NRR-PMDAPEm Resource

From:	Lingam, Siva
Sent:	Wednesday, February 17, 2016 10:38 AM
To:	'mjrm@pge.com'
Cc:	Pascarelli, Robert; Shoop, Undine; Erwin, Kenneth; Mazaika, Michael; White, Jason; Bucholtz, Kristy; Schrader, Kenneth (KJSe@pge.com)
Subject:	Diablo Canyon 1 and 2 - Met Data Second Round of Requests for Additional Information for License Amendment Request 15-03 to Adopt the Alternative Source Term per 10 CFR 50.67 (TAC Nos. MF6399 and MF640
Attachments:	DCPP AST LAR Met Data Related RAIs (2-17-16).docx

By a letter dated June 17, 2015 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15176A539), as supplemented by letters dated August 31, October 22, November 2, November 6, December 17, 2015, and February 1, 2016 (ADAMS Accession Nos. ML15243A363, ML15295A470, ML15321A235, ML15310A522, ML16004A363, and ML16032A603, respectively), Pacific Gas and Electric (PG&E, the licensee), submitted a license amendment request (LAR) to revise the licensing bases to adopt the alternative source term (AST) as allowed by Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.67, "Accident source term," for Diablo Canyon Power Plant (DCPP), Units 1 and 2. Please note the attached **official** follow-up requests for additional information (RAIs) from our Radiation Protection and Consequence Branch [ARCB] for the AST LAR associated with meteorological data and dispersion modeling analyses. Please note that we provided our first-round RAIs to you on October 1, 2015 (ADAMS Accession No. ML15278A049), and you responded on November 2, 2015 (ADAMS Accession NO. ML15321A235). Please provide your responses within 60 days from the date of this e-mail. We transmitted the draft RAIs to you on January 15, 2016, and we had a clarification call on February 16, 2016. Your timely responses will allow the U.S. Nuclear Regulatory Commission (NRC) staff to complete its review on schedule.

This set of RAIs identifies potentially significant issues with the Met data such that it is not yet clear to the NRC staff whether the sequential hourly data sets, to have been formatted in accordance with Regulatory Guide (RG) 1.23, are, in fact, valid and whether or not the correct data sets were used as input to the ARCON96 and EN-113 dispersion modeling analyses. Resolution of these issues may result in the need for the licensee to revise those data sets and re-work the dispersion estimates which could, in turn, affect downstream dose calculations.

We are continuing to review the submittal and we may have additional RAIs related specifically to the accident-related dispersion modeling analyses and assumptions. Those analyses are based on the NRC-endorsed ARCON96 code, which estimates onsite impacts at Control Room (CR) and Technical Support Center (TSC) receptor locations and the proprietary EN-113 code, which estimates offsite impacts at the Exclusion Area Boundary (EAB) and the outer boundary of the Low Population Zone (LPZ), the latter presumably equivalent to the NRC-endorsed PAVAN dispersion model incorporating guidance from RGs 1.145 and 1.111.

Siva P. Lingam
U.S. Nuclear Regulatory Commission
Project Manager (NRR/DORL/LPL4-1)
Diablo Canyon Nuclear Power Plant
Location: O8-D5; Mail Stop: O8-B3
Telephone: 301-415-1564; Fax: 301-415-1222
E-mail address: siva.lingam@nrc.gov

Hearing Identifier: NRR_PMDA
Email Number: 2662

Mail Envelope Properties (Siva.Lingam@nrc.gov20160217103700)

Subject: Diablo Canyon 1 and 2 - Met Data Second Round of Requests for Additional Information for License Amendment Request 15-03 to Adopt the Alternative Source Term per 10 CFR 50.67 (TAC Nos. MF6399 and MF640
Sent Date: 2/17/2016 10:37:58 AM
Received Date: 2/17/2016 10:37:00 AM
From: Lingam, Siva

Created By: Siva.Lingam@nrc.gov

Recipients:
"Pascarelli, Robert" <Robert.Pascarelli@nrc.gov>
Tracking Status: None
"Shoop, Undine" <Undine.Shoop@nrc.gov>
Tracking Status: None
"Erwin, Kenneth" <Kenneth.Erwin@nrc.gov>
Tracking Status: None
"Mazaika, Michael" <Michael.Mazaika@nrc.gov>
Tracking Status: None
"White, Jason" <Jason.White@nrc.gov>
Tracking Status: None
"Bucholtz, Kristy" <Kristy.Bucholtz@nrc.gov>
Tracking Status: None
"Schrader, Kenneth (KJSe@pge.com)" <KJSe@pge.com>
Tracking Status: None
"'mjrm@pge.com'" <mjrm@pge.com>
Tracking Status: None

Post Office:

Files	**Size**	**Date & Time**
MESSAGE	2906	2/17/2016 10:37:00 AM
DCPP AST LAR Met Data Related RAIs (2-17-16).docx	42084	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

BACKGROUND

The U.S. Nuclear Regulatory Commission (NRC) staff is in the process of reviewing the responses, data, and other information provided by Pacific Gas and Electric Company (PG&E. the licensee) in its letter of November 2, 2015 (PG&E letter DCL-15-130) responding to the staff's e-mail of October 1, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15278A049) with requests for additional information (RAIs) related to the license amendment request (LAR) 15-03 to adopt the Alternate Source Term per the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.67, "Accident source term," for Diablo Canyon Power Plant (DCPP), Units 1 and 2 (see ADAMS Accession Nos. ML15176A539 and ML15243A363, dated June 17 and August 31, 2015, respectively).

In particular, these RAIs focused on the meteorological (Met) data collected onsite during the period of record (POR) from 2007 through 2011 and used as input to two accident release-related atmospheric dispersion models (i.e., the NRC-endorsed ARCON96 code, which estimates onsite impacts at Control Room (CR) and Technical Support Center (TSC) receptor locations and the proprietary EN-113 code which estimates offsite impacts at the Exclusion Area Boundary (EAB) and the outer boundary of the Low Population Zone (LPZ)). These RAI questions also addressed information needs required to develop other inputs to these modeling analyses all of which will be used by the NRC staff, as part of its safety evaluation, to make confirmatory modeling runs (equivalent, in the case of the EN-113 code) of the licensee's dispersion estimates that provide basic input to the dose calculations associated with this LAR.

The RAIs that follow address apparent discrepancies between the sequential hourly onsite Met data, which appear to be formatted in accordance with NRC Regulatory Guide (RG) 1.23 (as requested in the RAIs of October 1, 2015), and the corresponding hourly Met data presumably input to the ARCON96 dispersion model (also requested in the initial set of RAIs but provided as MS Excel files for each year of the 5-year POR by the licensee in Attachment 3 to its November 2, 2015, responses). The licensee stated that the 2007 through 2011 sequential hourly files were "formatted in essentially the same format (with some differences in spacing) as NUREG/CR-6331, Revision 1".

With regards to the Met data input to the EN-113 model runs, the RAIs of October 1, 2015, focused primarily on joint frequency distributions (JFDs) of wind speed, wind direction, and atmospheric stability (typically input to the NRC-endorsed PAVAN dispersion model) rather than sequential hourly data for the 5-year POR. As a result, hourly data were neither requested of nor provided by the licensee. The licensee indicated in one of its responses that hourly average Met data were used in its offsite dispersion modeling analysis rather than individual yearly or a 5-year composite JFD. Given the nature of the discrepancies to be described below, the NRC staff needs to confirm that the hourly Met data used in making the ARCON96 onsite and EN-113 offsite dispersion estimates are consistent with the RG 1.23 Met data sets.

SUMMARIES OF SELECTED CHECK RESULTS

The NRC staff's Met data review began with a straightforward check for consistency between the RG 1.23-formatted hourly data sets and the hourly Met data presumably input to the ARCON96 dispersion modeling runs. The staff's expectation is that all such model input should descend from the RG 1.23 data sets and be identical on an hour-by-hour basis after accounting for any necessary adjustments between the two types of data files (e.g., differences in units of measure, scaling factors, data substitutions made in the RG 1.23-formatted data sets and, when applicable, those made internally by the ARCON96 model during its execution). The

RG 1.23-formatted hourly data sets were provided with Attachment 3 to the licensee's November 2, 2015, responses as five ASCII-character files designated as NRC07, NRC08, NRC09, NRC10, and NRC11. The requested ARCON96 model input files included with Attachment 3 to the licensee's responses identify five annual Met data sets used for each model run. Those files are designated as DCPP2007.MET, DCPP2008.MET, DCPP2009.MET, DCPP2010.MET, and DCPP2011.MET. However, the presumably parallel data sets provided to the staff as MS Excel data files with Attachment 3 to the licensee's responses are designated DCPP_Primary_2007 (DIT 50503441-02-00).xls, DCPP_Primary_2008 (DIT 50503441-02-00).xls, DCPP_Primary_2009 (DIT 50503441-02-00).xls, DCPP_Primary_2010 (DIT 50503441-02-00).xls, and DCPP_Primary_2011 (DIT 50503441-02-00).xls. The staff constructed MS Excel files from the RG 1.23-formatted data files to perform these consistency checks noting, among other things, that wind speeds in the ARCON96 Met files were in units of miles per hour rather than meters per second and all RG 1.23-formatted data were reported as integer values increased by a factor of 10 rather than with decimal precision format as in the guidance. The headings below summarize the results of the various basic checks made.

- **<u>Stability Class Discrepancies</u>**

Of greatest concern, the NRC staff found that approximately 30 to 35 percent of the RG 1.23-formatted stability classes did not match those for the corresponding hours in the ARCON96 MS Excel files, in some cases differing by as much as plus 6 or minus 5 stability classes. In the staff's evaluation, the RG 1.23-formatted numerical stability class (based on the DELT3 values or the temperature difference between the 76-meter (m) and 10-m measurement levels presumably represented in oC per 100 meters) was subtracted from the ARCON96-specified numerical stability class. A negative difference indicated a more unstable (i.e., less conservative) bias might occur in the ARCON96 dispersion modeling results at the CR and TSC air intakes and a positive difference indicated a more stable (i.e., more conservative) bias might occur in the dispersion modeling results. The table below summarizes these discrepancies for each year of the 5-year POR:

Difference ARCON96 Minus PG Stability Class Based on RG 1.23 Delta-T (DELT3 of DT76-10) Assuming Deg-C Per 100 m												
Year	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
2007	----	----	51	157	884	6224	849	357	161	----	----	----
2008	----	----	83	186	738	6038	871	372	209	9	1	----
2009	----	----	81	147	440	5681	1042	315	247	2	1	----
2010	----	----	64	143	473	5663	1109	338	190	2	1	1
2011	9	28	51	118	534	6196	840	318	166	2	1	----

The NRC staff has observed in other reviews that conversion between recorded and applied units of measure is sometimes necessary and that data precision can occasionally result in shifts to adjacent stability classes. These effects, especially due to data precision, can be more pronounced for stability classes B and C which have narrower temperature difference ranges compared to the other stability classes. However, both the number of mismatches between the RG 1.23-formatted and ARCON96-specified stability classes and the range of those discrepancies shown above suggests a significant degree of uncertainty to the staff that, without further explanation and justification, it is not clear which of the data sets is valid and whether or

not the correct data set was used as input to the ARCON96 and EN-113 accident-related dispersion modeling analyses.

Because of the range of these discrepancies, the staff considered whether the stability classifications based on the vertical temperature difference (delta-T) between the upper and lower measurement levels on the primary Met tower (i.e., 76- and 10-m), as listed in the RG 1.23-formatted data files, represented the temperature difference over the literal 66-m vertical distance rather than the temperature difference per 100 meters consistent with that regulatory guidance. A similar range of discrepancies were found based on this evaluation but with even more mismatches between the RG 1.23-formatted and corresponding ARCON96-specified stability classes. As a result, the staff is inclined to believe, but the licensee needs to verify, that the delta-T values listed in the RG 1.23-formatted data files represent the temperature difference per 100 meters (multiplied by a factor of 10 and reported as integer values as noted previously). At the same time, this assessment underscores (but does not provide an explanation for) the issue regarding the range and number observed discrepancies between the stability classes in the two indicated data sets.

- **<u>Unusual Persistence of Moderately and Extremely Stable Atmospheric Conditions</u>**

Moderately and extremely stable atmospheric conditions are characterized, among other things, by the limited dispersion of pollutant or radioactive emissions released into the air. Such conditions typically follow a diurnal (daily) cycle, occurring most often under periods of light wind speeds, beginning in the early evening and generally continuing into the early morning hours until about sunrise or shortly thereafter when the earth's surface again heats up resulting in relatively more atmospheric turbulence and better dispersion. Durations and the intensity of this daily cycle vary seasonally and, to some extent locality, and on a shorter-term basis with changing or persistent meteorological conditions (e.g., higher wind speeds, precipitation and cloud cover, air stagnation). In terms of accident-related dispersion modeling, however, less dispersion is associated with higher atmospheric relative concentrations (X/Q values) which could, in part, lead to higher radioactive dose estimates.

As a result of information obtained from the NRC staff's basic initial consistency checks of the RG 1.23-formatted sequential hourly Met data for the 2007 through 2011 POR and comparisons to the hourly Met data presumably input to the Licensee's ARCON96 dispersion modeling analyses, the staff has identified quite a few extended time periods (totaling over 40 days over the 5-year POR) where moderately or extremely stable atmospheric conditions (i.e., F or G Pasquill-Gifford stability classes, based on vertical temperature difference measurements on the primary (or, if necessary, back-up) onsite Met tower), persisted with very little or no variation. This is in marked contrast to the diurnal cycle described above.

The listing that follows is just a subset of what appears to be unusually long periods of persistence of F and G stability classes observed in the 2007 through 2011 RG 1.23-formatted Met data sets. Of these, the longest persistence periods lasted 137 hours (Julian Days (JD) 12 to 17 in 2009) and 112 hours (JD 267 to 272 in 2010), each the better part of five consecutive days, with only 12 and 6 hours, respectively, not designated as F or G stability. In the RG 1.23-formatted data sets, there are other extended time periods over the 5-year POR of lesser duration, but covering one or more complete diurnal cycles, and longer periods where more gaps in the consecutive string of hours of F and G stability classes appear to have been recorded.

Year	Duration	Notes
2007	JD 70 (Hr 10) to JD 72 (Hr 10)	All 49 hrs F or G stability
	JD 125 (Hr 21) to JD 128 (Hr 24)	Only 5 out of 76 hrs not F or G stability; with one 2-hr gap
	JD 228 (Hr 23) to JD 229 (Hr 24)	Only 1 out of 25 hrs not F or G stability
2008	JD 116 (Hr 9) to JD 199 (Hr 8)	Only 7 out of 72 hrs not F or G stability; with one 3-hr gap
	JD 169 (Hr 21) to JD 172 (Hr 7)	Only 10 out of 59 hrs not F or G stability; a few
	JD 281 (Hr 9) to JD 282 (Hr 20)	All 36 hrs F or G stability
	JD 294 (Hr 22) to JD 298 (Hr 20)	Only 12 out of 95 hrs not F or G stability; with one 3-hr and one 5-hr gap
	JD 319 (Hr 22) to JD 322 (Hr 17)	Only 1 out of 68 hrs not F or G stability
2009	JD 12 (Hr 2) to JD 17 (Hr 18)	Only 12 out of 137 hrs not F or G stability; with one 2-hr gap
	JD 17 (Hr 24) to JD 21 (Hr 12)	Only 8 out of 85 hrs not F or G stability; with two 2-hr gaps
	JD 109 (Hr 1) to JD 111 (Hr 13)	All 61 hrs F or G stability
	JD 239 (Hr 11) to JD 241 (Hr 19)	Only 2 out of 57 hrs not F or G stability; with one 2-hr gap
2010	JD 234 (Hr 12) to JD 236 (Hr 17)	Only 1 out of 54 hrs not F or G stability
	JD 267 (Hr 18) to JD 285 (Hr 2)	Only 6 out of 112 hrs not F or G stability; with two 2-hr gaps
	JD 282 (Hr 13) to JD 285 (Hr 2)	Only 2 out of 62 hrs not F or G stability
2011	JD 330 (Hr 15) to JD 333 (Hr 1)	Only 7 out of 59 hrs not F or G stability; with two 2-hr gaps

Given the other issues addressed in this evaluation, technical and climatological justification (which does not appear to be provided in the Updated Final Safety Analysis Report (UFSAR) or LAR submittal) of these frequencies and durations is needed to establish the validity of these portions of the basic Met data sets.

- **General Agreement With (But Incomplete) Data Recovery Rates**

Because the 2007 through 2011 POR of Met data represents a change to the current licensing basis, the NRC staff requested, in its October 1, 2015 RAIs, a summary of data recoveries by

year and for the composite 5-year POR for individual Met parameters and as joint recovery of concurrent hourly wind speed, wind direction, and atmospheric stability class for the same periods. In its November 2, 2015 responses (see Question 4 under the heading "Meteorological (Met) Data – Offsite Impacts"), the licensee summarized most of the data recovery information. In general, the individual parameter data recoveries provided by the licensee were either the same or slightly higher than those derived by the staff's consistency checks using the RG 1.23-formatted data sets, and for the most part were above 90 percent as called for in that regulatory guidance and its predecessor Safety Guide 23.

Several regularly-measured parameters reported in the RG 1.23-formatted data files were not used as input to the dispersion modeling analyses, the primary focus of this aspect of the LAR 15-03 safety review. These include: wind direction sigma-theta at both the 76- and 10-m measurement levels, ambient and dew point temperatures at 10-m, and near-ground-level precipitation. Individual parameter data recoveries were generally above 90 percent for the sigma-theta and ambient temperature measurements. However, data recovery for dew point temperature measurements never exceeded 90 percent for any year in the 5-year POR ranging from a high of about 89 percent in 2007 to a low of about 34 percent in 2009 with a 5-year composite recovery rate of about 71 percent.

Vertical temperature difference measurements are also made between an intermediate and the lower measurement level on the primary Met tower (i.e., 46- and 10-m, respectively) referred to as DELT1 in the RG 1.23-formatted data files. Data recoveries for each year and the overall 5-year POR are estimated based on the staff's consistency checks and are shown below. Except for two of the five years, data recoveries for the vertical temperature difference between 46 and 10 meters are less than the 90 percent objective stated in RG 1.23 and its predecessor Safety Guide 23.

Data Recovery Based on RG 1.23 Delta-T (DELT1 of DT46-10) Assuming Deg-C Per 100 m						
	2007	2008	2009	2010	2011	5-Year
Hours	8134	5982	7956	7529	7005	36606
Percent	92.9	68.1	90.8	85.9	80.0	83.5

The licensee stated in its November 2, 2015, responses (see Question 3 under the heading "Met Data – Onsite Impacts (Control Room and Technical Support Center") that "[t]he DCPP licensing basis for stability class has always been based on the temperature difference (delta-T) of the 10-meter and 76-meter measurements" and that "[s]tability class based on the 46-meter to 10-meter delta-T values has never been a part of the DCPP licensing basis". The response cites related meteorological monitoring guidance by NRC and Department of Energy and based on that cited information states that "the 46-meter to 10-meter levels is deemed insufficiently distant from each other to provide a vertical temperature difference that would support a valid stability class methodology". The licensee has taken the position that "the delta-T used to determine stability class at DCPP to determine all short-term (accident) atmospheric dispersion factors is in accordance with its current licensing basis, as well as current regulatory guidance, with respect to recommended locations for temperature instrumentation to determine stability class".

The NRC staff is continuing to evaluate the licensee's response to this issue as raised in the referenced RAI question.

- **<u>Missing Data Periods and Data Substitution</u>**

In its November 2, 2015 responses (see Question 5, Parts 1 and 2, under the heading "Meteorological (Met) Data – Offsite Impacts"), the licensee confirmed that missing data from the primary Met tower were supplemented by measurements from a 60-m back-up Met tower, also located on site. Those responses included a table that identifies the substituted time intervals and a general explanation of why the data substitutions were necessary. The table suggests that all parameters from the back-up tower were used when data substitution was implemented. The RG 1.23-formatted data sets appear to include hourly values from the primary Met tower as well as values (if available) from the back-up Met tower (except as noted below).

The basic consistency checks performed by the NRC staff comparing the RG 1.23-formatted and ARCON96-specified Met data sets revealed other potential issues leading to question which of the data sets is valid and whether or not the correct data set was used as input to the ARCON96 and EN-113 accident-related dispersion modeling analyses. These include:

- For some 10-m level wind speed and/or wind direction data coded as missing in the RG 1.23-formatted data files, the corresponding hourly values in the ARCON96 MS Excel files appeared to already include the counterpart missing values from the 76-m wind measurement level (if available). The staff's understanding of the ARCON96 dispersion model is that this data substitution takes place during code execution after reading the hourly Met input data files (listed earlier) for missing data codes. As a result, the ARCON96 MS Excel files provided in Attachment 3 to the responses would not be expected to match the ASCII-character data files input directly to the code for any of those hours unless the ASCII data files were pre-processed before being input to the ARCON96 modeling runs.

- A number of cases were observed where certain hours in the RG 1.23-formatted data files had stability classes coded as missing (typically as a field of five 9s (i.e., 99999) but in a few cases, as noted below, miscoded as a field of three 9s) while at the same time the ARCON96 MS Excel Met files appeared to have a valid stability class assigned to those hours. Among these cases, some of those hours were identified as being within time periods when data substitution from the back-up Met tower supposedly had taken place. These hours are indicated below with an asterisk (*). The number of discrepancies of this type increased from year to year over the 5-year POR. The basis for any of these stability classes appearing in the ARCON96 Met data files while coded as missing in the RG 1.23-formatted data files is not clear.

Year	Time Periods of Missing Stability Class in RG 1.23-Formatted Data File But With Corresponding Entry in ARCON96 Met Data File
2007	JD 83 (Hrs 21, 22) and JD 336 (Hr 19). ARCON96 stability class = 4.
2008	JD 117 (Hr 22), JD 173 (Hr 22*), JD 174 (Hr 24*), JD 175 (Hrs 1*-2*), JD 356 Hrs (3–6). ARCON96 stability class = 4.
2009	JD 306 (Hrs 12, 14). ARCON96 stability class = 1.
	JD 306 (Hr 13). ARCON96 stability class = 2.
	JD 29 (Hr 22*), JD 30 (Hr 1*). ARCON96 stability class = 4.
	JD 29 (Hr 23*). ARCON96 stability class = 5.
	JD 192 (Hr 4). ARCON96 stability class = 6.
	JD 192 (Hr 5), JD 333 (Hr 18). ARCON96 stability class = 7.
	JD 153 (Hr 6, 9) - missing data in RG 1.23-formatted file coded as 999. ARCON96 stability class = 1.
	JD 153 (Hr 8) - missing data in RG 1.23-formatted file coded as 999. ARCON96 stability class = 4.
	JD 153 (Hr 7) - missing data in RG 1.23-formatted file coded as 999. ARCON96 stability class = 5.
2010	JD 347 (Hr 10). ARCON96 stability class = 1.
	JD 347 (Hr 9). ARCON96 stability class = 3.
	JD 102 (Hrs 15-19), JD 223 (Hr 23), JD 347 (Hr 8). ARCON96 stability class = 4.
	JD 141 (Hr 24), JD 223 (Hr 22), JD 224 (Hrs 1, 2, 23, 24). ARCON96 stability class = 5.
2011	JD 185 (Hr 1), JD 290 (Hrs 7*, 9*–13*, 16*), JD 291 (Hrs 7*-9*), JD 293 (Hrs 9, 11). ARCON96 stability class = 1.
	JD 290 (Hr 8*), JD 291 (Hr 11*). ARCON96 stability class = 2.
	JD 84 (Hr 15*), JD 290 (Hrs 14*, 15*), JD 291 (Hrs 10*, 12*). ARCON96 stability class = 3.
	JD 84 (Hrs 13*-14*), JD 184 (Hr 24), JD 185 (Hrs 2-3), JD 256 (Hrs 23–24), JD 257 (Hrs 1–2), JD 285 (Hrs 20-21), JD 289 (Hrs 10*-21*, 24*). ARCON96 stability class = 4.
	JD 290 (Hrs 3*, 5*, 17*-22*, 24*), JD 291 (Hrs 1*, 3*, 5*, 13*), JD 293 (Hr 10), JD 346 (Hrs 4, 7). ARCON96 stability class = 4.
	JD 145 (Hrs 16*-18*), JD 256 (Hr 22), JD 285 (Hr 19), JD 289 (Hr 22*), JD 290 (Hrs 6*, 23*), JD 291 (Hrs 2*, 4*). ARCON96 stability class = 5.
	JD 290 (Hr 4*), JD 346 (Hr 5). ARCON96 stability class = 6.
	JD 289 (Hr 23*), JD 290 (Hrs 1*-2*), JD 291 (Hr 6*), JD 346 (Hrs 3, 6). ARCON96 stability class = 7.

RAI QUESTIONS

The licensee's use of Met data for the 2007 through 2011 POR in its atmospheric dispersion analyses accompanying LAR 15-03 represents a change to the current licensing bases for Units 1 and 2 of the DCPP. As stated previously, the NRC staff's expectation is that all Met data used as dispersion model input should descend from the RG 1.23 data sets and be identical on an hour-by-hour basis after accounting for any necessary adjustments between the types of data files (e.g., differences in units of measure, scaling factors, data substitutions). Through its initial basic consistency checks, the staff has identified numerous apparent discrepancies in and between the various Met data sets provided to date for its safety review such that it is not clear whether the sequential hourly data sets to be formatted in accordance with RG 1.23 are, in fact, valid and whether or not the correct data sets were used as input to the ARCON96 and EN-113 accident-related dispersion modeling analyses. As a result, the licensee needs to address the following technical issues:

(1) Either confirm and reconcile all noted and any other discrepancies within the RG 1.23-formatted hourly data sets and between those data sets and the presumably parallel hourly data sets input to the ARCON96 dispersion modeling analyses used to estimate onsite impacts at CR and TSC receptor locations, or provide technical justification for each of those differences. In addition, and as necessary, the licensee should:

   (a) verify that the DELT3 and DELT1 values listed in the RG 1.23-formatted data files represent the vertical temperature differences per 100 meters consistent with the guidance in Appendix A to RG 1.23 and stability classification methodology rather than the temperature differences over the literal vertical distances between the temperature measurement heights (i.e., respectively, 66 m between the 76- and 10-m measurement heights and 36 m between the 46- and 10-m measurement heights);
   (b) identify and explain any differences between the wind speed, wind direction, and atmospheric stability class values listed in the MS Excel files of ARCON96 sequential hourly Met data provided in Attachment 3 to the RAI responses of November 2, 2015 (PG&E Letter DCL-15-130) and those listed in the Met data files specified in the ARCON96 run files (i.e., DCPP2007.MET, DCPP2008.MET, DCPP2009.MET, DCPP2010.MET, and DCPP2011.MET);
   (c) resubmit any corrected RG 1.23-formatted Met data files and document any changes to the previously submitted data files;
   (d) resubmit any corrected Met data files input to the ARCON96 dispersion modeling runs and document any changes to the previously submitted data files;
   (e) revise (if necessary) the previously submitted ARCON96 dispersion modeling runs and resubmit any corrected model input and output files and affected summaries of results, or otherwise justify the previously submitted modeling results and downstream dose calculations and related impact evaluations;
   (f) update (if necessary) any previously submitted data recovery statistics or summaries of time periods during which data substitution was stated to have occurred; and
   (g) update (if necessary) the UFSAR and LAR 15-03 discussions.

(2) As explained previously, the NRC staff did not initially request the sequential hourly Met data used as input to the EN-113 dispersion model for estimating offsite impacts at the EAB and the LPZ. However, given the issues identified in the staff's initial evaluation, the licensee should:

(a) confirm, reconcile, and document any additional discrepancies between the RG 1.23-formatted and/or ARCON96 sequential hourly input Met data files;
(b) resubmit any corrected RG 1.23-formatted Met data files and document any additional changes to the previously submitted data files;
(c) submit that portion of the EN-113 input data files for the 2007 through 2011 POR that includes sequential hourly Met data and provide detailed formatting information for each parameter to facilitate the staff's understanding and review of those input data;
(d) revise (if necessary) the previously analyzed EN-113 dispersion modeling runs and resubmit any affected summaries of results, or otherwise justify the previously submitted modeling results and downstream dose calculations and related impact evaluations;
(e) update (if necessary) any previously submitted data recovery statistics or summaries of time periods during which data substitution was stated to have occurred; and
(f) update (if necessary) the UFSAR and LAR 15-03 discussions.

(3) In marked contrast to the typical daily variation in atmospheric stability class, the NRC staff has identified quite a few extended, and for the most part unbroken except for a few hours, time periods when moderately or extremely stable atmospheric conditions (i.e., F or G Pasquill-Gifford stability classes) persisted with very little or no variation. This includes two separate occasions that lasted the better part of five (5) consecutive days with a total of only 12 and 6 hours scattered over those entire time intervals not being designated as F or G stability. To the extent that the licensee believes that any of the time periods identified by the staff are valid (or other similar persistence periods in the RG 1.23-formatted Met data files), the licensee should:

(a) provide technical and climatological justification of these frequencies and durations to establish the validity of these portions of the basic Met data sets;
(b) confirm, reconcile, and document any additional related discrepancies and changes to the RG 1.23-formatted Met data sets;
(c) incorporate any related corrections to the Met data input to the ARCON96 and EN-113 dispersion modeling analyses and revised (if necessary) model runs;
(d) update (if necessary) any previously submitted data recovery statistics or summaries of time periods during which data substitution was stated to have occurred; and
(e) update (if necessary) the UFSAR and LAR 15-03 discussions.

(4) As indicated previously, the NRC staff is continuing to evaluate the appropriateness of determining atmospheric stability class based on the DELT1 measurements monitored on the primary Met tower (i.e., the vertical temperature differences between the 46- and 10-m measurement levels), when appropriate, in lieu of the DELT3 measurements between 76 and 10 m as used in the current licensing basis. To facilitate the staff's review, the licensee should address the following technical issues:

(a) All 116 accident scenarios evaluated by the licensee with the ARCON96 dispersion model to estimate onsite impacts at the CR and TSC air intakes have been assumed to be ground-level releases consistent with the guidance in Regulatory Positions C.3.2.1 and C.3.2.2 of RG 1.194. Of these, only 14 (or about 12%) have been assigned a release height of 74.1 m. The remainder of the modeled release heights and all of the receptor (intake) elevations are well within the vertical layer covered by the DELT1 temperature difference measurements. Under the ground-level release assumption, ARCON96 does not consider release velocity and all effluent vertical velocities appear to have been assigned a value of zero (0.00 m/sec). The

ARCON96 model does not calculate plume rise due to “buoyancy or mechanical jet effects”. However, the NRC staff understands that the LAR submittal indicates accident releases from the main steam safety valves and the 10% atmospheric dump valves would have significant vertical velocities. Of the remaining onsite accident release scenarios, confirm whether which (if any) of these would be subject to significant buoyancy and/or mechanical plume rise effects during part or all of the accident release duration.

(b) Provide any additional documentation (including NRC staff interactions and correspondence) regarding the specification and rationale for measuring the vertical temperature difference between 46 and 10 m and the intended application(s) of those data.

(c) Confirm whether vertical temperature differences between the 46- and 10-m measurement levels (i.e., DELT1) on the primary Met tower are relied on (even as a back-up source of information) by DCPP for characterizing atmospheric stability for purposes of emergency preparedness and planning. If so, explain the situation(s) under which this information would be used.