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

FPL

October 5, 2011

L-2011-404
10 CFR 50.90

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

Re: St. Lucie Plant Unit 2
Docket No. 50-389
Renewed Facility Operating License No. NPF-16

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-2011-021), "License Amendment Request for Extended Power Uprate," February 25, 2011, Accession No. ML110730116.
(2) Email from T. Orf (NRC) to C. Wasik (FPL), "St. Lucie 2 EPU draft RAIs – Accident Dose branch (AADB)," August 31, 2011.

By letter L-2011-021 dated February 25, 2011 [Reference 1], Florida Power & Light Company (FPL) requested to amend Renewed Facility Operating License No. NPF-16 and revise the St. Lucie Unit 2 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 August 31, 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 twelve questions (AADB-1 through AADB-12). The attachment to this letter provides the FPL responses to the RAI questions AADB-1 through AADB-11. The response to AADB-12 will be provided in a later submittal.

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-2011-021 [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 772-429-7138.

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

Executed on 05-Oct-2011

Very truly yours,

Richard L. Anderson
Site Vice President
St. Lucie Plant

Attachment
Enclosure
Paper copy drawings to support FPL's response to RAI AADB-4

cc: Mr. William Passetti, Florida Department of Health (w/o enclosure)

Response to Request for Additional Information

The following information is provided by Florida Power & Light (FPL) in response to the U.S. Nuclear Regulatory Commission's (NRC) Request for Additional Information (RAI). This information was requested to support the Extended Power Uprate (EPU) License Amendment Request (LAR) for St. Lucie Nuclear Plant Unit 2 that was submitted to the NRC by FPL via letter (L-2011-021), February 25, 2011, Accession No. ML110730116.

In an email dated August 31, 2011 from NRC (Tracy Orf) to FPL (Chris Wasik), Subject: St. Lucie 2 EPU draft RAIs – Accident Dose branch (AADB), the NRC staff requested additional information regarding FPL's request to implement the EPU. The RAI consisted of twelve (12) questions from the NRC Accident Dose Branch. Eleven (11) of the twelve RAI questions and the FPL responses are documented below. The response to RAI AADB-12 will be provided in a later submittal.

AADB-1

The following items concern the St. Lucie meteorological measurement program for calendar years 2001– 2007 and are not an exhaustive list of examples.

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) The 2001-2004 & 2006 hourly meteorological data set do not appear to be formatted to account for every hour in chronological sequence. Do the missing hours represent invalid data, or is the data set mislabeled?

c) 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.

d) It appears that 2005 data were used in the 2004–2007 data file, but not in the 2001-2004 & 2006 data file set. Please explain why these data were omitted.

e) There are periods in which some of the data appear to be anomalous, including 165 consecutive hours in 2001 reported as stability category F and several periods in 2004 where the data appear to be off by a factor of 10. Please explain these anomalies.

f) Stability category A is reported to occur at a relatively high frequency in the 2001-2004 & 2006 hourly data set and reported to occur at night in 2001 and 2006. Please explain these high occurrences.

Response

Revised meteorological data was submitted for the St. Lucie site with FPL letter L-2011-314, Response to NRC Accident Dose Branch Request for Additional Information Regarding Extended Power Uprate License Amendment Request, August 12, 2011 (Accession No. ML11234A283).

a & b) 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 St. Lucie Unit 2 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.

In the EPU LAR submittal, the data set was produced after FPL periodically acquired and saved the data from the meteorological tower data logging system. The meteorological tower data was then converted from the individual time period files to a common spreadsheet format.

Screening of the revised set of hourly data records ensured that there were no gaps in the hourly data files.

During the EPU LAR submittal activity's 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 on the data files. FPL decided to recalculate all the stability classes in this data validation step of the data handling process to ensure that they were all 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).

c) 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 over-written 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. Subsequent to the EPU LAR submittal, the calendar year 2004 was eliminated from the revised meteorological data set described later in this response.

Joint frequency distribution (JFD) data in the EPU LAR 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.

d) The JFD wind speed bins in the replacement set of meteorological data are consistent with the hourly data in the replacement set of meteorological data, and are compliant with the guidance in RIS-2006-4, Experience with Implementation of Alternative Source Terms.

In response to similar NRC RAI questions on the St.Lucie Unit 1 EPU LAR, FPL 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 EPU LAR data set with a new set of screened and validated data. The following description of the enhanced screening and validation provides 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 atmospheric dispersion factors (χ/Q) values.

e & f) 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 χ/Q determination. No data substitution was applied to assign 60 meter data to 10 meter values during this post processing activity.

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 preliminary1997-2003 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-2

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 ventilation system:

> "Due to changing environmental conditions during long term events, it may be necessary to repeat steps Attachment 5 Step 5 and Attachment 5 Step 6 to maintain the lowest possible dose."

Attachment 5 Step 5 provides the steps for determining the radiation levels at both control room outside air intakes. Attachment 5 Step 6 provides the steps for aligning the control room ventilation to the intake at the lowest radiation level. Attachment 5 Step 7 contains the following steps to monitor outside air intake (OAI) radiation levels:

A. INITIATE Unscheduled Surveillances and Evolutions Tracking Data Sheet.

B. MONITOR wind direction.

C. IF either of the following conditions are met:

- 4 hours have elapsed since OAI radiation levels were last evaluated
- Wind direction changed by greater than 90° since OAI radiation levels were evaluated

THEN **REPEAT** Attachment 5 Step 5 and Attachment 5 Step 6.

AADB-3

Please provide a list of ARCON96 inputs for the steam air jet ejector, waste gas decay tank, and louver 2L-11.

Response

a) For the steam jet air ejector (SJAE) release to louver 2L-11, no specific ARCON96 geometries or files were set up or used.

The louver 2L-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 2L-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 2L-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 2L-11 as a candidate unfiltered inleakage receptor point.

b) Unlike other events, the waste gas decay tank (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 heating, ventilation and air conditioning (HVAC) system "may" be in the emergency pressurization/recirculation mode at the beginning of the WGDT event.

For the WGDT release to louver 2L-11, the release point in the normal CR and auxiliary building HVAC configurations for this event is the plant stack. The WGDT area is served by the reactor auxiliary building (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 2L-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) atmospheric dispersion factors (χ/Qs) 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 χ/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 χ/Qs that would bound the event results for both units.

The worst case for the bounding 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 response to AADB-1, 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

AADB-4

Figure 2.9.2-1 of Attachment 5 to the St. Lucie, Unit 2, extended power uprate license amendment (LAR) request dated February 25, 2011, (ADAMS Accession Number ML110730299) 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 2L-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.**

Response

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.

b) Distance inputs into the ARCON96 calculations were directly estimated as horizontal straight line distances, based on site coordinates.

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	Reference
Stack/Plant Vent	North (N) Control Room (CR) intake	184	56.1	59.67	18.2	48.07	14.6	58	1, 2
Stack/Plant Vent	South (S) CR intake	184	56.1	57.58	17.6	126.7	38.6	1	1, 2
Refueling Water Tank (RWT)	N CR intake	48.22	14.6	59.67	18.2	245.3	74.7	65	2, 3, 4
RWT	S CR intake	48.22	14.6	57.58	17.6	275.6	84.0	42	2, 3, 4
Fuel Handling Building (FHB) Stack	N CR intake	90.5	27.6	59.67	18.2	154.4	47.0	41	2, 5, 6
FHB Stack	S CR intake	90.5	27.6	57.58	17.6	227.05	69.2	16	2, 5, 6
FHB Closest Point	N CR intake	43	13.1	59.67	18.2	121.3	36.9	48	2, 5, 7
FHB Closest Point	S CR intake	43	13.1	57.58	17.6	189.8	57.8	16	2, 5, 7
Louver L-7B	N CR intake	38.17	11.6	59.67	18.2	123.81	37.7	72	2, 8, 9, 10, 19
Louver L-7B	S CR intake	38.17	11.6	57.58	17.6	161.35	49.1	30	2, 8, 9, 10, 19
Louver L-7A	N CR intake	38.17	11.6	59.67	18.2	132.59	40.4	85	2, 8, 9, 10, 19
Louver L-7A	S CR intake	38.17	11.6	57.58	17.6	147.85	45.0	40	2, 8, 9, 10, 19

Release/Receptor Combination Table[1][2] (continued)

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	Reference
Personnel Airlock (Azimuth 240°; Elevation 34.42')	N CR intake	15.42	4.7	59.67	18.2	54.27	16.5	303	2, 11
Personnel Airlock (Azimuth 240°; Elevation 34.42')	S CR intake	15.42	4.7	57.58	17.6	155.07	47.2	328	2, 11
Annulus Door (Azimuth 228°; Elevation 26.50')	N CR intake	7.5	2.3	59.67	18.2	38.37	11.6	306	2, 11
Steam Jet Air Ejector	N CR intake	52.42	16.0	59.67	18.2	149.9	45.6	266	1, 2 12, 13
Steam Jet Air Ejector	S CR intake	52.42	16.0	57.58	17.6	208.44	63.5	296	1, 2, 12, 13
Condenser	N CR intake	5.25	1.6	59.67	18.2	153.23	46.7	244	2, 12, 13, 14, 15
Condenser	S CR intake	5.25	1.6	57.58	17.6	179.43	54.6	281	2, 12, 13, 14, 15
Closest Atmospheric Dump Valve (ADV)	N CR intake	47	14.3	59.67	18.2	100.66	30.6	298	2, 4, 16, 17
Closest ADV	S CR intake	47	14.3	57.58	17.6	195.55	59.6	320	2, 4, 16, 17

Release/Receptor Combination Table[1][2] (continued)

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	Reference
Closest Main Steam Safety Valve (MSSV)	N CR intake	49	14.9	59.67	18.2	107.42	32.7	301	2, 4, 16, 17
Closest MSSV	S CR intake	49	14.9	57.58	17.6	203.66	62.0	321	2, 4, 16, 17
Closest Main Steam Line Point	N CR intake	17	5.2	59.67	18.2	103.15	31.4	303	2, 7, 16, 18
Closest Main Steam Line Point	S CR intake	17	5.2	57.58	17.6	200.66	61.1	322	2, 7, 16, 18
Closest Feedwater Line Point	N CR intake	17	5.2	59.67	18.2	83.06	25.3	306	2, 11
Closest Feedwater Line Point	S CR intake	17	5.2	57.58	17.6	183.25	55.8	325	2, 11
Containment Maintenance Hatch	N CR intake	16	4.9	59.67	18.2	172.17	52.4	359	2, 11
Containment Maintenance Hatch	S CR intake	16	4.9	57.58	17.6	276.7	84.3	351	2, 11
Annulus Door (Azimuth 228°; Elevation 26.50')	S CR intake	7.5	2.3	57.58	17.6	141.71	43.1	331	2, 11

Release/Receptor Combination Table[1][2] (continued)

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	Reference
Stack/Plant Vent	Midpoint between intakes	184	56.1	58.625	17.9	72.02	21.9	10	2
RWT	Midpoint between intakes	48.22	14.6	58.625	17.9	244.78	74.6	53	2, 3, 4
FHB Closest Point	Midpoint between intakes	43	13.1	58.625	17.9	141.04	42.9	26	2, 5, 7
Louver L-7B	Midpoint between intakes	38.17	11.6	58.625	17.9	122.98	37.4	47	2, 8, 9, 10, 19
Louver L-7A	Midpoint between intakes	38.17	11.6	58.625	17.9	119	36.2	61	2, 8, 9, 10, 19
Annulus Door (Azimuth 228°; Elevation 26.50')	Midpoint between intakes	7.5	2.3	58.625	17.9	90.25	27.5	319	2, 11
Closest ADV	Midpoint between intakes	47	14.3	58.625	17.9	149.54	45.5	309	2, 4, 16, 17
Closest Feedwater Line Point	Midpoint between intakes	17	5.2	58.625	17.9	134.2	40.9	315	2, 11
Containment Maintenance Hatch	Midpoint between intakes	16	4.9	58.625	17.9	220.1	67.0	352	2, 11

Release/Receptor Combination Table[1][2] (continued)

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	Reference
Condenser	Midpoint between intakes	5.25	1.6	58.625	17.9	167.62	51.0	263	2, 12, 13, 14, 15
Stack/Plant Vent	Louver 2L-11	184	56.1	50.75	15.5	122.54	37.3	358	2
Closest Feedwater Line Point	Louver 2L-11	17	5.2	50.75	15.5	184.33	56.1	322	2, 11
RWT	Louver 2L-11	48.22	14.6	50.75	15.5	267.44	81.5	42	2, 3, 4
Louver 2L-7B	Louver 2L-11	38.17	11.6	50.75	15.5	154	46.9	28	2, 8, 9, 10, 19
Louver 2L-7A	Louver 2L-11	38.17	11.6	50.75	15.5	139.81	42.6	38	2, 8, 9, 10, 19
FHB Closest Point	Louver 2L-11	43	13.1	50.75	15.5	183.73	56.0	14	2, 5, 7, 8
Containment Maintenance Hatch	Louver 2L-11	16	4.9	50.75	15.5	273.79	83.4	350	2, 11
Closest ADV	Louver 2L-11	47	14.3	50.75	15.5	197.4	60.1	317	2, 4, 16, 17

NOTES:

(1) Release heights are calculated as 19 ft less than the reference elevations to account for the plant grade elevation. Plant drawings showing main steam safety valve (MSSV) and atmospheric dump valve (ADV) elevations could not be located; therefore, the Unit 1 values were used with slight adjustments based on height estimates from a walkdown. The refueling water tank (RWT) release height is scaled from Reference 4. The fuel handling building (FHB) closest point release 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 control room intakes being in the same wind direction window. Therefore, credit may be taken for intake dilution only for releases from the plant stack. The receptor point is taken as being on the outside of the control room (and H&V 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 control room intakes are required for the limiting cases to be used during the time period when the control room intakes are isolated. This midpoint receptor location is used to calculate the χ/Q value to be used for the unfiltered control room inleakage dose. The containment/ shield building penetrations at the 228° and 240° azimuths empty into the covered walkway that leads to the reactor auxiliary building (RAB); therefore, the closest containment/shield building penetration to the intakes that is directly exposed to the atmosphere is the closest feedwater line penetration.

(2) When both are open, both control room outside air intakes are assumed to have equal flow rates for makeup air. Both control room outside air intakes are open during normal operation. All shield building bypass leakage is assumed to leak into the RAB.

References:

1. St. Lucie Unit 2 Updated FSAR
2. Drawing 2998-G-076, "General Arrangement – Reactor Auxiliary Building Miscellaneous Plans & Sections"
3. Drawing 2998-G-077 Sheet 1 of 3, "General Arrangement – Component Cooling Water Area and Diesel Generator Building"
4. Drawing 2998-G-582, "Reactor Auxiliary Building Ext. Walls – Elevation 43.0 to Roof MAS & Reinf Sh. 1"
5. Drawing 2998-G-073, "General Arrangement – Fuel Handling Building – Plans"
6. Drawing 2998-G-074, "General Arrangement – Fuel Handling Building – Sections"
7. Drawing 2998-G-059, "Enlarged Plot Plan"
8. Drawing 2998-G-071, "General Arrangement – Reactor Auxiliary Building Plan Sheet 3"

9. Drawing 2998-G-568, “Reactor Auxiliary Building – Framing Plan – Slabs & Beams – Sh. 1”
10. Drawing 2998-G-880, “HVAC – Equipment Schedules & Details – Sh. 1”
11. Drawing 2998-G-503 S01, “Reactor Building – Cylinder Dev. Mas.”
12. Drawing 2998-G-061, “General Arrangement – Turbine Building – Mezzanine Floor – Plan”
13. Drawing 2998-G-062, “General Arrangement – Turbine Building – Operating Floor – Plan”
14. Drawing 2998-G-060, “General Arrangement – Turbine Building – Ground Floor – Plan”
15. Drawing 2998-G-064, “General Arrangement – Turbine Building Sections – Sheet 2”
16. Drawing 2998-G-125 Sheet MS-L-2, “Main Steam & Safety Valve Vents”
17. Drawing 2998-G-125 Sheet MS-L-14, “Main Steam & Safety Valve Vents”
18. Drawing 2998-G-147, “Main Steam & Feedwater Piping – Plan Sheet 1”
19. Drawing 2998-G-870, “HVAC – Reactor Auxiliary Building – Sh. 3”

AADB-5

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. There were no other penetrations through the concrete walls of the control room (CR) complex that were identified as significant contributors to the CR inleakage while the CR heating, ventilation and air conditioning (HVAC) system was in the identified mode of operation. As described in AADB-3, when the fans drawing air in through louver 2L-11 are in operation, the 2L-11 intake point is considered.

b) 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. Control room tracer gas testing did not identify any other significant inleakage locations.

c) Yes. As indicated by the asterisk in EPU LAR Attachment 5,Table 2.9.2-7, Cases A and B (stack/vent to North (N) and South (S) CR intakes, respectively) show the result of applying a dilution credit, as allowed per Section 3.3.2.3 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.

Prior to isolation, both intakes are in service. From the perspective of the plant/vent stack, the N & S intakes are in different wind sectors, allowing the maximum atmospheric dispersion factor (χ/Q) (between the S & N intakes) to be reduced by a factor of two. The N intake (for a stack release) is the highest value, so the ARCON96 result for this case was reduced by a factor of two.

Following isolation, FPL credits the manual operator selection of the favorable intake based on current meteorological and accident conditions. Thus, following initiation of emergency recirculation mode, the stack release to the favorable (S intake) ARCON96 value is reduced by a factor of 4.

AADB-6

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 2.

Response

See the response to AADB-1.d. The revised meteorological data set was binned in accordance with RIS 2006-4, Experience With Implementation of Alternative Source Terms, recommendations.

The following requests for additional information concern the radiological data provided in support of the St. Lucie, Unit 2, EPU LAR.

AADB-7

The current licensing basis (CLB) containment leak rate is expressed in weight percent per day according to Table 2.1-1 of NAI-1101-044, 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-1101-044, Rev 2.

Response

There is no proposed change to the current licensing basis (CLB) method of determining leak rate. The terms "volume percent per day" and "weight percent per day" are interchangeable in the RADTRAD dose analysis release models. In the re-submittal to implement the replacement χ/Qs, this language detail will be made to be consistent between the CLB and the EPU submittal.

AADB-8

The EPU licensing report discusses the use of a high burnup adjustment/increase of 0.922 percent applied to the release fractions for all non-LOCA events in which fuel damage causes the inventory of the fuel rod gaps to be released into the reactor coolant. The resulting high burnup fuel adjustment factor of 1.00922 is based on the bounding assumption that the equivalent of two fuel assemblies of the total 176 fuel assemblies will exceed the burnup limits specified in Footnote 11 of RG 1.183. Please provide additional information describing the actual number of rods that will be permitted to exceed the burnup/linear heat rate for St. Lucie Unit 2 and the means by which the actual number of rods expected to exceed the burnup limits in Footnote 11 of RG 1.183 will be controlled.

Response

The St. Lucie Unit 2 current licensing basis (CLB) alternative source term (AST) analysis is based on no fuel exceeding the burnup limitations of NRC Regulatory Guide (RG) 1.183, Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors, Footnote 11. As such, no adjustment factors for high burnup fuel were applied. St. Lucie Unit 2 is a low power density plant (16x16 fuel) with the fuel rods at high burnup remaining well below the linear heat generation rate (LHGR) limit of 6.3 kW/ft at pre-EPU conditions.

At EPU conditions, the high burnup fuel rods will continue to remain below the 6.3 kW/ft LHGR limit and as such, no fuel rods are expected to exceed the limitations of RG 1.183, Footnote 11. However, as a conservative measure, fuel rods equivalent of 2 fuel assemblies (i.e., 2 x 236 = 472 rods) are assumed to exceed the limitations of RG 1.183 Footnote 11, for dose consequences analysis. With 217 assemblies in the core, two assemblies correspond to [2 / 217] x 100 = 0.922% of the core. Doubling the gap release fractions for 0.922% of the core would yield a core wide adjustment factor of:

$$\text{Factor} = (2)(0.00922) + (1.0 - 0.00922) = 1.00922$$

This adjustment factor was applied to the gap inventory as used in the dose calculations, following the same method as approved for St. Lucie Unit 1 in Reference 1.

The number of rods exceeding the burnup limitations in Footnote 11 of RG 1.183 will be controlled through the core design process by verifying on a cycle-by-cycle basis that the number of rods exceeding this limit remains below 472.

Reference:

1: Letter to Mr. J. A. Stall (Florida Power & Light Company) from Ms. Brenda L. Mozafari (NRC), St. Lucie Plant, Unit 1 – Issuance of Amendment Regarding Alternative Source Term (TAC No. MD6173), November 26, 2008, Accession No. ML082682060.

AADB-9

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 LAR alternative source term (AST) steam release evaluation of each event's steam releases used a combination of event analysis defined statepoints, and evaluated a range of cooldown rates for the time periods when operators will cooldown the plant to 212°F.

For the steam generator tube rupture (SGTR) event, from the affected steam generator (SG) isolation time point, cooldown was continued to 212°F reactor coolant system (RCS) temperature. Various cooldown rates were considered following the 45 minute isolation time, and a post-isolation cooldown rate of 20°F per hour produced the limiting release and dose for this event.

The total masses of steam release for various time periods during the plant cooldown, which were also used for non-SGTR events, were converted to average steam release rates for the following time periods:

- Event start to reactor trip (mass release driven, no cooldown rate supplied);
- Reactor trip to 45 minutes (mass release driven, no cooldown rate supplied);
- 45 minutes to 2 hours (cooldown rate assumed: 100°F per hour hot zero power (HZP) to 410°F;
- 2 hours to 8 hours (410°F to residual heat removal (RHR) entry at 300°F, approximately 20°F per hour; and
- 8 hours until RCS = 212°F (based on 20°F per hour cooldown rate, end at 12.4 hrs).

For EPU conditions, the SGTR dose analysis conservatively continued the intact SG primary to secondary leakage until the 12.4 hour time of termination of all releases.

AADB-10

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-1101-044, Rev. 2. Please include information explaining the differences shown in the steam mass release rates from the unaffected SG after 8 hours.

Response

See response to AADB-9 for the EPU secondary side releases.

The following is the EPU LAR Attachment 5, Table 2.9.2-24 (SGTR) with (highlighted) NAI-1101-044, Rev. 2 table information added for comparison:

Table 2.9.2-24 - Markup
Steam Generator Tube Rupture (SGTR)
Break Flow and Steam Releases

Time (hr)*	Event Description	Ruptured Steam Generator Break Flow		Ruptured Steam Generator Steam Release		Unaffected Steam Generator Steam Release	
		EPU (lbm/min)	NAI 1101-044 lbm (lbm/min)	EPU (lbm/min)	NAI 1101-044 lbm (lbm/min)	EPU (lbm/min)	NAI 1101-044 lbm (lbm/min)
0	Event Initiation	3993.0	78,040 (2601.3)	122,133.8	661,842 (104,754)	121,521.1	656,568 (103,890)
0.0789	Reactor Trip	2277.3		3658.1		3397.4	
0.1053	Reactor Trip (CLB)	N/A		N/A		N/A	
0.5	Ruptured SG Isolated (CLB)	N/A	0.0	N/A	88,352 (3730.8)	N/A	86,821 (3,666)
0.75	Ruptured SG Isolated (EPU)	0.1	N/A	0.0	0.0	5028.0	601,096 (6,679)
1.25	Unaffected SG tubes Re-covered	0.0		0.0		5028.0	
2.0		0.0	N/A	0.0	N/A	2698.9	876,233 (2,434)
8.0		0.0	N/A	0.0	N/A	2626.7	(32.47)
9.0		0.0	N/A	0.0	N/A	2491.7	
10.0		0.0	N/A	0.0	N/A	2406.7	
10.32	Termination of Release (CLB)	0.0	N/A	0.0	N/A	N/A	0.0
11.0		0.0	N/A	0.0	N/A	2313.3	N/A
12.0		0.0	N/A	0.0	N/A	2223.3	N/A
12.40	Termination of SG Releases at 212F	0.0	N/A	0.0	N/A	0.0	N/A

* Flow rates are applied until the next time point.

Except for the time interval from 8 hours to 12.4 hours, the steam release rates for other time intervals are reasonable between the EPU analysis and the values shown in Table 2.4-2 from NAI-1101-044, Rev. 2.

Regarding the time period from 8 hours to 10.32 hours in the CLB analysis, the steam release value was derived using a cooldown rate of 38°F per hour (conservative compared to a cooldown rate of 100°F per hour). The event analysis showed a 51.053 lbm/sec release rate at the beginning of that interval, so that release rate was conservatively used for the entire interval with an additional conservative factor of 1.06 applied (to account for uncertainties associated with atmospheric dump valve (ADV) releases), so the conversion to lbm/min was:

(51.053 lbm/sec) x (60 sec/min) x 1.06 = 3247.0 lbm/min

From the calculation supporting the CLB licensing submittal, the following extracted table applies a decontamination factor of 100 to give the reported steam flow rate for the intact steam generator (SG) for input to RADTRAD-NAI:

Steam Flow From Intact SG

Time (hr)	Flow Rate (lbm/min)
0.0	1,038.9
0.105333	36.66
0.5	66.79
2.0	24.34
8.0	32.47
10.32	0.0

Thus, the "32.47 lbm/min" in Table 2.4-2 from NAI-1101-044, Rev. 2 contains a factor of 100 reduction for decontamination. This is the only rate supplied in the CLB table – the other values are total mass releases, and is thus, the only value that appears notably different due to the application of the factor of 100 for decontamination.

The EPU LAR Attachment 5, Table 2.9.2-24 (SGTR) did not include the decontamination factor of 100 in the reported values for steam release. The decontamination factor was used as required in the appropriate dose calculations.

AADB-11

Table 2.9.2-28 shows the secondary side minimum mass, used for primary to secondary leakage to maximize secondary activity concentration, as 243,941 lbm (Total). No value is shown for the maximum secondary side mass. In addition to a minimum secondary mass value the CLB included a maximum value of 260,000 lbm per SG to evaluate the initial secondary inventory release to maximize secondary side dose contributions. Please provide additional information describing the differences in the EPU evaluation as compared to the CLB regarding the use of minimum and maximum secondary side mass assumptions for all accidents involving secondary side releases.

Response

For both the current licensing basis (CLB) and the EPU alternative source term (AST) fuel failure event dose analyses, the minimum initial steam generator (SG) masses (105,000 lbm per SG for CLB; 121,970.5 lbm for EPU) were generally used in the non-noble gas RADTRAD-NAI dose models. This modeling technique conservatively maximizes the concentration of the radionuclides released from the failed fuel which leak from the primary to the secondary side, before mixing and release to the environment in cooldown events. For the secondary (only) release RADTRAD-NAI models for these same events in both the CLB and EPU, the models were modified to use the maximum initial SG inventory (260,000 lbm per SG for CLB; 208,850 lbm plus a 5% conservatism factor, for EPU) to maximize the total curies released in this model.

For the EPU AST secondary side release dose model, the locked rotor event used the maximum initial secondary side mass (based on both SGs at their maximum inventory of 208,580 lbm) at the maximum allowed initial dose equivalent iodine (DEI)-131 concentration to maximize the dose consequences of this event. In addition, a 5% adder to this mass was applied for conservatism. Thus, the 208,850 lbm nominal maximum inventory was increased by approximately 5% to 219,009 lbm for the faulted SG (non-noble gas cases), and to this value for both SGs in the secondary side release case. This maximum value and its use are discussed in EPU LAR Attachment 5, Table 2.9.2-20 main steam line break (MSLB) (and some of the other EPU LAR event tables). This same discussion was inadvertently left out of the EPU LAR Attachment 5, Table 2.9.2-28 for locked rotor, even though the same analysis technique was applied for both events.

The modeling use of minimum secondary side mass for non-noble gas (fuel failure nuclide laden primary reactor coolant system (RCS) leakage to secondary) dose models is unchanged from the process used in the CLB analyses. Likewise, the modeling use of the maximum secondary side mass inventory is essentially unchanged (an additional ≈5% conservatism above nominal was applied in the EPU AST submittal models) from the process used in the CLB analyses.

In the markups of the EPU LAR submittal that will be required to reflect the revised meteorological data inputs to these analyses (to be provided with the response to AADB-12), the discussion in Attachment 5, Table 2.9.2-28 and other similar secondary side release event tables (such as 2.9.2-23, 2.9.2-31, 2.9.2-37) will be updated to clearly identify the use of maximum and minimum secondary side masses.

AADB-12

The NRC staff is relying on the accuracy of the information presented in Table 2.9.2 for the review of the radiological inputs and assumptions for the EPU design basis accident analyses. The NRC staff notes that there are several instances in Table 2.9.2 where primary and secondary activity concentration is shown as mCi/gm instead of µCi/gm. The NRC staff review is proceeding based on the assumption that these instances represent typographical errors. Table 2.9.2-23 indicates two different times for the termination of SG tube leakage. The NRC staff review is proceeding based on the assumption that the time to terminate SG tube leakage for the EPU analysis is 12.4 hours. Please review and correct as necessary the information presented in Table 2.9.2 to ensure that it is accurate.

Response

Response to this RAI will be provided in a later submittal.

The 18 Drawings specifically referenced in the Attachment have been processed into ADAMS

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