Progress Energy

Serial: NPD-NRC-2009-167
July 29, 2009

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

**LEVY NUCLEAR POWER PLANT UNITS 1 AND 2**
**NRC DOCKET NOS. 52-029 AND 52-030**
**RESPONSE TO SUPPLEMENTAL REQUEST FOR ADDITIONAL INFORMATION REGARDING THE ENVIRONMENTAL REVIEW – HYDROLOGY 5.3.2.1-2**

Reference: Letter from Douglas Bruner (NRC) to James Scarola (Progress Energy), dated June 23, 2009, "Supplemental Request for Additional Information Regarding the Environmental Review of the Combined License Application for the Levy Nuclear Power Plant, Units 1 and 2"

Ladies and Gentlemen:

Progress Energy Florida, Inc. (PEF) hereby submits our response to the Nuclear Regulatory Commission's (NRC) supplemental request for additional information pertaining to Hydrology Request for Additional Information (RAI) 5.3.1-2 per the referenced letter. A response to the NRC request is addressed in the enclosure.

If you have any questions, or need additional information, please contact Bob Kitchen at (919) 546-6992 or me at (919) 546-6107.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on July 29, 2009.

Sincerely,

Garry D. Miller
General Manager
Nuclear Plant Development

Enclosure/Attachments

cc: Mr. Douglas Bruner, U.S. NRC Environmental Project Manager
Mr. Brian Anderson, U.S. NRC Project Manager
U.S. NRC Region II, Regional Administrator

**Progress Energy Florida, Inc.**
P.O. Box 14042
St. Petersburg, FL 33733

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NRO

**Levy Nuclear Power Plant Units 1 and 2**
**Response to NRC Supplemental Request for Additional Information Letter**
**Regarding the Environmental Review, dated June 23, 2009**

| NRC RAI # | Progress Energy RAI # | Progress Energy Response |
|---|---|---|
| 5.3.2.1-2 | L-0503 | Response enclosed – see following pages |

| Attachments | Associated NRC RAI # | Pages Included |
|---|---|---|
| Figure 5.3.2.1-2A | 5.3.2.1-2 | 1 |
| Figure 5.3.2.1-2B | 5.3.2.1-2 | 1 |
| Figure 5.3.2.1-2C | 5.3.2.1-2 | 1 |
| Figure 5.3.2.1-2D | 5.3.2.1-2 | 1 |

**NRC Letter No.:** ER-NRC

**NRC Letter Date:** June 23, 2009

**NRC Review of Environmental Report**

**NRC RAI #:** 5.3.2.1-2

**Text of NRC RAI:**

Provide details regarding addition of LNP discharge to existing CREC discharge canal and to the thermal plume in the Gulf of Mexico related to the power uprate planned for CREC Unit 3. The staff has recently become aware that CREC Unit 3 [CR3], a nuclear power plant, will request a power uprate from the NRC. Due to this uprate, the discharges and temperatures in the CREC discharge canal will likely change and need to be considered as a cumulative assessment with the combination of the proposed LNP units as the new units will discharge the CWS and service water system blowdown, and effluents from demineralized use and sanitary system to the CREC discharge canal.

Provide information regarding the following:

1. The time frame of the uprate when the discharges to the canal from CREC Unit 3 would change and its relation with the timing of the commencement of LNP operations.
2. A description of the new operational discharges and associated temperatures from CREC Units 1-5,
3. A description of the operation of the existing and any new helper cooling towers and their effect on discharges from CREC Units 1-3,
4. A schematic representation at the CREC discharge canal showing the locations of various discharges from the CREC units and the LNP units and the locations of intakes and discharges for the helper cooling towers,
5. The discharges and temperatures of the effluents in (4) above,
6. A description of how changes to the canal associated with CREC Unit 3 uprate are included in the effluent plume analysis at the discharge point in the Gulf of Mexico,
7. A table showing the effluent discharges, effluent temperatures, effluent salinities, ambient temperature, and ambient salinity at the discharge point in the Gulf or Mexico for summer, and winter conditions (a) before the addition of the LNP discharge and (b) after the addition of the LNP discharge, and
8. Figures showing the extent of the effluent plume in the Gulf of Mexico along with the dilution contours (a) before the addition of the LNP discharge and (b) after the addition of the LNP discharge.

**PGN RAI ID #:** L-0503

**PGN Response to NRC RAI:**

This response provides additional details about the proposed CREC Unit 3 (CR3) Uprate project. This project is under development and has not been finalized. Some aspects about the CR3 project are subject to Florida Department of Environmental Protection (FDEP) review and approval for the National Pollutant Discharge Elimination System (NPDES) permit. However, the

project components have been identified sufficiently for Progress Energy Florida Inc. (PEF) to provide information about the general components and expected performance of the CREC after the project is implemented, pending further PEF design review and NPDES permitting.

NRC's detailed comments and PEF's responses are provided below.

1. *The time frame of the uprate when the discharges to the canal from CREC Unit 3 would change and its relation with the timing of the commencement of LNP operations.*

The CR3 Uprate Project is currently scheduled to be completed in December 2011. Startup at the new "uprated" power unit operating conditions (that is, CR3 with the uprate features) will occur shortly following that date. Therefore, the CR3 Uprate Project is expected to be operational prior to the LNP discharge (approximately 2016 or later).

2. *A description of the new operational discharges and associated temperatures from CREC Units 1-5,*

The CR3 Uprate will cause increased heat rejection to the CREC discharge canal from the CR3 CWS discharge. No change to the existing CR3 CWS flow of 680,000 gallons per minute (680 kgpm) will occur as a result of the Uprate Project; however, there will be an increase in the thermal load (increased temperature) from the CR3 uprate.

As part of the CR3 Uprate Project, a new helper cooling tower (CT) will be installed along the south bank of the CREC discharge canal downstream of Units 1, 2, 3, 4 and 5 CWS discharge locations. The new helper cooling tower will withdraw, cool, and return CREC discharge canal water to mitigate the increased thermal load of the Uprate Project prior to it leaving the site. In addition, the installation of the new "south helper cooling tower" will allow for the removal of rental "modular helper cooling towers" that are currently installed adjacent to the existing "north helper cooling towers" that are in place to support existing operations. Other than the increased thermal output of the CR3 CWS and the flows associated with the installation of the new south helper CT and the removal of the "modular" helper CTs, CREC operational discharges will be minimally affected by the CR3 Uprate project. The projected operational discharges and temperatures at CREC Units 1 through 5 for critical summer conditions are shown in Table 5.3.2.1-2-1.

**TABLE 5.3.2.1-2-1**
Projected Summer Operational Discharges and Associated Temperatures from Units 1 through 5 at CREC – Post CR3 Uprate

| CREC Unit/CT | Discharge Flow (gpm) | Discharge Flow (mgd) | Intake Temperature (°F)* | Unit's Discharge Temperature* (°F) |
|---|---|---|---|---|
| 1 | 310,001 | 446 | 91.0 | 101.7 |
| 2 | 328,001 | 472 | 91.0 | 105.1 |
| 3 (Uprated) | 680,001 | 979 | 91.0 | 110.9 |
| 4 and 5 Combined** | 7,000 | 10.1 | 107.3 | 94.7 |
| Harmon CT (existing) | 673,944 | 971 | 107.2 | 92.0 |
| EvapTech CT (new) | 314,018 | 452 | 107.2 | 91.0 |

Notes:

* High summer design values (August)
** Net internal discharge to CREC discharge canal from both Units 4 and 5 CTs
gpm = gallons per minute
mgd = million gallons per day
CT = cooling tower
°F = degree Fahrenheit

3. *A description of the operation of the existing and any new helper cooling towers and their effect on discharges from CREC Units 1-3,*

Currently there are two types of existing helper cooling towers in use at the CREC; the permanently installed (Harmon) helper CTs and the rental modular (Aggreko) helper CTs. All of these helper CTs are located on the north bank of the CREC discharge canal and operate, as needed (seasonally), to withdraw, cool and return CREC discharge canal water. These helper CTs assist in maintaining the permitted discharge temperature to the Gulf of Mexico from CREC Units 1, 2 and 3. The modular towers are rental units that will be removed when the new south helper cooling tower is installed.

The new south helper cooling tower (CT) will be installed on the south side of the CREC discharge canal in conjunction with the CR3 Uprate Project. The new south CT is designed to mediate the increase in the heat load caused by the CR3 Uprate project, as needed (seasonally), and allow for the removal of the rental modular CTs. This will allow the facility to be operated similarly, before and after the Uprate project has been implemented.

The existing permanent helper CT along the north side of the discharge canal and the new helper CT on the south side will assist in maintaining compliance with the NPDES permitted limit at the point of discharge into the Gulf of Mexico.

4. *A schematic representation at the CREC discharge canal showing the locations of various discharges from the CREC units and the LNP units and the locations of intakes and discharges for the helper cooling towers,*

A schematic of the layout of the CREC after the CR3 Uprate Project is implemented is shown in Attachment 5.3.2.1-2A. The relative locations, flows, and temperatures from each unit are included in this diagram. A schematic showing how LNP would contribute to CREC after its implementation is shown in Attachment 5.3.2.1-2B. As shown in this figure, the predicted

maximum temperature at the CREC discharge canal after the LNP and CR3 Uprate projects is 95.6°F, which is below the permitted limit of 96.5°F (3-hour rolling average).

5. *The discharges and temperatures of the effluents in (4) above,*

The projected operational discharges and temperatures at CREC Units 1 through 5 after both the CR3 Uprate and LNP projects for critical summer conditions are shown in Table 5.3.2.1-2-2.

**TABLE 5.3.2.1-2-2**
Projected Summer Operational Discharges and Associated Temperatures from Units 1 through 5 at CREC – Post CR3 Uprate and LNP Discharge

| CREC Unit/CT | Discharge Flow (gpm) | Discharge Flow (mgd) | Intake Temperature (°F)* | Unit's Discharge Temperature (°F) |
|---|---|---|---|---|
| 1 | 310,001 | 446 | 91.0 | 101.7 |
| 2 | 328,001 | 472 | 91.0 | 105.1 |
| 3 (Uprated) | 680,001 | 979 | 91.0 | 110.9 |
| 4 and 5 Combined** | 7,000 | 10.1 | 107.3 | 94.7 |
| LNP | 61000 | 87.8 | 91.0 | 92.0* |
| Harmon CT (existing) | 674,490 | 971 | 106.5 | 92.0 |
| EvapTech CT (new) | 314,046 | 452 | 106.5 | 90.5 |

Note:

* High summer design values (August)

6. *A description of how changes to the canal associated with CREC Unit 3 uprate are included in the effluent plume analysis at the discharge point in the Gulf of Mexico,*

Flows and temperatures at the final point of discharge to the Gulf of Mexico will not change as a result of the CR3 Uprate project due to the addition of the new helper CT (see response to item 3 above); therefore, the Uprate project has no effect on the effluent plume analysis.

7. *A table showing the effluent discharges, effluent temperatures, effluent salinities, ambient temperature, and ambient salinity at the discharge point in the Gulf or Mexico for summer, and winter conditions (a) before the addition of the LNP discharge and (b) after the addition of the LNP discharge, and*

This information is provided in Table 5.3.2.1-2-3. The salinities were estimated using the flows and temperatures found in the schematic and then estimating the flow-weighted average in the discharge canal. The temperatures and flow are from item 4 above.

**TABLE 5.3.2.1-2-3**
Summer and Winter Discharges at the Point of Discharge of CREC With and Without LNP (CR3 Uprate Operational)

| | Gulf of Mexico Ambient Conditions at Point of Discharge | | CREC Discharge Canal, No LNP, w/ CR3 Uprate | | | CREC Discharge Canal, w/ LNP, w/ CR3 Uprate | | |
|---|---|---|---|---|---|---|---|---|
| Season | Temperature (°F) | Salinity (psu) | Flow (mgd) | Temperature (°F) | Salinity (psu) | Flow (mgd) | Temperature (°F) | Salinity (psu) |
| Summer | 91.0 | 35.0 | 1,859 | 95.4 | 35.8 | 1,948 | 95.6 | 36.6 |
| Winter | 60.0 | 35.0 | 1,598 | 79.0 | 35.4 | 1,686 | 78.1 | 36.3 |

8. *Figures showing the extent of the effluent plume in the Gulf of Mexico along with the dilution contours (a) before the addition of the LNP discharge and (b) after the addition of the LNP discharge.*

The NRC requested figures showing the extent of the temperature plume in the Gulf of Mexico. The temperature plume associated with the CREC discharge canal was last modeled in detail in 1985 in support of 316 studies (ER Reference 2.4-083). During this study, a two-dimensional model was developed for the Gulf of Mexico, off-shore of the CREC. This modeling accounts for the bathymetry and macro-scale mixing of the ambient currents and wind. There have been no substantial changes to the off-shore conditions since this work was completed. The main difference between the 1985 work and the current situation is the discharge temperatures.

The 1985 simulations were conducted with a discharge flow of 1,898 mgd (same as now) and at a temperature differential of 16.7°F. These studies were conducted prior to the addition of helper CTs. The average August Gulf water temperature is approximately 87°F, so at the permitted discharge limit of 96.5°F the average temperature differential would approach 9.5°F. The simulations in the 1985 316 Studies provided results for a variety of tidal conditions, and the plume with the widest extent occurred during slack tide conditions (labeled *low water slack* on figures). The extent of the winter plume was slightly larger than the extent for summer. This winter thermal plume is presented in Attachment 5.3.2.1-2C. The 1985 winter simulation results are still representative of the expected thermal plume footprint within reasonable accuracy because the same flows, bathymetry and temperature differential will occur.

The permitted maximum CREC discharge temperature is 96.5°F (3-hour rolling average) and the high design Gulf of Mexico intake water temperature in August is 91°F, for a differential temperature of 5.5°F. For summer conditions under the design conditions, the isotherms from the 1985 316 Studies were modified for the lower discharge temperature differential by fitting an exponential decay function and then lowering its starting value from 16.7°F to 5.5°F. This modification, as shown in Attachment 5.3.2.1-2D, results in a smaller temperature gradient for the thermal plume than what was shown in 1985 (ER Reference 2.4-083). The areal extent of the summer plume is somewhat smaller than the winter plume, so the winter plume would represent the largest footprint of the thermal plume.

Since the impact of the LNP's small increase in flow and salinity is predicted to be negligible in the near-field, any change in the footprint of the plume is also expected to be negligible and within the accuracy of the plots developed from the 1985 316 Studies. Near-field simulations predicted that the plume would be only about 13-meters different (narrower) 50 meters offshore. The far-field mixing (from Gulf currents, wind, etc.) would not be changed substantially by this small difference and it would be hard to visually discern this difference at the scale necessary to plot these results. Therefore, separate plots were not produced for post-project scenarios because the same ones shown in Attachments 5.3.2.1-2C and D would apply.

Reference

ER Reference 2.4-083 Stone and Webster, "Final Report – Crystal River 316 Studies," January 1985, prepared for Florida Power Corporation.

**Associated LNP COL Application Revisions:**

No COLA revisions have been identified associated with this response.

**Attachments/Enclosures:**

Attachment 5.3.2.1-2A: CREC EPU Summer Operation (Pre-Levy)

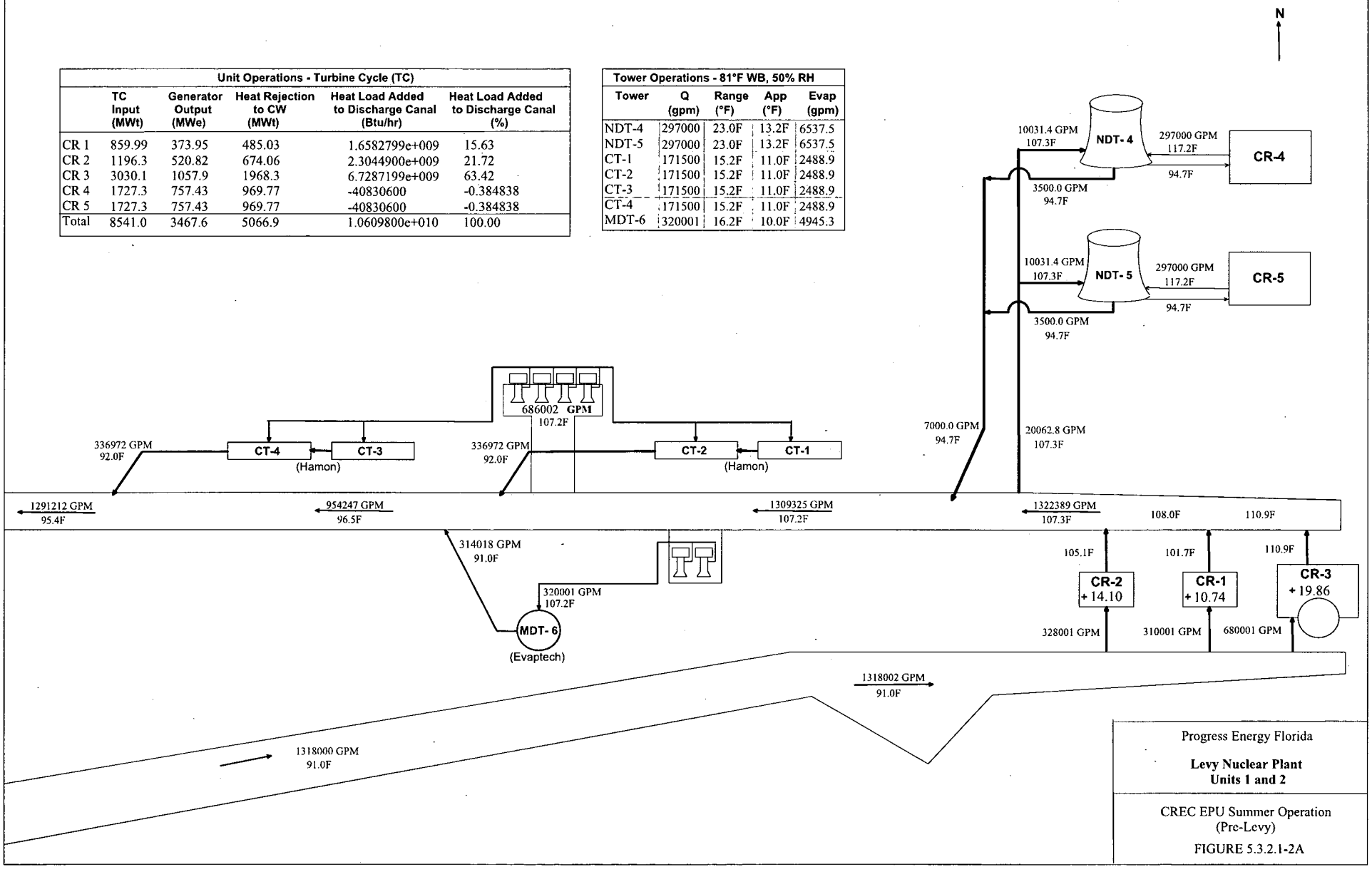
Attachment 5.3.2.1-2B: CREC EPU Summer Operation with Levy Blowdown

Attachment 5.3.2.1-2C: Estimated Thermal Plume Simulation ΔT-Winter-Low Water Slack

Attachment 5.3.2.1-2D: Estimated Thermal Plume Simulation ΔT-Summer-Low Water Slack

| Unit Operations - Turbine Cycle (TC) | | | | | |
|---|---|---|---|---|---|
| | TC Input (MWt) | Generator Output (MWe) | Heat Rejection to CW (MWt) | Heat Load Added to Discharge Canal (Btu/hr) | Heat Load Added to Discharge Canal (%) |
| CR 1 | 859.99 | 373.95 | 485.03 | 1.6582799e+009 | 15.63 |
| CR 2 | 1196.3 | 520.82 | 674.06 | 2.3044900e+009 | 21.72 |
| CR 3 | 3030.1 | 1057.9 | 1968.3 | 6.7287199e+009 | 63.42 |
| CR 4 | 1727.3 | 757.43 | 969.77 | -40830600 | -0.384838 |
| CR 5 | 1727.3 | 757.43 | 969.77 | -40830600 | -0.384838 |
| Total | 8541.0 | 3467.6 | 5066.9 | 1.0609800e+010 | 100.00 |

| Tower Operations - 81°F WB, 50% RH | | | | |
|---|---|---|---|---|
| Tower | Q (gpm) | Range (°F) | App (°F) | Evap (gpm) |
| NDT-4 | 297000 | 23.0F | 13.2F | 6537.5 |
| NDT-5 | 297000 | 23.0F | 13.2F | 6537.5 |
| CT-1 | 171500 | 15.2F | 11.0F | 2488.9 |
| CT-2 | 171500 | 15.2F | 11.0F | 2488.9 |
| CT-3 | 171500 | 15.2F | 11.0F | 2488.9 |
| CT-4 | 171500 | 15.2F | 11.0F | 2488.9 |
| MDT-6 | 320001 | 16.2F | 10.0F | 4945.3 |




Progress Energy Florida

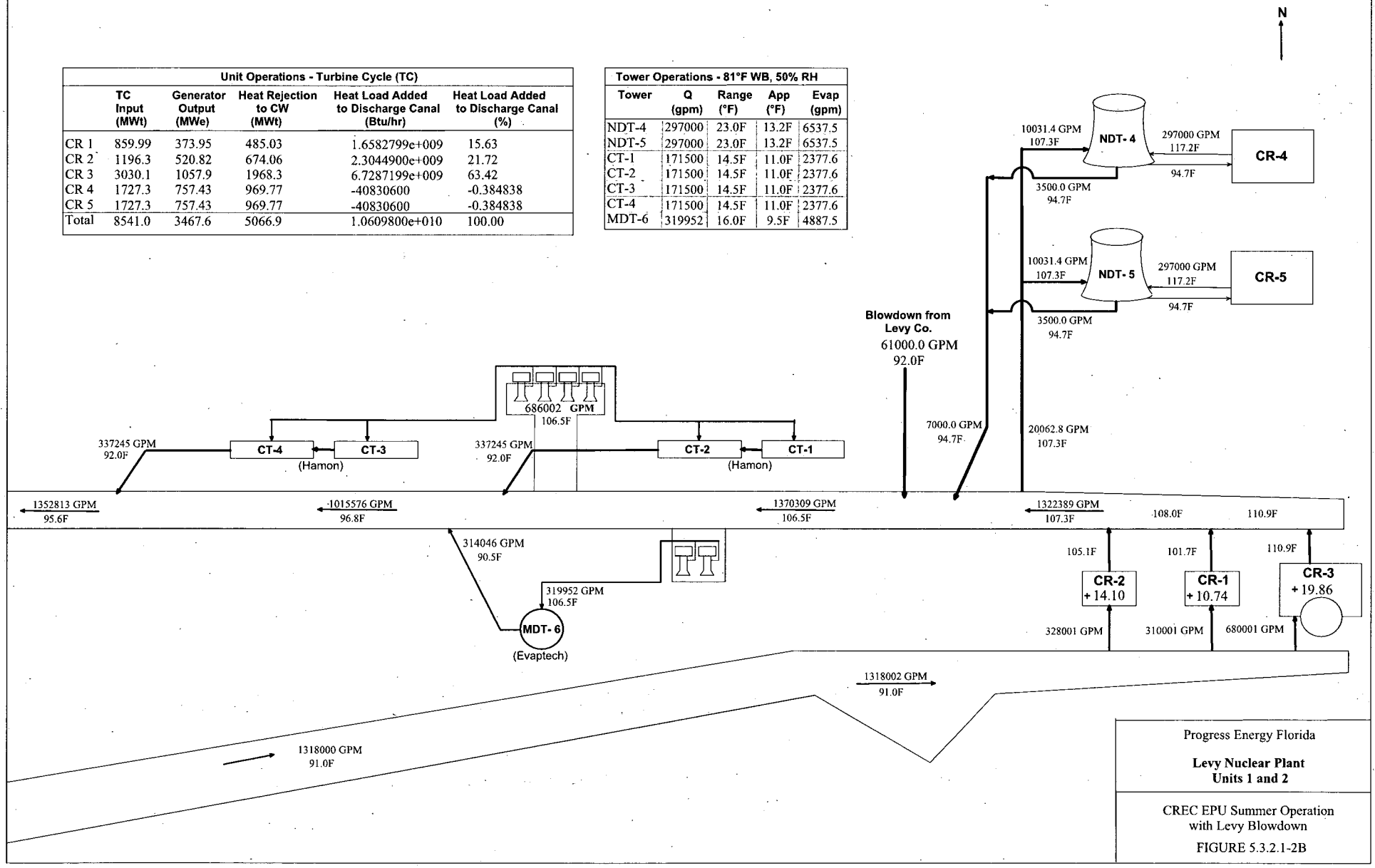
**Levy Nuclear Plant**
**Units 1 and 2**

CREC EPU Summer Operation
(Pre-Levy)

FIGURE 5.3.2.1-2A

| Unit Operations - Turbine Cycle (TC) | | | | | |
|---|---|---|---|---|---|
| | TC Input (MWt) | Generator Output (MWe) | Heat Rejection to CW (MWt) | Heat Load Added to Discharge Canal (Btu/hr) | Heat Load Added to Discharge Canal (%) |
| CR 1 | 859.99 | 373.95 | 485.03 | 1.6582799e+009 | 15.63 |
| CR 2 | 1196.3 | 520.82 | 674.06 | 2.3044900e+009 | 21.72 |
| CR 3 | 3030.1 | 1057.9 | 1968.3 | 6.7287199e+009 | 63.42 |
| CR 4 | 1727.3 | 757.43 | 969.77 | -40830600 | -0.384838 |
| CR 5 | 1727.3 | 757.43 | 969.77 | -40830600 | -0.384838 |
| Total | 8541.0 | 3467.6 | 5066.9 | 1.0609800e+010 | 100.00 |

| Tower Operations - 81°F WB, 50% RH | | | | |
|---|---|---|---|---|
| Tower | Q (gpm) | Range (°F) | App (°F) | Evap (gpm) |
| NDT-4 | 297000 | 23.0F | 13.2F | 6537.5 |
| NDT-5 | 297000 | 23.0F | 13.2F | 6537.5 |
| CT-1 | 171500 | 14.5F | 11.0F | 2377.6 |
| CT-2 | 171500 | 14.5F | 11.0F | 2377.6 |
| CT-3 | 171500 | 14.5F | 11.0F | 2377.6 |
| CT-4 | 171500 | 14.5F | 11.0F | 2377.6 |
| MDT-6 | 319952 | 16.0F | 9.5F | 4887.5 |

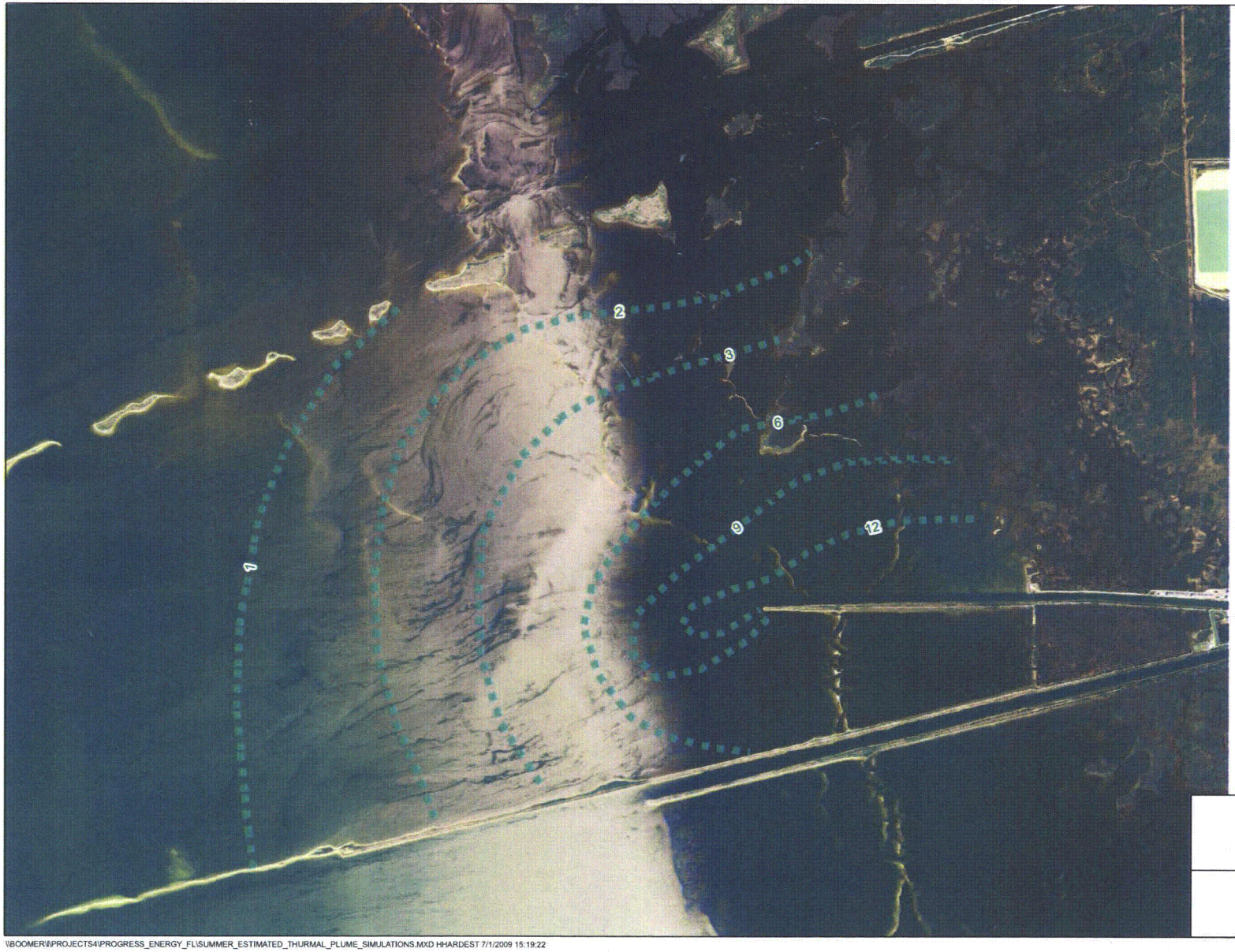



Progress Energy Florida

**Levy Nuclear Plant**
**Units 1 and 2**

CREC EPU Summer Operation
with Levy Blowdown

FIGURE 5.3.2.1-2B

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Thermal Plume Simulation

Sources

Adapted from Stone and Webster. 1985. Crystal River 316 studies

0 0.5 1
Kilometers

0 0.5 1
Miles

Progress Energy Florida

**Levy Nuclear Plant**
**Units 1 and 2**

Estimated Thermal Plume Simulation
ΔT-Winter-Low Water Slack
FIGURE 5.3.2.1-2C

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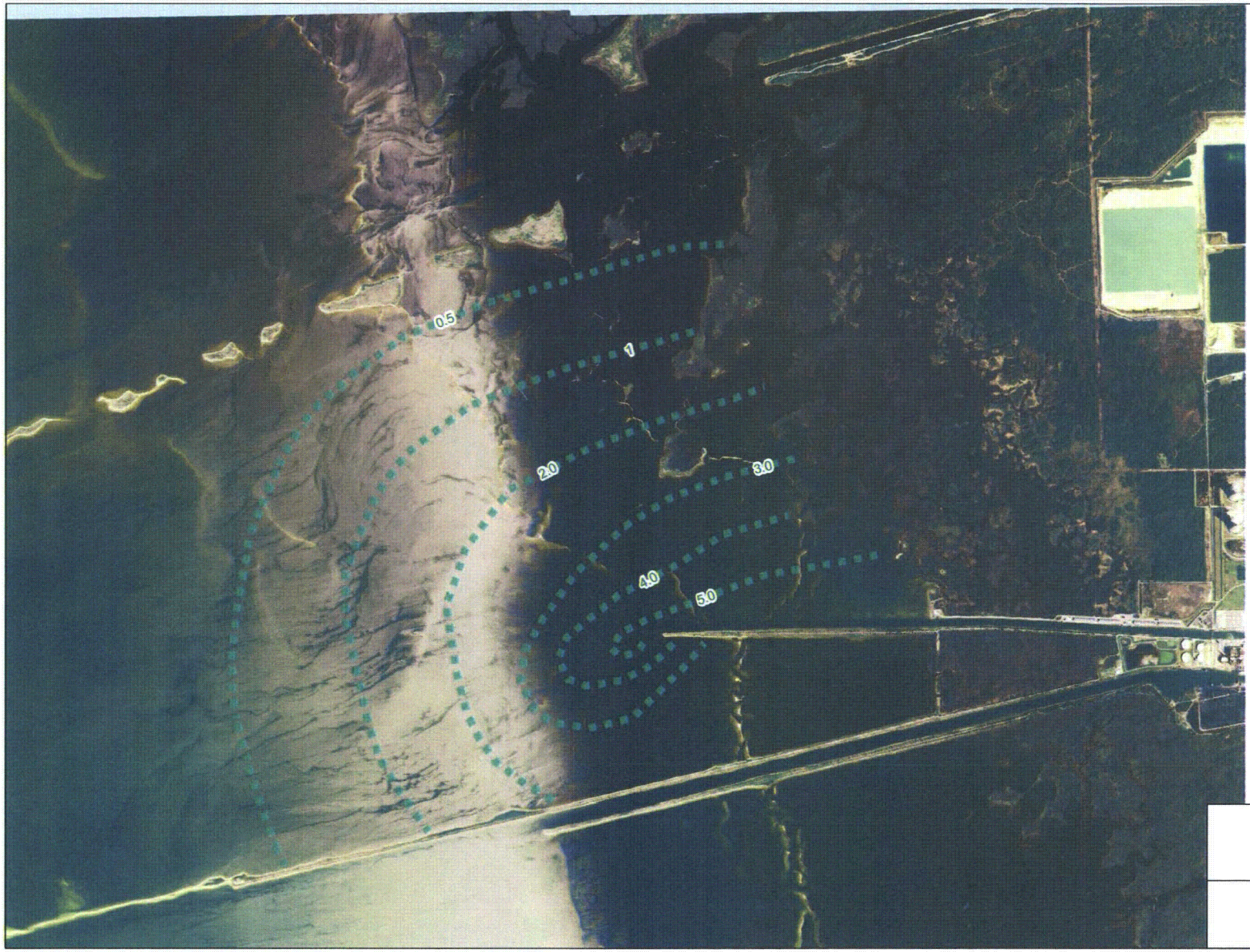


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Thermal Plume Simulation

Sources

Adapted from Stone and Webster. 1985. Crystal River 316 studies

0 0.5 1
Kilometers

0 0.5 1
Miles

Progress Energy Florida

**Levy Nuclear Plant**
**Units 1 and 2**

Estimated Thermal Plume Simulation
ΔT-Summer-Low Water Slack
FIGURE 5.3.2.1-2D

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