Florida Power & Light Company, 6501 S. Ocean Drive, Jensen Beach, FL 34957

FPL

August 12, 2011

L-2011-314
10 CFR 50.90

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

Re: St. Lucie Plant Unit 1
Docket No. 50-335
Renewed Facility Operating License No. DPR-67

Response to NRC Accident Dose Branch Request for Additional Information Regarding Extended Power Uprate License Amendment Request

References:

(1) R. L. Anderson (FPL) to U.S. Nuclear Regulatory Commission (L-2010-259), "License Amendment Request for Extended Power Uprate," November 22, 2010, Accession No. ML103560419.
(2) Email from T. Orf (NRC) to C. Wasik (FPL), "St. Lucie 1 EPU – RAIs (Accident Dose)," June 21, 2011.

By letter L-2010-259 dated November 22, 2010 [Reference 1], Florida Power & Light Company (FPL) requested to amend Renewed Facility Operating License No. DPR-67 and revise the St. Lucie Unit 1 Technical Specifications (TS). The proposed amendment will increase the unit's licensed core thermal power level from 2700 megawatts thermal (MWt) to 3020 MWt and revise the Renewed Facility Operating License and TS to support operation at this increased core thermal power level. This represents an approximate increase of 11.85% and is therefore considered an Extended Power Uprate (EPU).

By email from the NRC Project Manager dated June 21, 2011 [Reference 2], additional information related to accident dose was requested by the NRC staff in the Accident Dose Branch (AADB) to support their review of the EPU LAR. The request for additional information (RAI) identified sixteen questions. The response to these RAIs is provided in the attachment and enclosures to this letter.

In addition to the response provided in Attachment 1, enclosures to this letter consist of: 1) Compact disc (CD) containing site meteorological data, 2) paper copy drawings to support FPL's response to RAI AADB-9.

Attachment 2 to this letter contains the revised atmospheric dispersion factors based on the site meteorological data provided in the enclosed CD.

A001
NRR

In accordance with 10 CFR 50.91(b)(1), a copy of this letter is being forwarded to the designated State of Florida official.

This submittal does not alter the significant hazards consideration or environmental assessment previously submitted by FPL letter L-2010-259 [Reference 1].

This submittal contains no new commitments and no revisions to existing commitments.

Should you have any questions regarding this submittal, please contact Mr. Christopher Wasik, St. Lucie Extended Power Uprate LAR Project Manager, at 772-467-7138.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge.

Executed on Aug. 12, 2011

Very truly yours,

Richard L. Anderson
Site Vice President
St. Lucie Plant

Attachments (2)
Enclosures (2)
- CD containing meteorological data and atmospheric dispersion factors
- Paper copy drawings to support FPL's response to RAI AADB-9.

cc: Mr. William Passetti, Florida Department of Health

ATTACHMENT 1

Response to NRC Dose Analysis Engineering Branch Request for Additional Information Regarding Extended Power Uprate License Amendment Request

Response to Request for Additional Information

The following information is provided by Florida Power & Light Company (FPL) in response to the U. S. Nuclear Regulatory Commission's (NRC) Request for Additional Information (RAI). This information was requested to support Extended Power Uprate (EPU) License Amendment Request (LAR) for St. Lucie Nuclear Plant Unit 1 that was submitted to the NRC by FPL via letter (L-2010-259) dated November 22, 2010, Accession Number ML103560419.

In an email dated June 21, 2011 from NRC (Tracy Orf) to FPL (Chris Wasik), Subject: St. Lucie Unit 1 EPU – request for additional information (Accident Dose), the NRC requested additional information regarding FPL's request to implement the EPU. The RAI consisted of sixteen (16) questions from the NRC's Accident Dose Branch (AADB). These sixteen RAI questions and the FPL responses are documented below.

AADB-1:

The following items concern the St. Lucie meteorological measurement program for calendar years 2001– 2007.

a) Please provide information describing how the data were measured, processed, and selected to ensure that the data were of high quality and appropriate for input into the ARCON96 and PAVAN computer codes.

b) During the 2001–2007 period, please highlight any changes in the way in which the data were measured, processed, or selected for inclusion in the files and discuss why the changes were made.

c) Please identify each resultant temporal subset that comprises a homogeneous measurement, process, or selection subset of the 2001-2007 data base.

Response

See summary response to questions AADB-1 through AADB-6 and AADB-11.

AADB-2:

The 2001-2004 & 2006 hourly meteorological data set do not appear to be formatted to account for every hour in chronological sequence. The following are several examples.

a) In 2001, approximately 370 hours are not listed. One period appears to start on day 216, hour 17, and end on day 218, hour 13. A second period begins with day 248, hour 21, and ends on day 262, hour 11. In 2002, approximately 678 hours are not listed, beginning on day 155, hour 6, and ending on day 282, hour 0.

b) In 2004, approximately 25 hours are not listed, with 34 incidents of data flagged as out of sequence.

Do missing hours represent invalid data? Do day and hour labels that appear to be out of sequence represent mislabeled meteorological data which are in proper sequence?

Response

See summary response to questions AADB-1 through AADB-6 and AADB-11.

AADB-3:

With regard to the 2001–2004 & 2006 hourly meteorological data set, please confirm that the lower level wind direction is formatted in columns 17–19 and upper level wind direction is formatted in columns 29–31.

Response

See summary response to questions AADB-1 through AADB-6 and AADB-11.

AADB-4:

It appears that 2005 data were used in the 2004–2007 data file, but not in the 2001-2004 & 2006 data file set.

a) **Please explain why two different data periods were used.**

b) **NRC staff generated a joint wind direction, wind speed, and atmospheric stability distribution (JFD) from the 2001-2004 & 2006 data set and calculated exclusion area boundary (EAB) and low population zone (LPZ) atmospheric dispersion factors (χ/Q values) using the PAVAN computer code. Staff noted that the frequency occurrence of atmospheric stability category A was approximately 16% for the 2004-2007 data set and 22 percent for the 2001-2004 & 2006 data set. In addition, the resultant limiting χ/Q values were noticeably higher for the 2001-2004 & 2006 data set than for the 2004-2007 data set. Please provide justification that the 2001-2004 & 2006 data set used in the ARCON96 calculations and the 2004-2007 data set used in the PAVAN calculations have produced adequate estimates of the control room, and EAB and LPZ χ/Q values, respectively, for St. Lucie, Unit 1.**

Response

See summary response to questions AADB-1 through AADB-6 and AADB-11.

AADB-5:

There are periods in which some of the data appear to be anomalous. The following provide several examples.

a) **In 2001, there are approximately 165 consecutive hours reported as stability category F. There are other, shorter duration, occurrences when wind speed, wind direction and stability data were reported to be invariant for a number of consecutive hours. Please describe the meteorological phenomenon that resulted in continuous F stability for almost 7 days and other occurrences during 2001 when wind direction and wind speed, measured to the nearest degree and tenth of a mile per hour, respectively, did not vary for multiple consecutive hours.**

b) **In 2001, beginning with day 218, hour 13, NRC staff notes that the wind direction at both levels appears to be less variant for a period of approximately 2 weeks than for the former and subsequent periods. Please describe the meteorological phenomenon that resulted in a wind direction variation of 40 degrees or less during the two week period.**

c) **There are several lengthy periods in 2004 when data appear to be reported as a multiple of 10. Are these data valid, given that some of the other reported data for the same time period have been identified as invalid data?**

d) In cases where consecutive hours report the same data for both measurement levels, please explain which level represents the valid measurements.

e) Please explain how frequently, and under what circumstances, data from one level were formatted to apply to both measurement levels.

Response

See summary response to questions AADB-1 through AADB-6 and AADB-11.

AADB-6:

Stability category A is reported to occur at a relatively high frequency in the 2001-2004 & 2006 hourly data set. Four of the five years were between about 22% and 25%. The average for the 2004-2007 JFD data set appears to be about 16%. In addition, there is a relatively high occurrence of stability category A reported during the night in 2001 and, to a lesser extent, in 2006. Stability category A is not generally expected to occur at night. Therefore, provide a further discussion of the atmospheric stability measurements at the St. Lucie site and the site climatology. Please describe the meteorological phenomenon that results in the high occurrence of stability category A.

Response

See summary response to questions AADB-1 through AADB-6 and AADB-11.

Summary Response to AADB-1 through AADB-6 and AADB-11:

Note per AADB-1 and AADB-2:

The following general discussion describes the process used to acquire, review and format the original set of meteorological data. The discussion also applies to the data acquisition process for the replacement set of meteorological data, but the post-processing review, screening and validation process has been substantially improved.

The meteorological data that were submitted in support of the EPU LAR originate from the meteorological measurements program for the St. Lucie Plant. This program is described in detail in Section 2.3.3 of the Unit 1 Updated Final Safety Analysis Report (UFSAR). As stated in the UFSAR, the on-site meteorological program is designed to provide dispersion climatology for use in the planning of radioactive effluent releases and as a means of determining the meteorological parameters to be used in estimating the potential radiological consequences of hypothetical accidents.

FPL periodically acquired and saved the data from the met tower data logging system. The met tower data was then converted from the individual time period files to a common spreadsheet format.

During processing of annual composite spreadsheet files for the EPU project, the meteorological data was range checked for validity, and out of range data was marked as invalid. In certain files, stability class was not recorded for extended time periods, but sufficient temperature data at 10 and 57.9 (~60) meter elevations was available, so stability class was calculated from this data. Where "A" channel was valid at 10 and 60 meters, "A" channel was used for this stability calculation. If "A" channel was missing or invalid, and if "B" was available and valid, "B" was used instead of the missing or invalid "A" channel. In validating this calculation process for the missing stability class records, questions were identified in the pre-calculated stability class data in the data files, so it was decided to recalculate the stability classes in this data validation step of the data handling process to ensure that they were calculated on the same basis.

Once the stability classes were recalculated, suitable ARCON96 format card image files were produced. Required formatting changes were made (hour format in 0000-2300 format, vs. 0100-2400 format, wind direction in 1-360 degree format, vs. 0 to 359 degree format, wind speed multiplied by 10, i.e., 5.3 mph reported as 53, etc).

Note per AADB-3:

Wind direction data are formatted in the proper columns (17-19) and (29-31).

Where invalid data appeared in the resulting ARCON96 card deck, data was reviewed and changes were made to the screening process in the spreadsheets to mark this data invalid, in accordance with ARCON96 documentation specifications. A cursory final overview check was made of the remaining data, and any additional clearly bad data records were overwritten with bad data flags. This final overview yielded a large number of changes in the 2004 data files, when visual examination revealed significant periods where data was in range, but was clearly repetitive or cyclic in nature, and thus was not accurate meteorological data.

Joint frequency distribution (JFD) data in the original submittal was handled in a separate process. The FPL meteorological program produces quarterly text reports of JFD data. This data was converted from percentage of occurrence to numbers of observations, and summed for each year, and for the full time period of available data (2004-2007). The JFD data was then converted to PAVAN input format (wind speed categories are placed in rows and the wind direction in columns). The wind speed bins were chosen to be consistent with the wind speed bins that were used in the NRC-approved current licensing basis Alternative Source Term (AST) meteorological evaluations which support current power level plant operations.

Note per AADB-4 and AADB-11:

The JFD wind speed bins in the replacement set of meteorological data will be consistent with the hourly data in the replacement set of meteorological data, and will be compliant with the guidance in RIS-2006-4.

In response to this series of NRC RAI questions, FPL has reviewed the data files with METD (NUREG-0917) and manual/visual plotting tools. Based on this higher level of screening, FPL has chosen to replace the original submittal data set with a new set of screened and validated data. The following description of the enhanced screening and validation will provide assurance that the replacement set of data does not contain the types of questionable data that the NRC RAI questions have identified.

The METD-DATE, METD-MISS, METD-QA, METD-STABQ, and METD-JFREQ modules were used to screen the original submittal datasets, as well as the replacement 5 year data set. All available meteorological data (1996 (partial), 1997, 1998, 1999, 2000 (partial), 2001, 2002, 2003, 2004, 2006, 2007, 2008, and 2010) were evaluated. Application of the METD and the manual/visual trend plotting tools have identified five years in which the minimum recovery percentage of 90% is met for both ARCON96 and PAVAN inputs. These years – 1997, 1998, 1999, 2002, and 2003 – will be used with ARCON96 to calculate revised X/Q values.

Note per AADB-5:

The revised meteorological data set does not show the same anomalous high number of consecutive hours of same-stability-class behavior, persistent winds from one direction for extended periods of time, or anomalous (multiples of 10, or severely rounded) values. The screening tools have identified such anomalies, and when confirmed to be anomalous, the data was eliminated from the final data set used for X/Q determination. No data substitution was applied to assign 60 meter data to 10 meter values during this post processing activity.

Note per AADB-6:

The revised meteorological data set does not show the same high degree of stability class variability between years that the original data set contained. The annual stability class percentages in the re-screened and validated 1997, 1998, 1999, 2002 and 2003 data sets are as follows:

	1997	1998	1999	2002	2003
Missing/Bad	2.91%	7.03%	8.82%	8.49%	1.15%
Class A	19.03%	19.38%	18.63%	19.81%	13.41%
Class B	3.50%	3.49%	2.99%	2.96%	3.06%
Class C	3.16%	3.45%	3.32%	3.09%	3.21%
Class D	31.83%	25.68%	23.94%	24.20%	19.04%
Class E	32.49%	36.46%	36.20%	36.00%	44.35%
Class F	5.65%	3.63%	4.57%	3.41%	12.81%
Class G	1.43%	0.87%	1.53%	2.03%	2.97%

AADB-7:

The response to Question 2 of the Attachment to the March 18, 2008, Florida Power and Light Company letter concerning the alternative source term (Agencywide Documents Access and Management System (ADAMS) Accession Number ML080850561) stated that the then current St. Lucie procedures did not include guidance for monitoring meteorological conditions throughout a design basis accident for potential impact on the selection of the more favorable control room outside air intake. The response stated that applicable procedures would be revised, as needed, to provide the necessary guidance. Regulatory Guide 1.194, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants," states that the requisite steps to select the least contaminated outside air intake, and provisions for monitoring to ensure the least contaminated intake is in use throughout the event, should be addressed in procedures and in operator training. Therefore, please provide a description of revisions to the procedures that have been made subsequent to the March 18, 2008, response.

Response

FPL has revised the abnormal operating procedure for Ventilation Systems. This procedure is a continuous use procedure. The procedure contains the following note for the control room ventilations system:

"Due to changing environmental conditions during long term events, it may be necessary to repeat steps Attachment 4 step 7 and Attachment 4 Step 8 to maintain the lowest possible dose."

Attachment 4 Step 7 provides the steps for determining the radiation levels at both control room intakes. Attachment 4 Step 8 provides the steps for opening the control the control room intake to the at the lowest radiation level.

AADB-8:

Please provide a list of ARCON96 inputs for the steam jet air ejector, waste gas decay tank, and louver L-11.

Response

a) For the steam jet air ejector release to louver L-11, no specific ARCON96 geometries or files were set up or used.

The louver L-11 inleakage path is not generally considered during those time periods where the control room (CR) ventilation system is in the normal, non-isolated configuration. In this configuration, the normal intakes provide the unfiltered pressurization airflow that keeps the CR at a positive pressure relative to the environment. The louver L-11 receptor point only becomes a candidate unfiltered inleakage point when the CR is isolated or in emergency recirculation mode and the fans providing intake from louver L-11 to the cable spread room provide motive force to push unfiltered air into the CR envelope. Therefore, for pre-trip/pre-CR isolation configurations, there was no need to evaluate louver L-11 as a candidate unfiltered inleakage receptor point.

b) Unlike other events, the waste gas decay tank release (WGDT) event is worst after accumulating a full WGDT inventory following shutdown. Since refueling operations may be on-going, the initial state of the CR HVAC system "may" be in the emergency pressurization/recirculation mode at the beginning of the WGDT event.

For the WGDT release to louver L-11, the release point in the normal CR and reactor auxiliary building (RAB) HVAC configurations for this event is the plant stack. Figure 9.8-1 of the St. Lucie UFSAR shows that the WGDT area is served by the RAB ventilation system which normally exhausts out of this stack. To conservatively evaluate the worst case, FPL evaluated conditions at both units where the RAB exhaust might or might not be operating. If operating, the release would be through the stack. If not operating, the release would be through the nearest RAB louvers. Thus, there was no single WGDT release point or ARCON96 input data set for the WGDT to an L-11 release-receptor pair.

Instead, the case 134 (Unit 1 stack release to CR louver L-11) and case 241 (Unit 2 stack release to CR louver 2L-11) X/Q's were compared to the Unit 1/L-7A&B (cases 137 and 138) and Unit 2/L-7A&B (cases 245 and 244) RAB releases to CR louver L-11/2L-11 and the conservative worst X/Q from these six candidates was used in the unfiltered inleakage model in RADTRAD-NAI. This comparative selection of the worst case (for both units, for both stack and normal RAB leakage) yielded a single set of X/Q's that would bound the event results for both units.

The worst case for the bounding St. Lucie WGDT event CR unfiltered inleakage was the Case 245, Unit 2 RAB louver L-7A to the Unit 2 CR louver 2L-11. The text listing below provides the ARCON96 inputs for this worst case.

```
5
C:\PROGRAMS\ARCON96\SL1_EPU\SL01.MET
C:\PROGRAMS\ARCON96\SL1_EPU\SL02.MET
C:\PROGRAMS\ARCON96\SL1_EPU\SL03.MET
C:\PROGRAMS\ARCON96\SL1_EPU\SL04-S~1.MET
C:\PROGRAMS\ARCON96\SL1_EPU\SL06.MET
    10.00
    57.90
   2
   1
    11.60
     0.01
     0.00
     0.00
     0.00
  38  90
    42.60
    15.50
     0.00
sl245.log
sl245.cfd
 .2
     0.50
     4.30
   1   2   4   8  12  24  96 168 360 720
   1   2   4   8  11  22  87 152 324 648
     0.00      0.00
n
```

As described in the summary response to RAIs AADB-1 through AADB-6 and AADB-11, the individual meteorological files shown above will be replaced by screened and validated 1997, 1998, 1999, 2002, and 2003 data files.

The following table provides the geometry description upon which the candidate WGDT unfiltered inleakage cases were based.

Case	Release Location	Receptor Location	Release Height (m)	Building Area (m^2)	Distance (m)	Direction (deg)	Intake Height (m)
sl134	Stack/ Plant Vent	Louver L-11	56.1	0.01	38.9	355	15.1
sl137	Louver L-7A	Louver L-11	11.6	0.01	42.7	35	15.1
sl138	Louver L-7B	Louver L-11	11.6	0.01	47.4	25	15.1
sl241	Stack/ Plant Vent	Louver 2L-11	56.1	0.01	37.3	358	15.5
sl244	Louver 2L-7B	Louver 2L-11	11.6	0.01	46.9	28	15.5
sl245	Louver 2L-7A	Louver 2L-11	11.6	0.01	42.6	38	15.5

<u>AADB-9:</u>

Figure 2.9.2-1 of Attachment 5 to the St. Lucie, Unit 1, extended power uprate license amendment (LAR) request dated December 15, 2010, (ADAMS Accession Number ML103560415) shows the position of most of the postulated release locations with respect to key plant structures and the control room intakes. However, the figure does not appear to show the location of the steam jet air ejector, the waste gas decay tank, and louver L-11. Further, Figure 2.9.2-1 is not drawn to scale.

a) Please provide a scaled aerial-view drawing from which distance and direction inputs can be reasonably approximated for all postulated release and receptor locations. Indicate true north and provide the scale of the figure.

b) Explain whether distance inputs into the ARCON96 calculations were directly estimated as horizontal straight line distances. If the distances were not estimated directly as straight line horizontal distances, please explain how they were determined.

<u>RESPONSE</u>

a) Provided below is the Release – Receptor Combination Table that provides the cross references to the drawings used to determine the release and receptor heights and distances. The reference drawings provided are the latest revision and are provided in hard copy only. Release - receptor locations for this revision of the drawings are unchanged from the locations identified revision listed in the table references.

b) Straight line distances in a horizontal plane were used.

RELEASE/RECEPTOR COMBINATION TABLE(1)(2)

Release Point	Receptor Point	Release Height (ft)	Release Height (m)	Receptor Height (ft)	Receptor Height (m)	Distance (ft)	Distance (m)	Direction with respect to true north (deg)	Reference
Stack/plant vent	North (N) Control Room (CR) intake	184	56.1	59.75	18.2	48.08	14.6	58	1, 2
Stack/plant vent	South (S) CR intake	184	56.1	59.75	18.2	126.69	38.6	354	1, 2
Stack/plant vent	Midpoint between intakes	184	56.1	59.75	18.2	74.85	22.8	8	1, 2
Refueling water tank (RWT)	N CR intake	48.22	14.6	59.75	18.2	245.31	74.7	65	1, 3, 4, 5, 6
RWT	S CR intake	48.22	14.6	59.75	18.2	263.64	80.3	39	1, 3, 4, 5, 6
RWT	Midpoint between intakes	48.22	14.6	59.75	18.2	244.91	74.6	52	1, 3, 4, 5, 6
Fuel handling building (FHB) closest point	N CR intake	43.25	13.2	59.75	18.2	120.6	36.7	48	7

RELEASE/RECEPTOR COMBINATION TABLE(1)(2)

Release Point	Receptor Point	Release Height (ft)	Release Height (m)	Receptor Height (ft)	Receptor Height (m)	Distance (ft)	Distance (m)	Direction with respect to true north (deg)	Reference
FHB closest point	S CR intake	43.25	13.2	59.75	18.2	184.26	56.1	11	7
FHB closest point	Midpoint between intakes	43.25	13.2	59.75	18.2	142.19	43.3	25	7
Louver L-7B	N CR intake	38.17	11.6	59.75	18.2	123.77	37.7	72	1, 4, 7, 8, 9
Louver L-7B	S CR intake	38.17	11.6	59.75	18.2	152.75	46.5	24	1, 4, 7, 8, 9
Louver L-7B	Midpoint between intakes	38.17	11.6	59.75	18.2	123.56	37.6	45	1, 4, 7, 8, 9
Louver L-7A	N CR intake	38.17	11.6	59.75	18.2	132.29	40.3	83	1, 4, 7, 8, 9
Louver L-7A	S CR intake	38.17	11.6	59.75	18.2	136.97	41.7	34	1, 4, 7, 8, 9
Louver L-7A	Midpoint between intakes	38.17	11.6	59.75	18.2	118.59	36.1	59	1, 4, 7, 8, 9

RELEASE/RECEPTOR COMBINATION TABLE(1)(2)

Release Point	Receptor Point	Release Height (ft)	Release Height (m)	Receptor Height (ft)	Receptor Height (m)	Distance (ft)	Distance (m)	Direction with respect to true north (deg)	Reference
Closest atmospheric dump valve (ADV)	N CR intake	53	16.1	59.75	18.2	105.68	32.2	306	1, 10, 11, 12
Closest ADV	S CR intake	53	16.1	59.75	18.2	214.82	65.4	319	1, 10, 11, 12
Closest ADV	Midpoint between intakes	53	16.1	59.75	18.2	160.26	48.8	314	1, 10, 11, 12
Closest main steam safety valve (MSSV)	N CR intake	48	14.6	59.75	18.2	108.59	33.0	300	1, 10, 11, 12
Closest MSSV	S CR intake	48	14.6	59.75	18.2	215.01	65.5	316	1, 10, 11, 12
Closest MSSV	Midpoint between intakes	48	14.6	59.75	18.2	161.58	49.2	310	1, 10, 11, 12
Closest main steam (MS) line point	N CR intake	17	5.2	59.75	18.2	103.37	31.5	303	1, 10, 12. 13
Closest MS line point	S CR intake	17	5.2	59.75	18.2	211.31	64.4	318	1, 10, 12, 13
Closest MS line point	Midpoint between intakes	17	5.2	59.75	18.2	157.22	47.9	312	1, 10, 12, 13

RELEASE/RECEPTOR COMBINATION TABLE(1)(2)

Release Point	Receptor Point	Release Height (ft)	Release Height (m)	Receptor Height (ft)	Receptor Height (m)	Distance (ft)	Distance (m)	Direction with respect to true north (deg)	Reference
Closest feedwater (FW) line point	N CR intake	17	5.2	59.75	18.2	83.29	25.3	306	1, 13
Closest FW line point	S CR intake	17	5.2	59.75	18.2	193.15	58.8	321	1, 13
Closest FW line point	Midpoint between intakes	17	5.2	59.75	18.2	138.15	42.1	315	1, 13
Containment maintenance hatch	N CR intake	16	4.9	59.75	18.2	172.4	52.5	359	1, 13
Containment maintenance hatch	S CR intake	16	4.9	59.75	18.2	279.09	85.0	348	1, 13
Containment maintenance hatch	Midpoint between intakes	16	4.9	59.75	18.2	223.66	68.1	351	1, 13
Stack/plant vent	Louver L-11	184	56.1	49.5	15.1	127.68	38.9	355	1,2
RWT	Louver L-11	48.22	14.6	49.5	15.1	267.32	81.4	40	1, 3, 4, 5, 6
FHB closest point	Louver L-11	43.25	13.2	49.5	15.1	186.43	56.8	12	1, 7

RELEASE/RECEPTOR COMBINATION TABLE[(1)(2)]

Release Point	Receptor Point	Release Height (ft)	Release Height (m)	Receptor Height (ft)	Receptor Height (m)	Distance (ft)	Distance (m)	Direction with respect to true north (deg)	Reference
Louver L-7A	Louver L-11	38.17	11.6	49.5	15.1	140.21	42.7	35	1, 4, 7, 8, 9, 14
Louver L-7B	Louver L-11	38.17	11.6	49.5	15.1	155.72	47.4	25	1, 4, 7, 8, 9, 14
Closest ADV	Louver L-11	53	16.1	49.5	15.1	214.93	65.5	318	1, 10, 11, 12
Closest MSSV	Louver L-11	48	14.6	49.5	15.1	213.22	64.9	317	1, 10, 11, 12
Closest FW line point	Louver L-11	17	5.2	49.5	15.1	191.68	58.4	322	1, 13
Containment maintenance hatch	Louver L-11	16	4.9	49.5	15.1	279.61	85.2	349	1, 13
Steam jet air ejector	N CR intake	52.42	16.0	59.75	18.2	149.9	45.6	266	15, 16, 17, 18, 19, 20
Steam jet air ejector	S CR intake	52.42	16.0	59.75	18.2	208.44	63.5	296	15, 16, 17, 18, 19, 20
Condenser	N CR intake	5.25	1.6	59.75	18.2	153.23	46.7	244	16, 17, 18, 19, 20, 21
Condenser	S CR intake	5.25	1.6	59.75	18.2	179.43	54.6	281	16, 17, 18, 19, 20, 21

NOTES

(1) Release heights are calculated as 19 ft. less than the referenced elevations to account for plant grade elevation. When converting feet to meters, all significant figures reflect rounding down, so that analysis results are conservative. The FHB closest release point

elevation is taken as the roof elevation since the SW corner of the roof is the closest building point to the intakes. Release and receptor points are considered to be at the centerpoint or centerline of all openings. Inspection of the references and the directions calculated reveals that the only release/receptor combination that does not have the intakes in the same wind direction window from the release point is for the releases from the plant stack. Except for releases from the plant stack, all release points analyzed result in both CR intakes being in the same wind direction window. Therefore, credit may be taken for intake dilution only for releases from the plant stack. Some of the cases are for release/receptor combination information for a receptor point located halfway between the CR outside air intakes from the north-south direction. The receptor point is taken as being on the outside of the CR (and heating and ventilation room) east wall. The receptor elevation is taken as the average of the receptor elevations for the two outside air intakes. Atmospheric dispersion factors for the releases to the midpoint between the CR intakes are required for the limiting case to be used during the time period when the CR intakes are isolated. The midpoint receptor location is used to calculate the X/Q value to be used for the unfiltered CR inleakage dose. The closest containment/shield building penetration to the intakes that is directly exposed to the atmosphere is the closest feedwater line penetration. Based on the general symmetry between the St. Lucie units, the distances and directions with respect to true north from the steam jet air ejector and the condenser to the CR outside air intakes for Unit 1 were taken to be the same as those for Unit 2. Although the distances from these release points to the Unit 2 south CR outside air intake are slightly shorter, using the Unit 2 distances maintains the traceability of the measured Unit 2 values while introducing inputs that will yield slightly more conservative atmospheric dispersion factors for Unit 1 and the south CR outside air intake.

(2) When both are open, both CR outside air intakes are assumed to have equal flow rates for makeup air. Both CR outside air intakes are open during normal operation. All shield building bypass leakage is assumed to leak into the reactor auxiliary building (RAB). All potential bypass leakage paths exit into the RAB except for a couple that empty into the FHB and one whose outboard location is listed as being in a covered plenum area that is part of the RAB (and thus not directly exposed to the atmosphere).

References

1. Drawing 8770-G-076, "General Arrangement Reactor Auxiliary Building Miscellaneous Plans & Sections," Rev. 27.
2. Drawing 8770-G-821. Sheet 3, "Reactor Auxiliary Building Misc. Structural Steel – SH 3," Rev. 4.
3. Drawing 8770-4544, "Refueling Water Tank General Plan," Rev 3.
4. Drawing 8770-G-568, "Reactor Auxiliary Building Framing Plan – Slabs & Beams – Sh. 1," Rev. 5.
5. Drawing 8770-G-172, "Yard Piping Sheet No. 3," Rev. 24.
6. Drawing 8770-4549, "Refueling Water Tank 12" Diameter Mushroom Vent," Rev. 2.
7. Drawing 8770-G-071, "General Arrangement Reactor Auxiliary Building Plan Sheet 3," Rev. 25.
8. Drawing 8770-G-880, "HVAC – Equipment Schedules & Details Sh. 1," Rev. 24.
9. Drawing 8770-G-862, "HVAC – Air Flow Diagram," Rev. 31.
10. Drawing 8770-G-125 Sheet MS-L-6, "Large Bore Piping Isometric Main Steam," Rev. 6.
11. Drawing 8770-G-125 Sheet MS-L-10, "Large Bore Piping Isometric Main Steam Safety Valve Vents," Rev. 2.
12. Drawing 8770-G-147, "Main Steam & Feedwater Piping – Plan Sheet 1," Rev. 8.
13. Drawing 8770-G-503, "Reactor Building Cylinder Dev. Mas.," Rev. 11.
14. Drawing 8770-G-870, "HVAC – Reactor Auxiliary Bldg SH. 3," Rev. 22.
15. St. Lucie Unit 1 Updated FSAR Amendment 22.
16. Drawing 2998-G-059, "Enlarged Plot Plan," Rev. 30.
17. Drawing 2998-G-060, "General Arrangement – Turbine Building – Ground Floor - Plan," Rev. 24.
18. Drawing 2998-G-061, "General Arrangement – Turbine Building – Mezzanine Floor - Plan," Rev. 14.
19. Drawing 2998-G-062, "General Arrangement – Turbine Building – Operating Floor - Plan," Rev. 14.
20. Drawing 2998-G-076, "General Arrangement Reactor Auxiliary Building Miscellaneous Plans & Sections," Rev. 23.
21. Drawing 2998-G-064, "General Arrangement Turbine Building Plans & Sections – SH 2," Rev. 18.

AADB-10:

Item 6 of Table 2.9.2-6 of Attachment 5 to the LAR states that the χ/Q values in Table 2.9.2-6 are to be used for events where the limiting unfiltered inleakage location is through the control room intakes. Control room χ/Q values corresponding to the midpoint between the control room intakes are to be used during the time period when the control room intakes are isolated.

a) Given that some of the postulated release locations are closer to the control room than either of the control room intakes or the midpoint, please explain why the discussion under Item 6 of Table 2.9.2-6 is the limiting case.

b) Other than the control room air intakes, please describe any penetrations from the environment into the control room envelop.

c) Are control room χ/Q values assuming unfiltered inleakage into the south intake ever reduced from the values generated by ARCON96? If so, please describe why this is appropriate.

Response

a) The use of midpoint for this inleakage location is consistent with the current licensing basis determination of limiting inleakage locations. This location was originally chosen prior to performance of control room (CR) inleakage testing. Performance of inleakage testing indicated that the primary source of inleakage was the fans drawing air in through louver L-11 or 2L-11. Since the midpoint provided higher X/Q values, it continued to be conservatively used as the inleakage location.

b) As described in the response to AADB-10 (a), the primary inleakage locations were through the L-11 and 2L-11 louvers for Units 1 and 2. Although this inleakage would enter the elevation below the CR and have to leak through penetrations through the CR floor to enter the CR, no credit was taken for dilution or delay when evaluating the L-11 and 2L-11 louver locations. The testing did not identify any other significant inleakage locations.

c) Yes. As indicated by the asterisk in LAR Attachment 5, Table 2.9.2-7, Cases A and B (stack/vent to north and south (N & S) CR intakes, respectively) show the result of applying a dilution credit, as allowed per Section 3.3.2.2 of NRC Regulatory Guide (RG) 1.194, Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants to the ARCON96 computer code results. From the perspective of the plant/vent stack, the N & S intakes are in different wind sectors, allowing the maximum X/Q (between the N & S intakes) to be reduced by a factor of two. The south intake (for a stack release) is the highest value, so the ARCON96 result for this case was reduced by a factor of two.

AADB-11:

The choice of wind speed categories used in the PAVAN computer code calculation appears to result in clustering of data, with more than 80 percent of the wind speeds occurring in two of the wind speed categories. The lightest wind speed category has a frequency occurrence of more than 5 percent. NRC Regulatory Issues Summary (RIS) 2006-4, "Experience with Implementation of Alternative Source Terms" (ADAMS Accession Number ML053460347), states that input to PAVAN should have a large

number of wind speed categories at the lower wind speeds in order to produce the best results. Therefore, please provide justification that the wind speed categories used in the PAVAN calculations have produced adequate estimates of the EAB and LPZ χ/Q values for St. Lucie, Unit 1.

<u>Response</u>

See summary response to questions AADB-1 through AADB-6 and AADB-11.

The following requests for additional information concern the radiological data provided in support of the St. Lucie, Unit 1, EPU LAR.

<u>AADB-12:</u>

The current licensing basis (CLB) containment leak rate is expressed in weight percent per day according to Table 2.1-1 of NAI-1101-043, Rev 2. For the EPU LAR the containment leak rate is expressed in volume percent per day according to Table 2.9.2-12 and it is stated that this represents no change from the CLB. Please provide additional information to reconcile the apparent discrepancy in the method of determining containment leak rate between the EPU LAR and Table 2.1-1 of NAI-1101-043, Rev 2.

<u>Response</u>

There is no proposed change to the current licensing basis (CLB) method of determining leak rate. For Technical Specification 6.8.4.h, Containment Leakage Rate Testing Program, leak rate is measured in containment air weight percent per day. In the re-submittal to implement the replacement X/Q's, this language detail will be made to be consistent between the CLB and the EPU submittal.

<u>AADB-13:</u>

Table 2.9.2-12 describes the assumed flow rate between sprayed and unsprayed containment volumes as 23,389 cfm during spray operation, equal to 4 x unsprayed volume per hour and 11,695 cfm after sprays are secured, equal to 2 x unsprayed volume per hour. This represents a change to the CLB which incorporates a constant mixing rate of 11,695 cfm both during spray operation and after spays are secured. Please provide additional information describing the basis for this change to the CLB.

<u>Response</u>

The constant 2 times unsprayed volume per hour value was conservatively used in the prior alternative source term (AST) submittal, rather than the 4 times unsprayed volume described in Section 6.2.6.3.4 of the St. Lucie Unit 1 UFSAR. The 4 times unsprayed volume mixing flow value is used in the EPU analysis consistent with the NRC Regulatory Guide (RG) 1.183, Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors, Appendix A, Item 3.3 guidance "unless other rates are justified" based on its inclusion in the current UFSAR.

AADB-14:

For secondary side releases analyzed for the EPU, the time to terminate steam generator (SG) tube leakage and the time to reach 212 °F and terminate steam releases are both defined as 12.4 hours. In the CLB analyses these times are different; 12 hours to terminate SG tube leakage and 10.32 hours to reach 212 °F and terminate steam releases. Please provide additional information describing the basis for these changes to the CLB. Please include information on the assumed cooldown rates as they pertain to secondary side releases analyzed for the EPU.

Response

The EPU alternative source term (AST) analyses are based on the thermal hydraulic analyses performed at EPU conditions. In the AST analysis, both the steam release and the tube leakage into the unaffected steam generator (SG) terminate at the same time.

The AST steam release evaluation used event specific analysis defined statepoints (when available), and evaluated a range of cooldown rates for the time periods when controlled cooldown is achieved by operator actions subsequent to the isolation of affected SG. Both a hot leg break and a cold leg break scenario were considered.

For the steam generator tube rupture (SGTR) event, both a hot leg break and a cold leg break scenario were considered. Post-trip cooldown rates to the time of affected SG isolation were varied between 30 minutes and 45 minutes. From those isolation time points, cooldown rates between 100°F per hour and 20°F per hour were continued to 212°F reactor coolant system (RCS) temperature. Sensitivity studies showed that the hot leg break, with a post-isolation cooldown rate of 20°F per hour produced the limiting release and dose for this event. The corresponding time to reach 212°F was 12.4 hours. The tube leakage into the unaffected SG and the steam releases from the unaffected SG were thus terminated at 12.4 hours.

In the current licensing basis SGTR, although the tube leakage was continued up to 12 hours, the time to reach 212 °F was 10.32 hours, based on a slightly different cooldown rate used, when steam releases from the unaffected SG terminated.

Based on this SGTR event, total masses of steam release for various time periods were derived and applied to other non-SGTR events. Steam release masses were converted to steam release rates for the following time periods:

- Reactor trip to 30 minutes,
- 30 minutes to 2 hours, and
- 2 hours to RCS = 300°F at 8 hours (shutdown cooling condition)

Based on the SGTR event sensitivities, the conservative slow cooldown of 20°F per hour was assumed between 300°F and 212°F

AADB-15:

The main steam line break steam release rate Table 2.9.-21 from the EPU LAR displays values for the intact SG steam release rate that are substantially different than the values shown in Table 2.3-2 from NAI-1101-043, Rev. 2. Please provide additional information describing the basis for the differences.

Response

The EPU alternative source term (AST) analyses are based on the analyses performed at EPU conditions. The EPU steam releases are shown with the allowable partition factors of 100 applied, while the prior tables showed the steam releases before the application of this reduction factor. In the re-submittal of the AST dose analyses to implement the revised meteorological data, the data in the tables will be provided without the reduction for direct comparison to the prior current licensing basis table.

AADB-16:

The SG tube rupture break flow and steam releases as shown on EPU LAR Table 2.9.2-24 indicates values for the ruptured SG break flow for the time interval from 1 to 12.4 hours. Please provide additional information describing the differences between the values shown and the values shown in Table 2.4-2 from NAI-1101-043, Rev. 2.

Response

The EPU alternative source term (AST) analyses are based on thermal hydraulic analyses performed at EPU conditions for the steam generator tube rupture (SGTR). The EPU steam releases are shown with the allowable partition factors of 100 applied, while the prior tables showed the steam releases before the application of this reduction factor. Also, unlike the SGTR thermal hydraulic analysis that supported the current licensing basis AST break flow, the EPU thermal hydraulic analyses include ruptured steak generator (SG) break flow beyond isolation of the SG. The EPU SGTR radiological analysis includes this flow for consistency in LAR Attachment 5, Table 2.9.2-24, although the steam releases from the ruptured SG terminate at 45 minutes.

ATTACHMENT 2

Response to NRC Dose Analysis Engineering Branch Request for Additional Information Regarding Extended Power Uprate License Amendment Request

Revised LAR χ/Q Tables

The following tables replace the EPU LAR Attachment 5 Tables 2.9.2-7 and 2.9.2-9. These tables are based on the revised meteorological data provided on compact disc with this submittal.

Table 2.9.2-7
Onsite Atmospheric Dispersion Factors (χ/Q)for Analysis Events

Release Location	Receptor Location	Notes	0-2 hr χ/Q (sec/m³)	2-8 hr χ/Q (sec/m³)	8-24 hr χ/Q (sec/m³)	1-4 days χ/Q (sec/m³)	4-30 days χ/Q (sec/m³)
Stack/Plant Vent	N CR intake	2	4.78E-03	3.79E-03	1.62E-03	1.31E-03	1.03E-03
Stack/Plant Vent	S CR intake	2	2.77E-03	1.95E-03	8.74E-04	5.84E-04	5.12E-04
Stack/Plant Vent	Midpoint between intakes	1	3.91E-03	2.56E-03	1.11E-03	7.76E-04	5.85E-04
Refueling Water Tank (RWT)	N CR intake	3	1.37E-03	1.13E-03	5.12E-04	3.89E-04	3.32E-04
RWT	S CR intake	3	1.12E-03	9.10E-04	3.84E-04	2.93E-04	2.37E-04
RWT	Midpoint between intakes	1	1.34E-03	1.09E-03	4.74E-04	3.75E-04	3.11E-04
Fuel Handling Building (FHB) Closest Point	N CR intake	3	4.99E-03	4.02E-03	1.76E-03	1.37E-03	1.14E-03
FHB Closest Point	S CR intake	3	2.01E-03	1.44E-03	6.25E-04	4.34E-04	3.33E-04
FHB Closest Point	Midpoint between intakes	1	3.27E-03	2.45E-03	1.01E-03	7.56E-04	5.80E-04
Louver L-7B	N CR intake	2	4.80E-03	4.06E-03	1.81E-03	1.44E-03	1.16E-03
Louver L-7B	S CR intake	2	2.86E-03	2.05E-03	8.65E-04	6.36E-04	4.92E-04
Louver L-7B	Midpoint between intakes	1	4.55E-03	3.76E-03	1.60E-03	1.25E-03	1.03E-03
Louver L-7A	N CR intake	2	4.34E-03	3.72E-03	1.64E-03	1.35E-03	1.07E-03
Louver L-7A	S CR intake	2	3.61E-03	2.87E-03	1.20E-03	9.07E-04	7.13E-04
Louver L-7A	Midpoint between intakes	1	5.03E-03	4.21E-03	1.83E-03	1.45E-03	1.20E-03
Closest Atmospheric Dump Valve (ADV)	N CR intake	3,4	6.30E-03	4.90E-03	1.74E-03	1.49E-03	1.22E-03
Closest ADV	S CR intake	3,4	1.62E-03	1.32E-03	5.06E-04	3.88E-04	3.30E-04
Closest ADV	Midpoint between intakes	1,4	2.84E-03	2.26E-03	8.35E-04	6.60E-04	5.66E-04
Closest Main Steam Safety Valve (MSSV)	N CR intake	3,4	5.83E-03	4.62E-03	1.62E-03	1.42E-03	1.11E-03
Closest MSSV	S CR intake	3,4	1.58E-03	1.29E-03	4.82E-04	3.74E-04	3.22E-04
Closest MSSV	Midpoint between intakes	1,4	2.73E-03	2.15E-03	7.83E-04	6.47E-04	5.36E-04
Closest Main Steam Line Point	N CR intake	3	5.13E-03	4.07E-03	1.48E-03	1.25E-03	9.96E-04
Closest Main Steam Line Point	S CR intake	3	1.49E-03	1.19E-03	4.67E-04	3.57E-04	2.98E-04
Closest Main Steam Line Point	Midpoint between intakes	1	2.50E-03	2.00E-03	7.49E-04	5.97E-04	4.92E-04

Table 2.9.2-7 (continued) Onsite Atmospheric Dispersion Factors (χ/Q)for Analysis Events							
Release Location	**Receptor Location**	**Notes**	**0-2 hr χ/Q (sec/m^3)**	**2-8 hr χ/Q (sec/m^3)**	**8-24 hr χ/Q (sec/m^3)**	**1-4 days χ/Q (sec/m^3)**	**4-30 days χ/Q (sec/m^3)**
Closest Feedwater Line Point	N CR intake	3	7.29E-03	5.72E-03	2.11E-03	1.75E-03	1.43E-03
Closest Feedwater Line Point	S CR intake	3	1.76E-03	1.41E-03	5.72E-04	4.29E-04	3.57E-04
Closest Feedwater Line Point	Midpoint between intakes	1	3.17E-03	2.54E-03	9.73E-04	7.50E-04	6.26E-04
Containment Maintenance Hatch	N CR intake	3	1.90E-03	1.45E-03	6.58E-04	4.31E-04	3.88E-04
Containment Maintenance Hatch	S CR intake	3	8.22E-04	6.57E-04	2.87E-04	1.92E-04	1.74E-04
Containment Maintenance Hatch	Midpoint between intakes	1	1.21E-03	9.73E-04	4.26E-04	2.86E-04	2.59E-04
Condenser	N CR intake	3	2.46E-03	1.87E-03	6.86E-04	5.28E-04	3.86E-04
Condenser	S CR intake	3	1.63E-03	1.19E-03	4.39E-04	3.53E-04	2.84E-04
Condenser	Midpoint between intakes	1	2.05E-03	1.42E-03	5.57E-04	4.00E-04	3.02E-04
Stack/Plant Vent	Louver L-11	1	2.55E-03	1.78E-03	7.94E-04	5.37E-04	4.62E-04
RWT	Louver L-11	1	1.11E-03	8.89E-04	3.79E-04	2.91E-04	2.40E-04
FHB Closest Point	Louver L-11	1	1.99E-03	1.39E-03	6.13E-04	4.23E-04	3.24E-04
Louver L-7A	Louver L-11	1	3.56E-03	2.83E-03	1.17E-03	8.92E-04	7.14E-04
Louver L-7B	Louver L-11	1	2.72E-03	2.06E-03	8.51E-04	6.37E-04	4.88E-04
Closest ADV	Louver L-11	1,4	1.62E-03	1.31E-03	4.95E-04	3.84E-04	3.28E-04
Closest MSSV	Louver L-11	1,4	1.61E-03	1.31E-03	4.94E-04	3.82E-04	3.27E-04
Closest Feedwater Line Point	Louver L-11	1	1.82E-03	1.47E-03	5.92E-04	4.43E-04	3.67E-04
Containment Maintenance Hatch	Louver L-11	1	8.25E-04	6.58E-04	2.91E-04	1.94E-04	1.75E-04
Steam Jet Air Ejector	N CR intake	3	3.02E-03	2.20E-03	8.01E-04	6.17E-04	4.63E-04
Steam Jet Air Ejector	S CR intake	3	1.73E-03	1.37E-03	4.71E-04	4.17E-04	3.29E-04

Notes

1. No dual ventilation intake dilution credit allowed.
2. Intakes are not in the same wind direction window. Dilution credit possibly may be taken for these cases according. Note that the values in the table do not have this factor applied.
3. Intakes are in the same direction window. Dilution credit possibly may be taken for these cases. Note that the values in the table do not have this factor applied.
4. Plume rise credit may possibly be taken for these release-receptor combinations. Note that the values in the table do not have this factor applied.

Table 2.9.2-9
Offsite Atmospheric Dispersion Factors (χ/Q) for Analysis Events

Time Period	EAB χ/Q (sec/m^3)	LPZ χ/Q (sec/m^3)
0-2 hours	9.84E-05	9.56E-05
0-8 hours	5.53E-05	5.34E-05
8-24 hours	4.15E-05	3.99E-05
1-4 days	2.22E-05	2.12E-05
4-30 days	9.06E-06	8.55E-06

The 20 Drawings specifically referenced in Attachment 1 have been processed into ADAMS.

These drawings can be accessed within the ADAMS package or by performing a search on the Document/Report Number.