FLORIDA PUBLIC SERVICE COMMISSION
AUDIT DOCUMENT/RECORD REQUEST
NOTICE OF INTENT

undktd

TO: Maritza Iacono

UTILITY: Progress Energy Florida

FROM: Carl Vinson

Carl Vinson
AUDIT MANAGER

REQUEST NUMBER: DR-4

DATE OF REQUEST: 05/08/08 Due: 05/19/08

AUDIT PURPOSE: Nuclear Controls Review

REQUEST THE FOLLOWING ITEM(S) BE PROVIDED BY: Maritza Iacono

REFERENCE RULE 25-22.006, F.A.C., THIS REQUEST IS MADE: ___ INCIDENT TO AN INQUIRY

___ OUTSIDE OF AN INQUIRY

ITEM DESCRIPTION:

1. Please describe how Duncan Companies was selected to represent Progress in site acquisition.

2. Please indicate the amount paid to Duncan for its services, and provide a description of the services provided.

3. Please provide copies of the following procedures: NUA-NGGC-1501, NUA-NGGC-1510, NUA-NGGC-1511, NUA-NGGC-1530, NUA-NGGC-1534, NGGM-PM-0007, NGGC-205 AND NGGC-206.

4. Please provide the cover letter to the 2008 Internal Audit of the CR3 Urpate (12/28/07).

5. Please provide copies of Progress Internal Audits performed on other uprates or Progress nuclear units over the period 2005 to date.

6. Please provide MCP-NGGC-001 (supplied 5/1/08 by Terry Hobbs).

7. Please provide NCR's 259604, 259604 and 259608 (supplied 5/1/08 by Steve Huntington).

8. Please provide "Open Action Plans due in 45 days or Past due" dated Feb. 19, 2008. (4 pages containing internal audit issues, etc.) (supplied 5/1/08 by Steve Huntington).

9. Please provide a current copy of Steve Huntington's organization chart.

10. Please provide an organization chart of the Progress Audit Services department and an organization chart of PES group. (Phyllis/Dixon)

11. Please provide a copy of the INPO Standards (Performance Objectives & Criteria).

12. Please provide a copy of the Sargent & Lundy cooling tower study.

13. Please provide a list of assessment planned for 2008 by PES. (Phyllis/Dixon)

14. Please provide copies of 258644 (COLA) and 258658 (Contract Admin).

15. Please provide copies of 2007 and 2008 QA evaluations of CR3 uprate activities on processes (Dixon).

16. Please provide a scope description for the planned 3rd quarter 2008 CR3 audit (Phillips).

17. Please provide the INPO uprate lessons learned document that lists and describes problems encountered and solutions employed at nuclear units across the U.S. during uprate activities.

COM ___
ECR ___
GCL ___
OPC ___
RCP I
SSC ___
SGA ___
ADM ___
CLK ___

TO: AUDIT MANAGER Carl Vinson DATE: 5/13/2008

THE REQUESTED RECORD OR DOCUMENTATION:

(1) ☒ HAS BEEN PROVIDED TODAY

(2) ☐ CANNOT BE PROVIDED BY THE REQUESTED DATE BUT WILL BE MADE AVAILABLE BY ________

(3) ☒ AND IN MY OPINION, ITEMS(S) 12 IS (ARE) PROPRIETARY AND CONFIDENTIAL BUSINESS INFORMATION AS DEFINED IN 364.183, 366.093, OR 367.156 F.S. TO MAINTAIN CONTINUED CONFIDENTIAL HANDLING OF THIS MATERIAL, THE UTILITY OR OTHER PERSON MUST, WITHIN 21 DAYS AFTER THE AUDIT EXIT CONFERENCE, FILE A REQUEST FOR CONFIDENTIAL CLASSIFICATION WITH THE DIVISION OF COMMISSION CLERK AND ADMINISTRATIVE SERVICES. REFER TO RULE 25-22.006, F.A.C.

(4) ☐ THE ITEM WILL NOT BE PROVIDED. (SEE ATTACHED MEMORANDUM)

SIGNATURE AND TITLE OF RESPONDENT Maritza N. Iacono
Supervisor - Regulatory Planning

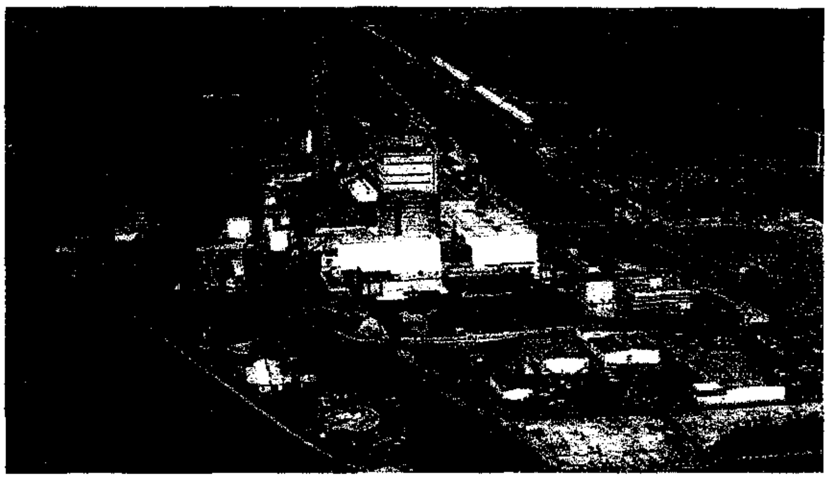
CONFIDENTIAL

DRAFT

Progress Energy

ENGINEERING SERVICES
CRYSTAL RIVER DISCHARGE CANAL COOLING STUDY
MASTER PROJ. NO. 200578849 / REQUEST NO. DH07-003

PHASE 1-SELECTION OF PREFERRED ALTERNATIVES



FINAL COMMENT ISSUE

S&L EVALUATION NO. 2008-00845, REV. 0D

S&L PROJECT NUMBER 11550-028

APRIL 23 , 2008

SUBMITTED BY

Sargent & Lundy LLC

EXECUTIVE SUMMARY

Crystal River 3 will be increasing rated thermal and electrical power after the 2011 refueling outage. The additional heat rejected to the Crystal River Energy Complex (CREC) discharge canal must be mitigated in order to remain in compliance with the National Pollutant and Discharge Elimination System (NPDES) Point of Discharge (POD) permit. This report (herein after called Phase 1 Report) documents the evaluations and analyses of potential thermal and flow mitigation alternatives.

The alternative selected in this Phase 1 Report will be designed and implemented to support the Crystal River Extended Power Uprate. The proposed solution will mitigate for 100% of the additional EPU heat rejection, provide 100% equivalent heat removal capacity to compensate for replacement of the Modular Cooling Towers, provide mitigation for EPU related increase in Circulating Water (CW) flow, and provide a small margin of additional heat rejection to compensate for transient conditions. The proposed solution will eliminate all potential EPU related de-rates and 99% of de-rates due to existing conditions. The other 1% of potential de-rates are of very short duration and can not be adequately forecast in enough detail to make it cost effective to install additional capacity.

In this Phase 1 study, the following activities were completed:

- Alternatives – A list of alternative technologies which could be considered in addressing heat removal from the discharge canal was prepared.
- Previous Work –Recommendations from previous CREC cooling tower studies (Bechtel, Cooper) were reviewed and incorporated as appropriate.
- Evaluate Alternatives – The viability of the various alternatives was evaluated.
- 316(b) Mitigation for EPU – The use of recirculation to mitigate the 316(b) impact of increased discharge canal flow was evaluated.
- Aggreko Cost Benefit – A basis for making a decision on the Aggreko lease termination was prepared.
- Hamon Tower Expansion – The potential for Hamon tower optimization, upgrades, and expansion was developed and presented.

From the list of alternatives, combinations were formed into cases which were evaluated from a mass and energy balance and cost perspective. Cases which met the thermal discharge limit with margin were considered to form solutions. Multiple solution cases were then compared in a cost benefit analysis. Costs included (a) capital costs to design, procure, and install the equipment, (b) operating costs to maintain the equipment, (c) production penalties or credits based on condenser backpressure calculations and gross generation, and (d) auxiliary power consumption. To account for diurnal and seasonal variations, production costs and benefits were based on hourly analysis of net production with input for weather, ocean temperature, and electricity pricing data.

Redacted

Since the majority of Phase 2 work is independent of the decision regarding increased CW flow through CR3, detailed design work can begin. However, it is recommended that CREC complete design evaluations of the condensers to determine final flow requirements for CR3 circulating water.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

(Total Attachment Pages – 150)

ACRONYMS

Acronym	Description
316(a)	Section 316(a) of the Clean Water Act
316(b)	Section 316(b) of the Clean Water Act
AFB	Aquatic Fish Barriers
BTA	Best Technology Available
BTU	British Thermal Unit
cfm	Cubic Feet per Minute
CR1	Crystal River Unit #1
CR2	Crystal River Unit #2
CR3	Crystal River Unit #3
CR4	Crystal River Unit #4
CR5	Crystal River Unit #5
CREC	Crystal River Energy Complex
CRN	Crystal River North Plant (Units 4&5)
CRS	Crystal River South Plant (Units 1&2)
CTI	Cooling Tower Institute
CW	Circulating Water
CWA	Clean Water Act
EPA	Environmental Protection Agency
EPU	Extended Power Uprate
FBN	Fish Barrier Nets
FDEP	Florida Department of Environmental Protection
fps	Feet per second
GEA	GEA Power Cooling, Inc.
gpm	Gallons per minute
HCT	Helper Cooling Towers (HCT-1, HCT-2, HCT-3, HCT-4)
HDPE	High Density Polyethylene
hp	Horsepower
I&E	Impingement and Entrainment (Mortality)
kgpm	Thousands of gallons per minute
kW	Kilo-watt
MCC	Motor Control Center
MCT	Modular Cooling Towers
MDT	Mechanical Draft Tower
MWe	Megawatts-Electric
MWt	Megawatts-Thermal
NDT	Natural Draft (Cooling) Tower
NDT-4	Natural Draft Tower Serving Unit 4

Acronym	Description
NPDES	National Pollutant Discharge Elimination System
NPV	Net Present Value
OD	Outside Diameter
PEF	Progress Energy Florida
POD	Point of Discharge
ppm	Parts pr Million
S&L	Sargent & Lundy[LLC]
S/R	Safety Related
SPX	SPX Cooling Technologies
SSI	Screening Systems International
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
W	Watts

1.0 OVERVIEW AND PURPOSE

Crystal River 3 will be increasing rated thermal and electrical power after the 2011 refueling outage. The additional heat rejected to the Crystal River Energy Complex (CREC) discharge canal must be mitigated in order to remain in compliance with the National Pollutant and Discharge Elimination System (NPDES) Point of Discharge (POD) permit. This report (herein after called Phase 1 Report) documents the evaluations and analyses of potential thermal and flow mitigation alternatives. The alternative selected in the Phase 1 Report will be designed and implemented to support the Crystal River Extended Power Uprate (additional discussion below). Attachment A identifies the content required to be included in this Phase 1 Report. The requirements for the Phase 1 Report are further detailed in the Project Plan [Ref. 7.1]. Sargent & Lundy^{LLC} (S&L) was awarded this work [Ref. 7.2] under the scope as detailed in the Request [Ref. 7.3] and agreed to in the S&L proposal and clarification letter [Ref. 7.4].

The Phase 1 Report was developed with eight sections and ten attachments. Section 1 states the document purpose, provides an overview of the facility, and describes the CREC areas that could be affected by this project. Section 2 states the scope of the Phase 1 Report and describes the process used to select and recommend the most appropriate discharge canal additional cooling capacity solution. Section 3 identifies the project alternatives and screens each alternative to determine if further analysis will be performed on the alternative. Section 4 addresses cooling solutions while Section 5 examines strategies for environmental compliance. Section 6 makes a recommendation of the optimal approach in providing additional discharge canal cooling capacity. Section 7 states the references used in developing the Phase 1 Report and Section 8 provides signatures.

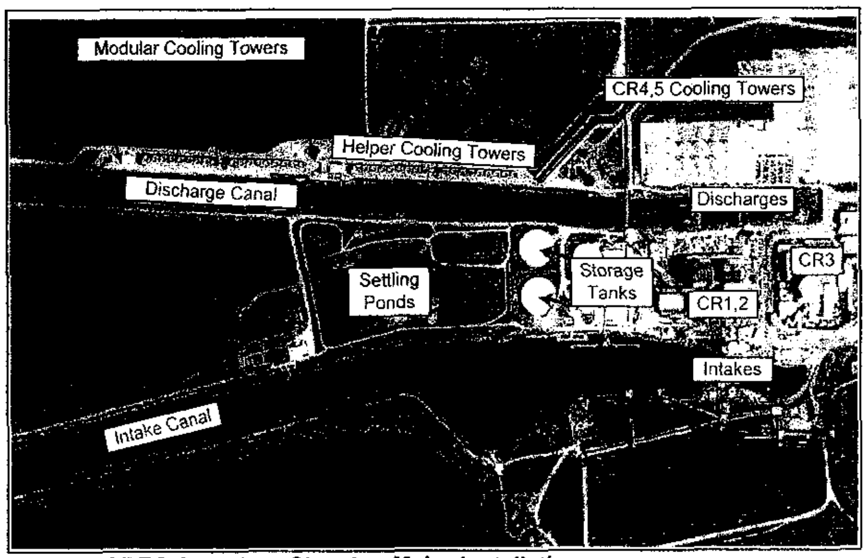


Fig. 1-1: CREC Overview, Showing Major Installations

1.1 CREC Configuration

CREC is comprised of five steam electric generating stations. The five operating units were commissioned and operate with approximate gross electrical output (summer) as follows:

Table 1-1: CREC Operating Units

Unit	Commercial Operation	Fuel Type	Summer Output (Approximate MWe, Gross)	Heat Rejection
1	1966	Pulverized Coal	398	Once through Seawater (Gulf of Mexico)
2	1969	Pulverized Coal	515	Once through Seawater (Gulf of Mexico)
3	1977	Uranium	883	Once through Seawater (Gulf of Mexico)
4	1982	Pulverized Coal	757	Natural Draft Tower (Closed Loop)
5	1984	Pulverized Coal	757	Natural Draft Tower (Closed Loop)

Once through cooling for CREC CR1, CR2, and CR3 is accomplished by the intake of seawater from the Gulf of Mexico. The seawater is then passed in parallel through the three units and returned to the Crystal River Bay approximately three miles west of CREC. Environmental regulations as detailed in the NPDES permit issued by the Florida Department of Environmental Protection [Ref. 7.5] establish seasonal limits for the volumetric flow of seawater discharged from the plant and also restrict the POD temperature to a maximum three hour rolling average of 96.5°F. This discharge temperature limit is challenged during the hottest five months of the year and addressed through use of once through cooling towers located adjacent to the discharge canal.

CR4 and CR5 operate on a closed cycle with natural draft cooling towers. Makeup to the towers is lifted from the discharge canal into a makeup canal which supplies CRN. Blowdown from the CR4 and CR5 towers is combined and directed back into the discharge canal for mixing, dilution, and return to the Gulf.

Once Through Towers – The discharge canal is equipped with two groupings of once through cooling towers. The first group is a permanent arrangement of four linear forced draft cooling towers termed 'Helper Towers.' These towers are designated HCT-1, HCT-2, HCT-3, and HCT-4. This set of towers was designed by Hamon Cooling Towers and entered service in 1991. The helper cooling towers are each rated at ~171,000 gpm (19,000 gpm per cell), and are served by a set of four seawater lift pumps. The discharge of the lift pumps is to a common header which can be valved to direct flow from the pumps to the various towers. The combined capacity of the thirty-six (36) cells which make up the four Hamon towers is currently ~52% of the total (summer) flow in the canal.

In addition to the Helper Towers, four groupings of modular towers were installed and first operated in the summer of 2006. The Modular Cooling Towers (MCTs), comprised of a total of sixty-seven (67) smaller units, were installed, and are owned and maintained by Aggreko. Flow through the modular cooling towers is estimated at 180,000 gpm, or ~14% of total flow in the discharge canal. Together, the Hamon plus Aggreko tower flow is ~66% of total discharge canal flow.

The helper and modular cooling towers are operated seasonally to reduce Point of Discharge (POD) temperatures in the hot months. The number of lift pumps and cooling towers in service is adjusted to match the required heat rejection duty and to meet the POD temperature limit. Historically, on the hottest summer days with all pumps and towers in service, one or both of the coal fired units, CR1 and CR2, must be down-powered to meet NPDES discharge temperature limits [Ref. 7.6].

1.2 CR3 Uprate

EPU – The CR3 EPU will increase the plant's thermal power to approximately 3014 MWt, an increase of ~23% above the original license. The equipment and component modifications within CR3 will be completed during the 2009 and 2011 refueling outages. The additional heat rejection to the discharge canal from the higher power operations will start after the 2011 refueling outage. For EPU, an increase in circulating water flow through the CR3 condenser from 680,000 gpm to ~830,000 gpm is planned, a change of 150,000 gpm, or ~22%.

As discussed in this Phase 1 Report, this increased flow demand will require one or a combination of the following:

(a) an increase in the NPDES permit flow limit,

(b) recirculation of flow from the discharge canal to the intake canal, or

(c) modification of the CR3 intake screens or intake structure to accommodate the increased flow.

The current and expected heat rejection to the canal for CR3 is given in Table 1-2 below:

Table 1-2: Heat Rejection to the Discharge Canal from CR1, CR2, and CR3

Conditions	Units	Heat Rejection to Discharge Canal
Current	BTU/hr	$\sim 9.85 \times 10^9$
EPU(1)	BTU/hr	$\sim 10.69 \times 10^9$
Δ Due to EPU	BTU/hr	$\sim 840 \times 10^6$

(1) Based on increased CW flow rate of 830 kgpm through CR3.

1.3 Purpose

The purpose of the Phase 1 study is to identify an alternative or alternatives that will mitigate the potential environmentally harmful thermal and flow stresses placed on the environment due to the changes in CR3 operating parameters for the EPU. The purpose of the Phase 1 Report is to present the findings from the Phase 1 Study actions stated in Attachment A, Project Requirements. The following bulleted items summarize the major objectives of the Phase 1 Study:

- Develop a list of potential alternatives that could be used to mitigate the increase in the CR3 Circulating Water heat and flow discharged into the discharge canal.

- Review historical cooling tower studies and incorporate recommendations as appropriate.
- Evaluate the list of alternatives and determine the optimal alternatives that would mitigate the increase in discharge canal temperature and flow.
- Analyze related information and identify how to recirculate cooled water to the intake canal as a mitigation alternative for the increased discharge canal flow.
- Complete a cost benefit evaluation of the modular cooling towers to determine if it is prudent to re-lease, purchase, or permanently replace the modular cooling towers at the end of the current lease in 2010. The evaluation will analyze the actions over a 20 year total life.
- Evaluate the helper cooling towers to determine if the helper cooling towers could be upgraded to provide additional cost effective cooling. Part of this evaluation included adding additional helper cooling tower cells (i.e., Hamon expansion cells).

The Phase 1 Report concludes with a recommended solution or mix of solutions to meet the above objectives.

1.3.1 Note on Terminology

In this report various terms are used to describe groupings of technology and equipment intended to meet the objectives stated above. These terms are defined as follows:

Alternative – An alternative is an approach to meeting the study objectives and may involve various groupings of equipment (e.g., screens, pumps, piping, cooling towers) but may not in and of itself be sufficient to achieve all of the stated objectives. Alternatives are screened under Section 3 to determine if they merit further, detailed review. Alternatives which pass the screening may be combined with other alternatives to form a 'Case.'

Case – Once alternatives have been identified and screened, they are then combined into cases as described by the diagrams per Attachment B. Cases consist of specific groupings of alternatives (see Table C1) and establish specific sizing requirements for the equipment required for an alternative.

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These additional cooling tower flows are used to establish the pumping requirements, line sizing, and so on. Cases are considered within the constraints of maximum single tower size, maximum Hamon tower expansion, and maximum considered dilution flow. Not all cases meet all of the major objectives from above, but these cases are presented in Attachment B for information (e.g., to show they will not work). Cases which do meet the design objectives are then termed 'Solutions.'

[redacted]

Solution – A solution is a case which meets the design objectives relative to POD temperature, I&E reduction, reliability, controls, etc. The optimal solution will be the solution which in addition to meeting the design objectives, does so with a balance of maximum station revenue, low life cycle cost, and low regulatory risk.

2.0 ALTERNATIVE SELECTION PROCESS

2.1 Alternative List

PEF supplied an initial list of alternatives in the project contract. In developing the list, S&L reviewed cooling approaches used within the nuclear industry and at several stations considering approaches to 316(b) compliance. Additional alternatives for cooling the discharge canal were also discussed in regular weekly meetings, and a combined list was developed, reviewed, and approved. The agreed upon list was used as the basis for the evaluations. An overview of the selections is provided below.

2.1.1 Conventional Technologies

Conventional technologies for the magnitude of heat rejection required for the once through cycle at CREC (>10^9 BTU/hr) come down to the following:

- Large cooling lakes or bodies of water (e.g., Great Lakes)
- Once through cooling using river or ocean water
- Once through cooling with supplemental cooling towers
- Closed cycle cooling using natural or forced draft cooling towers

A survey of the heat rejection design of the 104 operating nuclear power plants in the U.S. provided the following distribution of options:

Table 2-1: Heat Rejection Design for Operating U.S. Nuclear Units[1]

Option	Description	No. of Units	Percent of Total
1	**Open Cycle**	**68**	**65%**
1a	Once through – Ocean or Bay	21	(20%)
1b	Once through – Great Lakes	8	(8%)
1c	Once through – River	7	(7%)
1d	Once through – Man-made Lake	22	(21%)
1e	Once through with Seasonal Once through Towers	10	(10%)
2	**Closed Cycle**	**36**	**35%**
2a	Natural Draft Cooling Tower(s)	23	(22%)
2b	Forced Draft Cooling Towers	13	(13%)

1) The survey examines nuclear units since the cooling duty is similar to that for CREC and since data for cooling options on these units is readily available.

All operating units within the U.S. fleet make use of surface rejection on a large body of water, or evaporative rejection in a cooling tower. No units make use of indirect cooling of circulating water (e.g., finned tubes) and no units make use of direct condensing options (e.g., extended surface condenser). Further, although Dresden 2,3 and Quad Cities 1,2 did at one time make use of cooling canal sprays, it is not believed that any units make extensive use of such sprays for main cycle cooling. Note that several units use spray ponds to meet ultimate heat sink duty.

In general, approaches using conventional technology which could be considered include:

(a) Extended surface (holdup) lake or pond (new) (Alternative 8)
(b) (New) Natural draft cooling tower(s) (Alternative 1)
(c) (New) Mechanical draft cooling tower(s) (Alternative 1)
(d) Enhancements to the existing mechanical draft towers (Alternative 2)
(e) Increased use of the CR4 and CR5 towers, (convert to closed cycle plus partial once through) (Alternative 3)

2.1.2 Other Technologies

Other technologies to be considered are:

- Steam chiller (Alternative 4)
- Refrigeration cycle to cool circulating water prior to entering one or more units (Alternative 5)
- Air bubble injection for evaporative cooling (Alternative 6)
- Canal sprays for evaporative cooling (Alternative 7)
- Use of quarry ponds north of the plant (Alternative 8)
- Extended intake trench or pipe into Gulf (Alternative 9)
- Dilution of discharge canal water with additional water from the Gulf (Alternative 12)
- Indirect (non-contact) cooling of circulating water (finned tubes) (Not included, see discussion below)
- Extended surface condenser for direct condensing (Not included, see discussion below)

The identified technologies were listed as alternatives in Section 3 for further evaluation. The last two technologies were not considered further, since based on S&L's direct experience in the analysis and design of power cycle cooling systems and recent studies for the Progress Harris AP1000 [Ref. 7.16], (a) indirect cooling of circulating water, also known as 'dry cooling' is not economic for plants with available cooling tower makeup (e.g., seawater), and (b) extended surface condensers are only practical for new construction in arid regions.

2.2 Alternative Selection Process

After the alternatives were selected (added to the Alternative List) each alternative was then screened against the following criteria:

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