent offsite to a vendor for calibration. System calibrations encompass the entire data loop from channel sensors to recorders to displays.

Dominion purchased Kewaunee in 2005. However, daily review of Kewaunee meteorological data was not formally incorporated into the Dominion meteorological program until after 2006. Therefore, the 2002-2006 data compiled for use in this submittal did not fall under the normal process of daily review by Dominion meteorologists. It cannot be determined if Kewaunee had formal meteorological data reviews performed under previous ownership. Rather than reviewing a live/real-time feed of 24 hours of data with probable knowledge of on-going maintenance activities or weather patterns within the region, the Dominion meteorologists had to review five years worth of data, after-the-fact.

Dominion's Meteorological Group is comprised of two individuals. Both individuals hold a BS in Meteorology. One meteorologist has ten years of forecasting experience, and the other has fifteen years of forecasting experience and one year of weather observing experience. Their QC review of the 2002-2006 data relied on past experience and did identify instances where data needed to be marked as invalid. These instances included situations where there was an existing 'bad data' flag, where data was missing, where data did not behave in a meteorologically consistent manner (such as repeating values), or where data preceded or followed 15 minutes of data values around missing or bad data (occurrences that looked partially influenced by missing or faulty data, e.g., five out of the 15 minutes).

Data substitution was performed if available backup data was available. Missing primary tower 10-meter values were substituted with backup tower 10-meter data. When Delta Temperature was unavailable, Sigma Theta based stability class was used as a substitute. Sigma Theta substitution was used in less than 6 percent of the data over the entire five year data file.

a. Missing upper wind data occurrences in the last three days of 2002-2004 are not seen in the new data file, which was created by pulling data from the station archive Plant Information (PI) system.

b. DEK has determined that a conversion error created the blank fields in the data file that was originally sent to the NRC. The meteorological data received from the Dominion meteorologist had to be reformatted for input to ARCON96. The reformatting process used incorrectly converted values of zero to blanks. There were 31 hourly lower wind speed records and three hourly upper wind speed records that had a "0" value. It was for these 34 records that a blank wind speed was mistakenly generated.

   The new data file in Enclosure 1 does not contain blanks.

c. The new data file does not contain the invalid observations recorded in the period of question. Examination of the station archive PI files show that valid data exists. It is unknown why invalid observations were recorded in the original data file.

d. As described in the response to 1.b, the data extracted from the Plant Information (PI) system can show repeating values which are likely the result of the compression/deviation criteria set up in PI to only record values when the values show enough change (this is done to save space in the database). This is a function of the data historian (how the data is recorded), not an indication of a fault with the meteorological tower.

   The new 2002-2006 data file is entirely extracted from PI. Repeating values noted for 2002-2004 data caused by the data historian may now also appear for some 2005-2006 data; where before the data for 2005-2006 came from the PPCS. DEK felt it was appropriate to retrieve historical data from one source to create the new data file rather than merge data from two different archive systems, as was done previously. Repeating values that result from the data historian are valid. They represent recorded values that show minimal change from the previous recorded value.

   In the new data file, both the lower and upper level wind direction data have been marked as bad data between Day 79, Hour 9 through Hour 23, in 2005.

e. After analysis of the 2002 through 2006 data, there is no explanation as to why the frequency of wind speeds decreasing with increasing height was different in 2004

compared to the other years of data (2002, 2003, 2005, and 2006). As a point of reference, Point Beach meteorological data collected over the same period, 2002-2006, was reviewed. The Point Beach data also shows occurrences where the upper wind speed is smaller than the lower wind speed. The annual frequency at Point Beach of this phenomenon ranged between a low of five percent to a high of nine percent.

f. There is no explanation why there are more calms at the lower level in 2005 compared to all other years and levels. A review of calms recorded at Point Beach also reveals an increase in calms in 2005 at both the lower and upper wind speed sensor elevations.

   Increased occurrence of calms will drive the calculated X/Q to be higher, which is conservative (light winds will create less diffusion, thus higher X/Qs). Based on this fact and the similarity with increased calm conditions also measured at Point Beach in 2005 provides assurance that the data is likely correct and conservative in its effects to calculated X/Q.

ME7110-RAII-AADB-Brown-003-2012-05-13

Page 28 of Attachment 4 states: "Intuitively, an increase in the percentage of highly unstable wind conditions should cause the resulting atmospheric dispersion factors to be smaller. Based on the stability class distribution, it was believed that use of only the final 2 years of data would result in smaller X/Q values. Use of only the first 3 years of data could be overly conservative. Since the last two years of data meet quality standards and compare favorably to data recorded for the same period at Point Beach, the use of only the first 3 years of data, which contain a larger distribution of stable atmospheric conditions for unknown reasons, did not seem appropriate. Therefore, the meteorological data for all 5 years were used and are believed to be appropriate and conservative."

Input data should be of high quality. Please provide further justification for use of the 2002–2006 data period. The ARCON96 and PAVAN computer codes assess atmospheric dispersion based on the joint occurrence of wind speed, wind direction, and atmospheric stability. NRC staff notes that its cursory estimates indicate that the 2002–2004 data files resulted in generally larger X/Q values for ARCON96 and smaller X/Q values for PAVAN for the limiting cases than for the 2005–2006 data files. Therefore, staff has not concluded at this time that use of the first three years ensures conservatism.

Response:

DEK carefully considered the implications and consequences when selecting the meteorological data to represent conditions pertinent to the site and capable of providing a conservative assessment of the dispersion of radioactive material from the station. As discussed in the LAR, DEK staff were aware of the inconsistent stability class frequencies apparent in the two subsets of data that were merged together to form one full five-year contiguous block of data. After investigating the programs and processes for collection of both sets of data, no evidence was found at that time to suspect that either data set was in error. The decision to use both data subsets to form five years of meteorological data considered the following:

1. The 2005-2006 data was the newest data collected. It differed from the historical stability class distribution, showing a higher frequency of unstable stability classes. No reason could be found for the difference.
2. The 2002-2004 data contain a larger distribution of stable atmospheric conditions and smaller frequencies of unstable conditions compared to the 2005-2006 data. No reason could be found for the differences.
3. The limiting dose for Kewaunee is the control room dose, as ample margin exists to the EAB and LPZ limits. Determination of which meteorological data to use (i.e., 2002-2004, 2005-2006, or 2002-2006) was based on reasonable conservatism to control room consequences.

4. Consideration of data effects on predicted EAB/LPZ X/Qs is minimal since considerable conservatism is being utilized in the method to calculate EAB and LPZ doses by assuming the "release ring concept" (i.e., the distance from the site to the EAB and LPZ are minimized by assuming all releases emanate from the extreme, furthest most point outward (300 feet) from the station from all release points, in all directions). For example, the predominant release points that would apply to the LOCA and FHA would be at least 200 feet more distant from the nearest EAB boundary than what is assumed in the X/Q calculation.
5. 2002-2006 stability class frequencies show agreement with corresponding Point Beach data. Point Beach is located approximately 4 miles south of Kewaunee, and is also on the western shore of Lake Michigan.

With the discovery of two issues that affect the original data file (incorrect stability conversion and instantaneous stability values), a new data file was created from one historical archive system. This data has received additional review and checks from the corporate meteorologists for any data issues and trends. Many of the issues that needed to be addressed in the original data file either no longer exist or are explainable. Figure 1 and 2 help demonstrate that stability frequencies are consistent. This is most noticeable in the 'A' stability category which was focused on in the data consistency review and discussions in LAR-244. Taking a larger picture into consideration (e.g., more years of data and comparison to other local sources like Point Beach), DEK is confident that the 2002-2004 data is appropriate for use in the five years of data used to calculate X/Q values for Kewaunee.

DEK performed a spot check on some of the more limiting control room X/Qs using the new data file. In the checks performed and shown below in Tables 1 and 2, the new calculated values are essentially the same, (e.g., minimal or insignificant differences, some slightly higher, some slightly lower, and some the same). The overall changes are negligible. In addition, the method used by DEK to determine the horizontal distance from each source-to-receptor was conservatively kept smaller than the actual distances to assure higher X/Qs. For control room distances this was done by neglecting the effects of intervening structures and not using the taut-string technique. For offsite X/Qs, the horizontal distance to the EAB and LPZ was minimized by assuming a release ring technique. The X/Q values as presented in LAR-244 continue to provide a conservative assessment of meteorological dispersion of radioactive material from design-basis accidents at Kewaunee. The slight changes in X/Q values resulting from the new data file are insignificant compared to the conservatisms that were purposely built into the originally calculated values.

In summary, a new meteorological data file has been created to resolve errors identified in the original data file. The differences of stability frequencies originally apparent between the two subsets of data from 2002-2006 are no longer apparent. The new data file has been compiled and reviewed by corporate meteorologists. DEK is confident the new data file represents the local meteorology surrounding Kewaunee and is appropriate for use in X/Q calculations. Negligible differences are noted between X/Q

values calculated using the new data file compared to the calculated values in LAR-244. The methods employed in the original calculation of both control room and offsite X/Q values assure conservative results. Therefore, the X/Q values presented in LAR-244 provide a conservative assessment of radioactive dispersion at the Kewaunee site.

A new electronic data file of 2002-2006 data is being provided for the staff's use in Enclosure 1.

Table 1
Most Limiting Control Room Atmospheric Dispersion Factors

Source / Duration	Control Room Intake X/Q (sec/m^3)		Isolated Control Room Worst In-leakage X/Q (sec/m^3)	
	Original Data	New Data	Original Data	New Data
Reactor Building Stack Exhaust				
0 – 2 hour	4.88E-03	4.89E-03	3.97E-03	4.00E-03
2 – 8 hour	3.51E-03	3.54E-03	2.95E-03	2.95E-03
8 – 24 hour	1.37E-03	1.36E-03	1.11E-03	1.15E-03
24 – 96 hour	1.12E-03	1.11E-03	8.89E-04	8.92E-04
96 – 720 hour	9.41E-04	9.27E-04	7.87E-04	7.77E-04
Containment / Shield Building				
0 – 2 hour	1.84E-03	1.79E-03	1.74E-03	1.70E-03
2 – 8 hour	1.23E-03	1.24E-03	1.16E-03	1.18E-03
8 – 24 hour	5.03E-04	4.97E-04	4.70E-04	4.66E-04
24 – 96 hour	4.22E-04	4.15E-04	4.02E-04	3.89E-04
96 – 720 hour	3.50E-04	3.33E-04	3.28E-04	3.22E-04
Auxiliary Building Stack Exhaust				
0 – 2 hour	3.67E-03	3.69E-03	2.90E-03	2.92E-03
2 – 8 hour	2.83E-03	2.81E-03	2.26E-03	2.24E-03
8 – 24 hour	1.11E-03	1.12E-03	8.79E-04	8.82E-04
24 – 96 hour	7.34E-04	7.41E-04	5.80E-04	5.91E-04
96 – 720 hour	5.64E-04	5.65E-04	4.47E-04	4.49E-04
"B" Steam Generator PORV				
0 – 2 hour	3.96E-02	3.98E-02	2.92E-02	2.94E-02
2 – 8 hour	3.20E-02	3.24E-02	2.34E-02	2.34E-02
8 – 24 hour	1.21E-02	1.25E-02	8.67E-03	8.86E-03
24 – 96 hour	1.01E-02	1.03E-02	6.97E-03	7.04E-03
96 – 720 hour	8.58E-03	8.69E-03	6.41E-03	6.35E-03

Table 2
Offsite Atmospheric Dispersion Factors

Location / Duration	Original Data X/Q (sec/m^3)	New Data X/Q (sec/m^3)
EAB (All release points)		
0 – 2 hour	1.76E-04	1.77E-04
LPZ (All release points)		
0 – 8 hour	3.36E-05	3.19E-05
8 – 24 hour	2.37E-05	2.26E-05
1 – 4 day	1.12E-05	1.09E-05
4 – 30 day	3.94E-06	3.96E-06

ME7110-RAII-AADB-Brown-004-2012-05-13

Attachment 4, p. 137, of the LAR states: "Using linear interpolation the 95th percentile wind speed at this elevation is 8.6 meters per second. Five times this speed is 43 meters per second." Please justify that wind speed increases linearly with height at the Kewaunee site.

Response:

It is understood that wind speed does not increase linearly with height. The statement that linear interpolation was used represents the calculational method that was used to estimate the wind speed at the intermediate height between the lower and upper measurement levels on the meteorological tower.

DEK has confirmed that the method used to estimate the wind speed at the height of PORV release using linear interpolation did not provide a degree of conservatism as anticipated. Using the following common relationship;

$$u_x = u_r (z_x / z_r)^a$$

where,

x is the height of interest (23.34 m)
r represents the known reference
u is the wind speed (m/s)
z is the height (m), and
a is 0.236 *(derived from 95th percentile Wind Speeds measured at 10m = 7.6 m/s and 60m= 11.6 m/s using the 2002-2006 data)*

Inserting the known heights and corresponding 95th percentile wind speed taken from the lower level of the meteorological tower (z_r = 10 m and u_r = 7.6 m/s) yields u_x = 9.3 m/s. This wind speed represents the 95th percentile wind speed at 23.34 m, (the physical height of the PORV).

Five times the 95th percentile wind yields 46.5 m/s. The average exhaust velocity from the PORV over the 2 to 8 hour period is discussed in the LAR as being 43 m/s. The exhaust velocity does not exceed five times the 95th percentile wind speed during the 2 to 8 hour period in the current configuration of the PORV exhausts.

As discussed with the NRC staff during a phone conversation on June 13, 2012, DEK recently identified that the cooldown rate of the RCS following a Locked Rotor Accident (LRA) with Loss-of-offsite-power (LOOP) would be longer than assumed. The current LRA analysis contained in LAR-244 is affected by this emergent issue and is being revised to incorporate the effects of extended cooldown and steaming from the RCS. DEK plans to submit the revised LRA analysis to the NRC as a supplement to the LAR.

The LRA analysis contained in LAR-244 contains little margin to the 5 Rem control room dose limit. Therefore, as part of the LRA re-analysis, DEK will likely propose a physical plant modification to gain X/Q reductions and revise the method and inputs to the LRA radiological analysis in order to achieve acceptable control room doses within regulatory limits. Calculated offsite doses compared to regulatory limits are not challenged in the current or future plant configuration.

DEK is currently pursuing a modification to the PORV exhausts so that the exit conditions of steam released from the PORVs will no longer be affected by the diffusers on these exhaust pipes. The modification will effectively increase the resultant steam exit velocity from the PORV exhausts by more than five times; significantly greater than five times the 95th percentile wind speed at the PORV height at all times during LRA steaming. After this modification is complete, the reduction of calculated control room X/Qs for the A and B PORV releases by a factor of five can then be credited.

References

1. Letter from J. A. Price (DEK) to Document Control Desk (NRC), "License Amendment Request 244, Proposed Revision to Radiological Accident Analysis and Control Room Envelope Habitability Technical Specifications," dated August 30, 2011. [ADAMS Accession No. ML11252A521]
2. Letter from Craig W. Lambert (NMC) to Document Control Desk (NRC), "Generic Letter 2003-01; Control Room Habitability – Supplemental Response," dated April 1, 2005. [ADAMS Accession No. ML050970303]
3. E-mail from Karl D. Feintuch (NRC) to Craig D. Sly and Jack Gadzala (DEK), "ME7110 Kewaunee - Request for Additional Information (RAI) AADB and SCVB 2012-04-12," dated April 13, 2012. [ADAMS Accession No. ML12107A144]
4. Letter from J. A. Price (DEK) to Document Control Desk, "Response to Request for Additional Information: License Amendment Request 244, Proposed Revision to Radiological Accident Analysis and Control Room Envelope Habitability Technical Specifications (TAC No ME7110)," dated April 30, 2012. [ADAMS Accession No. ML12124A283]
5. Generic Letter 2003-01, "Control Room Habitability," dated June 12, 2003 [ADAMS Accession No. ML031620248]