Progress Energy

Crystal River Nuclear Plant
Docket No. 50-302
Operating License No. DPR-72

June 29, 2012
3F0612-07

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

Subject: Crystal River Unit 3 – Response to Second Request for Additional Information to Support NRC Accident Dose Branch (AADB) Technical Review of the CR-3 Extended Power Uprate LAR (TAC No. ME6527)

References:

1. CR-3 to NRC letter dated June 15, 2011, "Crystal River Unit 3 – License Amendment Request #309, Revision 0, Extended Power Uprate" (ADAMS Accession No. ML112070659)
2. Email from S. Lingam (NRC) to D. Westcott (CR-3) dated April 10, 2012, "RE: Crystal River, Unit 3 EPU LAR - Draft RAIs from AADB (TAC No. ME6527)"
3. NRC to CR-3 letter dated May 4, 2012, "Crystal River Unit 3 Nuclear Generating Plant – Request For Additional Information For Extended Power Uprate License Amendment Request (TAC No. ME6527)" (ADAMS Accession No. ML12102A044)

Dear Sir:

By letter dated June 15, 2011, Florida Power Corporation, doing business as Progress Energy Florida, Inc., requested a license amendment to increase the rated thermal power level of Crystal River Unit 3 (CR-3) from 2609 megawatts (MWt) to 3014 MWt (Reference 1). On April 10, 2012, via electronic mail, the NRC provided a draft request for additional information (RAI) related to atmospheric dispersion needed to support the AADB technical review of the CR-3 Extended Power Uprate (EPU) License Amendment Request (LAR) (Reference 2). By teleconference on May 1, 2012, CR-3 discussed the draft RAI with the NRC to confirm an understanding of the information being requested. On May 4, 2012, the NRC provided a formal RAI required to complete its evaluation of the CR-3 EPU LAR (Reference 3). Per verbal communication between the NRC Project Manager for the CR-3 EPU and the CR-3 Licensing Superintendent, the due date for providing the formal response to the RAI was extended from 45 days from the date of the May 4, 2012 letter (Reference 3) to the end of June 2012.

Attachment A, "Response to Second Request for Additional Information – Accident Dose Branch Technical Review of the CR-3 EPU LAR," provides the formal response to the RAI.

Progress Energy Florida, Inc.
Crystal River Nuclear Plant
15760 W. Powerline Street
Crystal River, FL 34428

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NRR

In support of the EPU technical review RAI responses, two enclosures are provided to the attachment: Enclosure 1, "CR-3 Plant Drawings of Radioactivity Sources and Receptors," provides approximate direction and distances from potential radioactive source locations to offsite and onsite receptor locations; and Enclosure 2, "Summary of CR-3 EPU EAB and LPZ χ/Q Data," provides summary tables showing direction dependent sector atmospheric dispersion factors (χ/Q) and site limit χ/Q values for offsite receptors considering CR-3 EPU operation.

Attachment B, "List of Regulatory Commitments," includes a regulatory commitment to provide: 1) revised main control room (MCR) χ/Q values for each design basis event reported in Section 2.9.2, "Radiological Consequences Analyses," of the CR-3 EPU Technical Report based on ARCON96 methodology described in Regulatory Guide 1.194, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants;" and 2) revised MCR dose results for the loss of coolant accident and fuel handling accident. This information will be provided to the NRC staff by October 12, 2012.

If you have any questions regarding this submittal, please contact Mr. Dan Westcott, Superintendent, Licensing and Regulatory Programs at (352) 563-4796.

Sincerely,

Jon A. Franke
Vice President
Crystal River Nuclear Plant

JAF/gwe

Attachments:

A. Response to Second Request for Additional Information – Accident Dose Branch Technical Review of the CR-3 EPU LAR

B. List of Regulatory Commitments

Enclosures:

1. CR-3 Plant Drawings of Radioactivity Sources and Receptors

2. Summary of CR 3 EPU EAB and LPZ χ/Q Data

xc: NRR Project Manager
Regional Administrator, Region II
Senior Resident Inspector
State Contact

STATE OF FLORIDA

COUNTY OF CITRUS

Jon A. Franke states that he is the Vice President, Crystal River Nuclear Plant for Florida Power Corporation, doing business as Progress Energy Florida, Inc.; that he is authorized on the part of said company to sign and file with the Nuclear Regulatory Commission the information attached hereto; and that all such statements made and matters set forth therein are true and correct to the best of his knowledge, information, and belief.

Jon A. Franke
Vice President
Crystal River Nuclear Plant

The foregoing document was acknowledged before me this 29TH day of JUNE, 2012, by Jon A. Franke.

Signature of Notary Public
State of Florida

CAROLYN E. PORTMANN
Commission # DD 937553
Expires March 1, 2014
Bonded Thru Troy Fain Insurance 800-385-7019

(Print, type, or stamp Commissioned Name of Notary Public)

Personally Known ✓ -OR- Produced Identification ______

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

ATTACHMENT A

RESPONSE TO SECOND REQUEST FOR ADDITIONAL INFORMATION – ACCIDENT DOSE BRANCH TECHNICAL REVIEW OF THE CR-3 EPU LAR

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By letter dated June 15, 2011, Florida Power Corporation (FPC), doing business as Progress Energy Florida, Inc., requested a license amendment to increase the rated thermal power level of Crystal River Unit 3 (CR-3) from 2609 megawatts (MWt) to 3014 MWt. On April 10, 2012, via electronic mail, the NRC provided a draft request for additional information (RAI) related to atmospheric dispersion needed to support the Accident Dose Branch (AADB) technical review of the CR-3 Extended Power Uprate (EPU) License Amendment Request (LAR). By teleconference on May 1, 2012, CR-3 discussed the draft RAI with the NRC to confirm an understanding of the information being requested. On May 4, 2012, the NRC provided a formal RAI required to complete its evaluation of the CR-3 EPU LAR.

For tracking purposes, each item related to this RAI is uniquely identified as AADB X-Y, with X indicating the RAI set and Y indicating the sequential item number.

1. (AADB 2-1)

Please provide detailed information describing how the CR-3 2003 – 2007 meteorological data provided in support of the CR-3 EPU original LAR dated June 15, 2011 (ADAMS Accession No. ML112070659) were measured and processed, and the criteria used to determine the validity of the data. Describe the temporal sequence of the processing steps to generate the hourly data file and criteria for any data substitutions or modifications.

The NRC staff has noted some apparent anomalies in the five-year data file and provide the following examples, which should not be regarded as all inclusive. Therefore, please reevaluate the data file and provide justification that the 2003-2007 data are accurate or provide a supplemental file with revisions to identify any data as invalid for which such a justification cannot be provided.

a. Occurrences of data ending in a multiple of 10 for a number of consecutive hours (e.g., 2003, lower level wind direction for day 55, hour 3 through day 57, hour 17; day 58, hour 0 through hour 23; day 66, hour 11 through day 69 through hour 13).

b. Occurrences of identical reported readings for a number of consecutive hours (e.g., 2004, lower level wind direction for day 85, hour 18, through day 86, hour 11; 2004 upper level wind direction for day 260, hour 15, through hour 21).

c. Identical wind direction values reported at both measurement levels (e.g., 2004, day 250, hour 11, through hour 15; 2005, day 222, hour 3 through day 228, hour 9).

Response:

Hourly meteorological data was obtained from the primary and backup towers at the Crystal River Energy Complex for the years 2003 through 2007, when available, and provided to the CR-3 consulting meteorologist. The primary tower provides wind speed and direction at 33 ft. elevation and 175 ft. elevation. The backup tower provides wind speed and direction at the 33 ft. elevation. The lower level (33 ft. elevation) wind speed and wind direction data and the change in temperature (ΔT) with height data were used to generate the joint frequency tables. This data

was appended to a site database from annual data text files provided to the meteorological consultant. Hourly data was generated and printed from the database and a professional meteorologist reviewed the hourly data and determined its validity.

The following describes the process for determining the validity of the data of each parameter and the process used when data was determined to be invalid:

Wind Speed - The lower elevation primary wind speed was compared to the upper elevation wind speed. Occurrences of the lower elevation wind speed being greater than the upper elevation wind speed were scrutinized. The lower elevation wind speed from time to time is greater than the upper elevation wind speed but seldom for extended periods of time. When the lower elevation primary speed data was missing for a short period of time (e.g., one to two hours), interpolation was used to fill the data gap. When the primary wind speed was missing for extended periods and the backup wind speed was available and valid, the lower elevation wind speed was replaced with the backup wind speed value. If both primary and backup wind speed data were missing for extended periods but the upper elevation wind speed was available, the upper elevation speed value was adjusted and replaced the lower elevation wind speed. For periods where no wind speed data was available (lower elevation primary, lower elevation backup, and upper elevation primary), data from the Tampa International Airport (TPA) was generally used to fill data gaps. Wind speed values less than 0.5 meters per second (i.e., below sensor threshold) were considered to be calm.

Wind Direction - The lower elevation primary wind direction was compared to the upper elevation wind direction. When comparing wind directions from two different heights, the meteorologist expects a consistent correlation between the lower and upper level values, especially at higher wind speeds. When the lower elevation primary wind direction data was missing for a short period of time (e.g., one to two hours), interpolation was used to fill the data gap. When the primary wind direction was missing for extended periods and the backup wind direction was available and valid, the lower elevation wind direction was replaced with the backup wind direction value. If both the primary and backup wind direction data were missing for extended periods but the upper elevation wind direction was available, the upper elevation wind direction value was used to replace the lower elevation wind direction. For periods where no wind direction data was available (lower elevation primary, lower elevation backup, and upper elevation primary), data from TPA was generally used to fill data gaps.

Temperature Difference (ΔT) - ΔT is the difference in temperature between the lower measuring height and the upper measuring height. The data was reviewed to verify typical ΔT conditions; ΔT is typically more negative during the day (less stable) and more positive at night (more stable). When validating the CR-3 meteorological data, the meteorologist anticipated the atmosphere to be more unstable during the day and more stable at night. When ΔT data was missing for brief periods, interpolation was used to fill data gaps. When ΔT data was missing for longer periods of time (e.g., 4 to 12 hours), the sigma-theta data from the backup tower was used to estimate the stability class. If ΔT and sigma-theta data were missing for an extended period of time, a conservative ΔT value was entered; Class D stability during the day and Class E at night.

Precipitation - Precipitation data was not scrutinized as closely as the wind and stability data as precipitation data is not required to produce joint frequency tables which are

necessary for atmospheric dispersion programs. Hours that had obvious erroneous data (e.g., 9+ inches in an hour without a tropical storm evident on archived radar) were invalidated. In some cases, radar image archives were used to help determine precipitation data validity.

Due to the methods described above, only a small percentage of the data for the five year period was considered missing for the three primary data fields; lower elevation wind speed, lower elevation wind direction, and ΔT.

In addition to periods of missing data, meteorological data was edited to replace erroneous data. Some indications of erroneous data included but was not limited to:

- Duplicate hourly records;
- Occurrences of wind data remaining unchanged for several hours;
- Occurrences of ΔT data remaining unchanged for several hours;
- Frequent occurrences of stable conditions during the day or unstable conditions at night; and
- Extended periods of extremely unstable (Class A stability) conditions.

When invalid data existed and no data substituted, 9's were entered into the missing field to indicate the data was missing. Additionally, the CR-3 consulting meteorologist confirmed that the Crystal River Energy Complex 5-year meteorological data exceeded the 90% data recovery requirement of Regulatory Guide 1.23, "Meteorological Monitoring Programs for Nuclear Power Plants."

Specifically addressing the noted data anomalies:

a. From 0300 on Day 55 of 2003 through 1700 on Day 57, the lower and upper wind direction data on the primary tower and the direction data from the backup tower were invalid. The data gap for the lower level was filled using TPA meteorological data. All TPA wind direction data ends in a zero (10, 20, 30, ...360). The same is true for the data on Days 66 through 69, 2003.

b. From 1800 on Day 85 through 1100 on Day 86, the lower and upper wind direction data on the primary tower and the direction data from the backup tower were invalid. The data gap for the lower level was filled using TPA meteorological data. The wind direction at TPA during that time period varied from 50 to 90 degrees with several hours listed as variable direction. The hour prior to the beginning of the invalid data had a lower wind direction on the primary tower of 67 degrees and the hour after the invalid period had a lower wind direction of 54 degrees. In addition to a review of the TPA data, interpolation was also used for this brief data period.

   From 1500 on Day 260 of 2004 through 2100 on Day 260, the upper level wind direction remained a constant 181 degrees. The lower wind direction was also fairly constant during this period and only differed from 187 to 192 degrees during that seven hour period. Wind speeds were relatively high during this time period which increases the potential for a more constant or steady wind direction.

c. Interpolation and rounding were used to fill the four hour invalid data gap from 1100 through 1400 on Day 250 of 2005. During the 1000 hour on Day 250, the upper and lower wind

direction data were valid; 167 degrees and 171 degrees. Also during the 1500 hour on Day 250, valid lower and upper wind direction data were obtained and matched at 173 degrees.

From 0300 on Day 222 of 2005 through 0900 on Day 228, the lower wind direction data was invalid. The upper level wind direction data as used to replace the lower level wind direction for this period.

Any similar data anomalies, in addition to the ones noted above, were likely edited in a similar manner to the description of edits provided above.

2. (AADB 2-2)

Page 2.9.2-3 of Attachment 7 to the original LAR states that the main control room (MCR) atmospheric dispersion factors (χ/Q values) were calculated using the Murphy-Campe methodology. The calculation is explained on page 13 of a May 23, 1988 letter (ADAMS Accession No. 8805310306) associated with a prior licensing action request from Florida Power Corporation. These values were approved by the NRC as part of the NUREG-0737, "Clarification of TMI Action Plan Requirements," Item III.D.3.4 review. The Murphy-Campe paper, "Nuclear Power Plant Control Room Ventilation System Design for Meeting General Criterion 19," advises that use of the equation on page 13 may be appropriate for a diffuse source-point receptor case for those cases when dual intakes are adequately separated and meet certain criteria as described in the Murphy-Campe paper. However, it is unclear to the NRC staff that the appropriate criteria are met for the purpose of the current LAR. Regulatory Guide 1.194, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants," states that if the previously approved values are based on a misapplication of a methodology, calculational errors are identified in the values, or changes are deemed necessary to ensure adequate protection of the health and safety of the public, the NRC staff will pursue necessary corrections with the licensee or applicant. Therefore, please provide the following information.

a. Confirm that each MCR intake meets the requirements of an engineered safety feature including, as applicable, single-failure criteria for active components, seismic criteria, and missile criteria.

Response:

The CR-3 Control Room Emergency Ventilation System (CREVS) operates in a recirculation mode of operation and the common outside air intake plenum is isolated during a design basis event (DBE). The CREVS components, including the intake plenum components required for operation in the recirculation mode, are designed to meet engineered safety feature requirements to the extent described in Table 9-16, "Ventilation System Compliance with Regulatory Guide 1.52," of the CR-3 Final Safety Analysis Report (FSAR), including single-failure criteria for active components, seismic criteria, and missile criteria.

As described in Section 9.7.2.1.g.1 and Figure 9-13 of the CR-3 FSAR, the common air intake plenum supplies outside air to the CR-3 control complex habitability envelope (CCHE) via series intake dampers. Outside air intake dampers AHD-1C and AHD-1E are normally open when energized with the damper manual control selector switch in the "ON" position. Upon receipt of an Engineered Safeguards Actuation System (ESAS) Reactor Building Pressure - High signal or a Control Room Isolation – High Radiation signal, these

series-configured intake dampers automatically close. In addition, on a loss of power, the CREVS dampers reposition to the recirculation mode including the outside air intake dampers repositioning to the closed position. Since the outside intake dampers are configured in series and these solenoid operated dampers fail to the recirculation position (i.e., closed position) on a loss of power, a single active failure of one damper will not prevent the isolation function from occurring.

In order to maintain functional integrity of the CREVS during an earthquake, the CREVS is designed as Seismic Class I, including the CREVS intake components.

The CREVS intake components are protected from externally generated missiles by the Seismic Class I Control Complex building. This building is designed to Seismic Class I requirements for protection against dynamic effects including the effects of external missiles induced by the main turbine or a tornado.

b. Further, confirm that the design details assure that the most contaminated intake is isolated and the least contaminated intake remains in operation to provide control room pressurization.

Response:

As described in Section 9.7.2.1.g.1 of the CR-3 FSAR, the CREVS operates in a recirculation configuration during emergency operation and not in a control room pressurization configuration. Upon receipt of an ESAS Reactor Building Pressure - High signal, the CREVS dampers reposition to the recirculation mode; outside air intake dampers AHD-1C and AHD-1E close, outside air discharge dampers AHD-2C and AHD-2E close and the return (i.e., recirculation) damper AHD-3 opens. Thus, the potentially contaminated outside common air intake is isolated during a DBE. To assure a leak-resistant boundary between the outside atmosphere and the CREVS, the outside air intake and discharge plenum are equipped with bubble-type dampers. In addition, the CREVS high efficiency particulate air filter units are configured on the supply side of the CREVS emergency fans; thereby, processing the recirculated CCHE air and any potentially contaminated air inleakage from the outside intake or discharge plenums prior to entering the CCHE.

c. Given that the Murphy-Campe paper provides several equations, to address several different scenarios, provide justification that all of the possible releases for each design basis accident (DBA), including those associated with loss of offsite power or other single failure, meet the criteria which substantiate that use of the equation on page 13 of the May 23, 1988 letter is appropriate.

Response:

The CR-3 CREVS design is similar to that described in Section III.B, "Isolation with Filtered Recirculated Air," of the Murphy-Campe paper (Reference 2). The CREVS operates in a recirculation configuration during emergency operation and the potentially contaminated outside common air intake is isolated during a DBE. The MCR χ/Q values are based on the CR-3 plant-specific methodology defined in the FPC to NRC letter dated May 23, 1988 (Reference 3). This plant-specific methodology of determining MCR χ/Q values was approved for use as promulgated in the NRC to FPC letter dated May 25, 1989 (Reference 4).

FPC cannot conclusively describe how the NRC-approved formulation of χ/Q has been derived from the Murphy-Campe paper formulations; therefore, informal ARCON96 calculations have been performed for comparison. The informal ARCON96 calculations indicated an increase in MCR χ/Q values from the CR-3 current licensing basis (CLB) MCR χ/Q values provided in Table 2.9.2-5, "CR-3 Atmospheric Dispersion Factors, Breathing Rates & Occupancy," of the CR-3 EPU TR (Reference 1, Attachments 5 and 7). This apparent increase in MCR χ/Q values is, in part, due to conservatively assuming all inleakage into the MCR is by way of leakage past the closed bubble-type intake dampers on the Control Complex Building roof; a location which is relatively close to the release sources.

As indicated in Table 2.9.2-1, "Summary of CR-3 EPU TEDE Doses and Acceptance Criteria, rem TEDE," of the CR-3 EPU TR (Reference 1, Attachments 5 and 7), the calculated MCR doses at EPU conditions have significant margin to the dose limits for the main steam line break (MSLB) and the letdown line rupture (LLR); MCR doses for the MSLB and LLR at EPU conditions are < 1 rem. Also, the calculated MCR doses for a steam generator tube rupture (SGTR), including a SGTR with a loss of offsite power (LOOP), have significant margin to the dose limits; MCR doses for the SGTR with and without a LOOP at EPU conditions are < 1 rem. Thus, it is reasonable to conclude that an increase in MCR χ/Q values associated with the MSLB, LLR, and SGTR will not result in these events becoming the MCR dose-limiting event.

Further, the reactor coolant pump locked rotor accident (LRA) and rod ejection accident (REA) MCR dose analyses for EPU conditions were developed to ensure MCR dose did not exceed 90% of the dose limit; 4.5 rem of 5.0 rem. Currently, the MCR dose analyses for the LRA and REA assume conservative fuel cladding failure and fuel melt values as shown in Table 2.9.2-13, "CR-3 EPU Locked Rotor Accident Radiological Consequences," and Table 2.9.2-14, "CR-3 EPU Control Rod Ejection Accident Radiological Consequences," of the CR-3 EPU TR (Reference 1, Attachments 5 and 7). Since the MCR dose analyses for the LRA and REA were conservatively performed to ensure the calculated doses do not exceed 90% of the dose limit, an increase in MCR χ/Q values is not expected to impact the LRA and REA MCR dose results reported in Tables 2.9.2-13 and 2.9.2-14 of the CR 3 EPU TR; rather, an increase in MCR χ/Q values would result in a reduction of the acceptable fuel cladding failure and fuel melt margin for these DBEs.

Additionally, informal MCR dose estimates resulting from a loss of coolant accident (LOCA) and a fuel handling accident (FHA) at EPU conditions using the ARCON96 χ/Q values indicate an increase in MCR dose, which may approach or exceed the 10 CFR 50.67(b)(2)(iii) dose criterion.

To ensure dose to the control room operator does not exceed the 10 CFR 50.67(b)(2)(iii) dose criterion following a DBA at EPU conditions, formal calculations will be performed using the ARCON96 methodology described in Regulatory Guide 1.194 to determine MCR χ/Q values and an evaluation will be performed to determine the impact to the MCR doses associated with each DBE reported in Table 2.9.2-1 of the CR-3 EPU TR. FPC will provide: 1) revised MCR χ/Q values for each DBE reported in Table 2.9.2-1; and 2) revised MCR dose results for the LOCA and FHA. This information will be provided to the NRC staff by October 12, 2012 as indicated in Attachment B, "List of Regulatory Commitments."

d. Provide one or more scaled figures, showing true north, with all possible sources and receptors highlighted from which distance and direction inputs can be approximated, for each

DBA. Provide the scale of the figure. In addition, provide the height above grade of each source and receptor. Please include figures that show sources and receptors that consider loss of offsite power or other single failure and control room inleakage.

Response:

As stated in the FPC to NRC letter dated July 5, 2011 (Reference 5), the distance to the exclusion area boundary (EAB) is 1340 m. (~4396 ft.) and the distance to the low population zone (LPZ) is 8047 m. (~5 mi.). A scaled drawing showing the EAB and LPZ offsite receptors is not readily available. Direction to the regional population zones near CR-3 can be estimated utilizing Figure 2-6, "Population Distribution," and Table 2-21, "Crystal River Annual Average X/Q (sec/m^3) Values for the Standard Population Distances," of the CR-3 FSAR.

Additionally, MCR inleakage assumptions for the CLB MCR dose analyses are indicated in the figures (Figures 2.9.2-1 through 2.9.2-8) of Section 2.9.2, "Radiological Consequences Analyses," of the CR-3 EPU TR (Reference 1, Attachments 5 and 7).

Enclosure 1, "CR-3 Plant Drawings of Radioactivity Sources and Receptors," provides scaled figures showing true north and includes the expected radioactive release points for the CR-3 DBAs identified in Table 2.9.2-1 of the CR-3 EPU TR (Reference 1, Attachments 5 and 7) and the onsite dose receptor locations; MCR intake plenum and Technical Support Center (TSC) intake plenum. Enclosure 1 also includes a figure showing the CR-3 reactor building (RB) radius from which the RB diameter can be calculated; inner diameter is 130 ft. (~39.6 m.) and the outer diameter is 137 ft. (~41.8 m.). Enclosure 1 provides a figure showing the height of the common RB and auxiliary building (AB) air shaft. As shown in the "Plan View" portion of CR-3 Plant Drawing E-521-051, "Reactor Building Plant Vent Plan Sections and Details," the common air shaft is comprised of both the RB vent stack, which is approximately 1/4 of the common air shaft, and the AB vent stack, which is approximately 3/4 of the common air shaft.

The following is a list of the scaled figures provided in Enclosure 1 with associated drawing size and associated scale from which radioactive source and receptor direction and distance may be approximated:

Plant Drawing No.	Original Drawing Size	Scale
E-101-111	42.8 in. X 30.0 in.	1/16 in. = 1 ft.
E-744-007	44.0 in. X 34.0 in	1 in. = 50 ft.
E-421-031	50.5 in. X 34.0 in.	Various
E-521-051	23.1 in. X 16.0 in.	Various

Table 1, "CR-3 Radioactive Release Points and Approximate Heights," provides the expected radioactive release points associated with the CR-3 DBAs: intermediate building (IB), containment (i.e., side of RB), main steam safety valves (MSSVs) and atmospheric dump valves (ADVs), RB and AB stacks. Table 1 also includes events that assume a LOOP, whether CREVS is credited in the associated DBA, and the approximate radioactive release height for point sources. The approximate onsite receptor location heights are: MCR intake plenum height of approximately 68.3 ft. (20.8 m.) and TSC intake plenum height of approximately 2.0 ft. (0.6 m.) below plant grade elevation. The approximate source and receptor release heights are based on a plant grade elevation of 118.5 ft. Elev. (~36 m. Elev.).

Table 1: CR-3 Radioactive Release Points and Approximate Heights

DBA	CREVS Operable (Y/N)	Release Points	Approx. Release Height ft. (m.)
LOCA	Y	Containment leakage: side of RB ECCS: AB Stack RB Purge: RB Stack	NA 153.6 (46.8) 153.6 (46.8)
SGTR (LOOP)	Y	AB Stack MSSVs/ADVs	153.6 (46.8) 38.5 (11.7)
SGTR (w/o LOOP)	N	AB Stack MSSVs/ADVs	153.6 (46.8) 38.5 (11.7)
MSLB (LOOP)	Y	IB leakage MSSVs/ADVs	NA 38.5 (11.7)
FHA	N	RB and AB Stacks	153.6 (46.8)
LRA (LOOP)	Y	MSSVs/ADVs	38.5 (11.7)
LLR (LOOP)	Y	AB Stack	153.6 (46.8)
LLR (w/o LOOP)	N	AB Stack	153.6 (46.8)
REA (LOOP)	Y	Containment leakage: side of RB ADVs	NA 38.5 (11.7)

3. (AADB 2-3)

Regulatory Guide 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants," states that the selection of χ/Q values to be used in exclusion area boundary (EAB) or low population zone boundary (LPZ) evaluations should be the maximum 0.5 percentile direction dependent (e.g., S, SSW, SW, etc.) χ/Q value or the 5 percent overall site limit χ/Q value for each time interval, whichever is higher. Please provide a summary table for the CR-3 EAB, and a second table for the LPZ, showing all 0.5 percentile direction dependent sector χ/Q values and the 5 percentile site limit χ/Q values. A copy of the EAB and LPZ summary pages from the PAVAN computer code output for CR-3 is acceptable. On these summary pages, highlight each of the EAB and LPZ χ/Q values listed in Table 2.9.2-5 of Attachment 7 to the original LAR and provide justification for selection of each of the highlighted values.

Response:

Enclosure 2, "Summary of CR-3 EPU EAB and LPZ χ/Q Data," provides summary tables showing EAB and LPZ direction dependent sector χ/Q values and site limit χ/Q values for the EAB and LPZ considering CR-3 EPU operation. The summary pages include highlighted values which were selected for the EAB and LPZ χ/Q values listed in Table 2.9.2-5 of the CR-3 EPU TR (Reference 1, Attachments 5 and 7). As described in FSAR Section 2.3.4, "Short-Term (Accident) Diffusion Estimates," plume meander was assumed for longer time periods; thus, χ/Q values listed in Table 2.9.2-5 were selected considering plume meander for time periods greater than 8 hours. For time periods 0 to 8 hours, plume meander was not considered.

The following is a specific justification for each selected value:

For the LPZ χ/Q values, offshore direction dependent sectors (i.e., SSW, SW, WSW, W, and WNW) are not applicable since there are no residences to consider as indicated in CR-3 FSAR Table 2-21, "Crystal River Annual Average X/Q (sec/m^3) Values for the Standard Population Distances." With the offshore direction dependent sectors eliminated, the highest χ/Q values indicated in the PAVAN data file are either: 1) the χ/Qs based on the 5% overall site limit criterion of Section 2.3.4, "Short-Term Atmospheric Dispersion Estimates for Accident Releases," of the NRC Standard Review Plan (SRP) where plume meander was not considered; or 2) χ/Q site limit values based on the 5% overall site limit criterion of Section 2.3.4 of the CR-3 FSAR where plume meander is considered. Therefore: the highest χ/Q values for the 0 to 8-hour periods were selected from the SRP 2.3.4 line in the PAVAN data file; for 8-hour to 30-day periods, the χ/Q values were selected from the Site Limit line in the PAVAN data file.

For the EAB, the χ/Q value was selected based on the highest calculated 0 to 2 hour value from the PAVAN data file; SRP 2.3.4 line.

References

1. FPC to NRC letter dated June 15, 2011, "Crystal River Unit 3 – License Amendment Request #309, Revision 0, Extended Power Uprate." (ADAMS Accession No. ML112070659)

2. K.G. Murphy and K. M. Campe, "Nuclear Power Plant Control Room Ventilation System Design for Meeting General Design Criterion 19," 13th AEC Air Cleaning Conference, August 1974.

3. FPC to NRC letter dated May 23, 1988, "Control Room Habitability – NUREG 0737, Item III.D.3.4 – Request for Additional Information (TAC No. 64805)." (ADAMS Accession No. 8805310306)

4. NRC to FPC letter dated May 25, 1989, "Crystal River Unit 3 – Control Room Habitability Evaluation (NUREG-0737 Item III.D.3.4) (TAC No. 64805)." (ADAMS Accession No. 8906010241)

5. FPC to NRC letter dated July 5, 2011, "Crystal River Unit 3 – Request for Additional Information to Support NRC Acceptance Review of CR-3 Extended Power Uprate LAR." (ADAMS Accession No. ML11201A310)

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

ENCLOSURE 1

CR-3 PLANT DRAWINGS OF RADIOACTIVITY SOURCES AND RECEPTORS

The following full-scale Crystal River Unit 3 plant drawings are included separately:

E-101-111: Architectural Roof Plan and Sections
E-744-007: Site Improvements Access and Service Roads and Railroads Plan
E-421-031: Reactor Building Exterior Wall – Concrete Outline
E-521-051: Reactor Building Plant Vent Plan, Sections, and Details

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

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ENCLOSURE 2

SUMMARY OF CR-3 EPU EAB AND LPZ X/Q DATA

EAB_1340 table

PLANT NAME: Crystal River Statio   METEOROLOGICAL INSTRUMENTATION
DATA PERIOD: n Jan-Dec 2003-2007   WIND SENSORS HEIGHT: Wind 10.0 53.3m   De
TYPE OF RELEASE: Ground Level Releas   DELTA-T HEIGHTS: lta T 53.3m - 10m
SOURCE OF DATA: Wind at 10 meters   Delta T 175'- 33'
COMMENTS: Final Run 7/8/08 to Correct EAB Distance from 1341 to 1340 and Plant Grade Elev.
PROGRAM: PAVAN, 10/76, 8/79 REVISION, IMPLEMENTATION OF REGULATORY GUIDE 1.145

RELATIVE CONCENTRATION (X/Q) VALUES (SEC/CUBIC METER) VERSUS AVERAGING TIME

DOWNWIND SECTOR	DISTANCE (METERS)	0-2 HOURS	0-8 HOURS	8-24 HOURS	1-4 DAYS	4-30 DAYS	ANNUAL AVERAGE	HOURS PER YEAR MAX 0-2 HR X/Q IS EXCEEDED IN SECTOR	DOWNWIND SECTOR
S	1340.	7.73E-05	3.63E-05	2.48E-05	1.09E-05	3.35E-06	7.92E-07	5.4	S
SSW	1340.	7.93E-05	3.82E-05	2.65E-05	1.20E-05	3.84E-06	9.52E-07	146.9	SSW
SW	1340.	1.02E-04	4.84E-05	3.33E-05	1.48E-05	4.60E-06	1.10E-06	14.8	SW
WSW	1340.	1.37E-04	6.75E-05	4.73E-05	2.18E-05	7.21E-06	1.86E-06	43.7	WSW
W	1340.	1.13E-04	5.49E-05	3.82E-05	1.74E-05	5.62E-06	1.41E-06	20.9	W
WNW	1340.	1.22E-04	5.89E-05	4.10E-05	1.86E-05	6.02E-06	1.51E-06	25.8	WNW
NW	1340.	9.92E-05	4.80E-05	3.34E-05	1.52E-05	4.90E-06	1.23E-06	13.5	NW
NNW	1340.	5.65E-05	2.62E-05	1.78E-05	7.74E-06	2.33E-06	5.38E-07	3.8	NNW
N	1340.	4.52E-05	2.11E-05	1.44E-05	6.33E-06	1.94E-06	4.55E-07	2.9	N
NNE	1340.	4.38E-05	2.06E-05	1.41E-05	6.23E-06	1.92E-06	4.57E-07	1.8	NNE
NE	1340.	4.61E-05	2.19E-05	1.51E-05	6.72E-06	2.10E-06	5.09E-07	2.1	NE
ENE	1340.	3.90E-05	1.95E-05	1.38E-05	6.49E-06	2.20E-06	5.87E-07	1.1	ENE
E	1340.	3.38E-05	1.74E-05	1.24E-05	6.05E-06	2.14E-06	6.03E-07	0.2	E
ESE	1340.	3.45E-05	1.78E-05	1.28E-05	6.23E-06	2.22E-06	6.30E-07	0.7	ESE
SE	1340.	4.17E-05	2.00E-05	1.38E-05	6.23E-06	1.98E-06	4.88E-07	0.6	SE
SSE	1340.	5.93E-05	2.80E-05	1.93E-05	8.55E-06	2.66E-06	6.37E-07	2.0	SSE
MAX X/Q		1.37E-04				TOTAL HOURS AROUND SITE:		286.4	
SRP 2.3.4	1340.	. E- 4	7.86E-05	5.42E-05	2.42E-05	7.63E-06	1.86E-06		
SITE LIMIT		9.80E-05	5.09E-05	3.67E-05	1.80E-05	6.48E-06	1.86E-06		

Highest of all χ/Q values.

LPZ table

PLANT NAME: Crystal River Statio
DATA PERIOD: n Jan-Dec 2003-2007
TYPE OF RELEASE: Ground Level Releas
SOURCE OF DATA: Wind at 10 meters Delta T 175'- 33'
COMMENTS: Final Run 7/8/08 to Correct EAB Distance from 1341 to 1340 and Plant Grade Elev.
PROGRAM: PAVAN, 10/76, 8/79 REVISION, IMPLEMENTATION OF REGULATORY GUIDE 1.145

METEOROLOGICAL INSTRUMENTATION
WIND SENSORS HEIGHT: Wind 10.0 53.3m De
DELTA-T HEIGHTS: lta T 53.3m - 10m

RELATIVE CONCENTRATION (X/Q) VALUES (SEC/CUBIC METER)
VERSUS
AVERAGING TIME

DOWNWIND SECTOR	DISTANCE (METERS)	0-2 HOURS	0-8 HOURS	8-24 HOURS	1-4 DAYS	4-30 DAYS	ANNUAL AVERAGE	HOURS PER YEAR MAX 0-2 HR X/Q IS EXCEEDED IN SECTOR	DOWNWIND SECTOR
S	8047.	1.14E-05	4.80E-06	3.12E-06	1.22E-06	3.17E-07	6.10E-08	8.3	S
~~SSW~~	~~8047.~~	~~1.15E-05~~	~~4.96E-06~~	~~3.26E-06~~	~~1.31E-06~~	~~3.56E-07~~	~~7.22E-08~~	~~181.8~~	~~SSW~~
~~SW~~	~~8047.~~	~~1.90E-05~~	~~7.83E-06~~	~~5.03E-06~~	~~1.92E-06~~	~~4.82E-07~~	~~8.90E-08~~	~~23.6~~	~~SW~~
~~WSW~~	~~8047.~~	~~2.36E-05~~	~~1.03E-05~~	~~6.77E-06~~	~~2.74E-06~~	~~7.49E-07~~	~~1.53E-07~~	~~43.7~~	~~WSW~~
~~W~~	~~8047.~~	~~1.98E-05~~	~~8.46E-06~~	~~5.53E-06~~	~~2.20E-06~~	~~5.86E-07~~	~~1.16E-07~~	~~25.1~~	~~W~~
~~WNW~~	~~8047.~~	~~2.15E-05~~	~~9.19E-06~~	~~6.02E-06~~	~~2.40E-06~~	~~6.40E-07~~	~~1.27E-07~~	~~31.8~~	~~WNW~~
NW	8047.	1.75E-05	7.46E-06	4.87E-06	1.93E-06	5.11E-07	1.01E-07	19.2	NW
NNW	8047.	6.91E-06	2.95E-06	1.93E-06	7.65E-07	2.03E-07	4.01E-08	4.8	NNW
N	8047.	4.89E-06	2.14E-06	1.41E-06	5.75E-07	1.58E-07	3.27E-08	3.4	N
NNE	8047.	4.89E-06	2.14E-06	1.41E-06	5.75E-07	1.58E-07	3.26E-08	1.8	NNE
NE	8047.	5.09E-06	2.24E-06	1.49E-06	6.11E-07	1.70E-07	3.56E-08	2.2	NE
ENE	8047.	4.17E-06	1.92E-06	1.31E-06	5.64E-07	1.69E-07	3.85E-08	1.1	ENE
E	8047.	3.46E-06	1.64E-06	1.13E-06	5.00E-07	1.56E-07	3.75E-08	0.2	E
ESE	8047.	3.56E-06	1.69E-06	1.17E-06	5.19E-07	1.63E-07	3.94E-08	1.0	ESE
SE	8047.	4.30E-06	1.92E-06	1.29E-06	5.37E-07	1.53E-07	3.31E-08	0.8	SE
SSE	8047.	7.06E-06	3.08E-06	2.03E-06	8.28E-07	2.27E-07	4.68E-08	2.3	SSE
MAX X/Q		2.36E-05				TOTAL HOURS AROUND SITE:		351.2	
SRP 2.3.4	8047.	. E-	. E-	5.79E-06	2.43E-06	7.02E-07	1.53E-07		
SITE LIMIT		1.62E-05	7.50E-06	. E-	. E-	. E- 7	1.53E-07		

0 to 8-hour χ/Q values: plume meander was not considered.

8-hour to 30-day χ/Q values: plume meander was considered.

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

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ATTACHMENT B

LIST OF REGULATORY COMMITMENTS

List of Regulatory Commitments

The following table identifies those actions committed to by Florida Power Corporation (FPC) in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments. Please notify the Superintendent, Licensing and Regulatory Programs of any questions regarding this document or any associated regulatory commitments.

Regulatory Commitment	Due date/event
FPC will provide: 1) revised main control room (MCR) χ/Q values for each design basis event reported in Section 2.9.2, "Radiological Consequences Analyses," of the CR-3 EPU Technical Report based on ARCON96 methodology described in Regulatory Guide 1.194; and 2) revised MCR dose results for the loss of coolant accident and fuel handling accident.	October 12, 2012

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FLORIDA POWER CORPORATION
CRYSTAL RIVER PLANT, UNIT 3
ST. PETERSBURG, FLORIDA

REACTOR BUILDING
EXTERIOR WALL-CONCRETE
OUTLINE, REV. 4
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