Florida Power
CORPORATION

July 11, 1974

Donald F. Knuth, Director
The Directorate of Regulatory Operations
U. S. Atomic Energy Commission
Washington, D. C. 20545

Subject: Crystal River Plant - Unit #3
Docket No. 50-302

Dear Mr. Knuth:

In accordance with Federal Regulation 10CFR50.55(e), we wish to submit the final report regarding the nonconformance reported on 4/24/74 by Florida Power Corporation. The final evaluation and recommendations have been made regarding this nonconformance. As a result of an extensive evaluation of the strength of the in-place concrete, it has been decided that the concrete be accepted as is.

To assist you in evaluating our decision, we wish to offer the following:

On April 4, 1974, concrete pour L-9 of the reactor building dome was placed. This pour is a complete circular ring mid-way up the dome of the building, consisting of 129 cubic yards. This concrete had an intended design strength of 5000 psi at 28 days. Seven day test cylinder breaks indicated that the concrete would not achieve the design strength level. The 28 day cylinder test results averaged 4570 psi. Gilbert Associates, Inc. was requested to perform a review of the reactor building dome design to determine a minimum acceptable concrete strength for this particular area of the structure. The results of their review indicated that 4500 psi was an acceptable minimum design strength.

In evaluating the field cylinder test results, Gilbert Associates, Inc. has utilized provisions of the 1971 ACI-318 code to evaluate the structure. Strict interpretation of the 1963 code which was used in the original design calculations, would indicate that the 4500 psi requirement is not satisfied, since 10% of the tests lie below the 4500 psi. The applicability of the 1963 code to this limited number of samples is questionable. Since the 1971 code provided a clear basis of strength evaluation, it is being used in this case. The Crystal River Unit #3 FSAR is being so amended.

S

We have determined that this nonconformance was caused by the failure of the cement to meet specifications. The exact cause of the failure is not completely clear, since test results for this particular batch of cement submitted to Florida Power Corporation prior to its use indicated the cement was acceptable. Test results of samples taken from the silo at the site however, indicate that the cement was, in fact, unacceptable. In order to preclude a reoccurrence of this problem, Florida Power Corporation initiated the following corrective action:

Cement inspection during both the grinding of the cement at the manufacturer and after its delivery to the site have been markedly increased. This includes full time inspection at the manufacturer and during the grinding of cement for Florida Power Corporation.

In order to provide you with the necessary data to evaluate our actions regarding this nonconformance, we are enclosing copies of the following data:

1. Gilbert Associates, Inc. letter, FPC #10373, dated 1/23/74.

2. Chronological Log of sequence of events regarding the subject nonconformance.

3. Florida Power Corporation letter to G. B. Brown, Pittsburg Testing Laboratories, dated 5/14/74, regarding cement corrective action.

4. Pittsburg Testing Laboratories letter, dated 5/15/74 to Paul Weigelt of the Tampa Office of PTL, regarding cement corrective action.

5. Gilbert Associates, Inc. letter, FPC #10517, dated 5/22/74, including attachments.

A complete file of these and other supporting documents is available at the Crystal River Plant site for review by your inspectors at their convenience. We hope that this information provides you with all the necessary data to close this item. Please advise us if you require any further information.

Very truly yours,

JTRodgers

J. T. Rodgers
Assistant Vice President

ldh
Enclosures

cc: Norman C. Moseley
Director, Region II

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
P.O. BOX 1498 / READING, PA. 19603

VERY POOR ORIGINAL

May 2, 1974

Mr. W. A. Szelistowski, Director
Generation Engineering Department
Florida Power Corporation
P. O. Box 14042
St. Petersburg, Florida 33733

FPC - #10373

Re: Concrete in Dome Pour L-9
Reactor Building
Crystal River - Unit #3
Florida Power Corporation

Dear Mr. Szelistowski:

With reference to Telecopy No. 6028 from Mr. J. Duren dated May 2, 1974 giving the results of the concrete 28 day test cylinders for pour L-9 of the Dome our findings are as follows:

We have evaluated the design at location L-9 of the Dome and find that the minimum concrete strength required to meet the load case giving the maximum stress is f'_c = 4500 psi.

1. The provisions of ACI-318-63 are difficult to apply in the evaluation of concrete strength for an individual pour with the number of cylinder tests available in this case, however, ACI-318-71 provides a more definitive method of evaluation.

2. Interpreting the test results in accordance with ACI-318-71 Section 4.3.3 the test results overall average of 4570 psi is greater than the 4500 psi required, and no one set of results is less than 500 psi below 4500 psi, on this basis the concrete strength is acceptable.

In conclusion, we can accept the concrete strength in accordance with ACI-318-71, however, a deviation from the FSAR will have to be documented and presented to the AEC.

Very truly yours,

S N Dobreff

S. N. Dobreff
Project Structural Engineer

JEL/SND/kf

cc: W. A. Szelistowski (2)
C. E. Jackson
J. R. Duren (Telecopy to St. Petersburg)

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CRYSTAL RIVER UNIT 3

REACTOR BUILDING DOME POUR L-9

LOW STRENGTH CONCRETE

CHRONOLOGICAL LOG

4/15/74 Low 7 day cylinder breaks for pour L-9 (poured 4/4/74) reported to W. Buck 4/15/74 no data was available from construction.

4/17/74 WAS requested we expedite resolution of low concrete strength question - telecopied request for information to CEJ.

4/18/74 At C.R. gathered data on low strength conc. tests. Requested S.N. Dobreff to look at design and report by Monday a minimum acceptable 28 day cylinder strength. Average of 7 day breaks is 3030 psi. Concrete cores (12) are being removed from pour. The following data was collected:

a. 7 day and 5 day cylinder breaks
b. design mix curves
c. 7 day cement tests
d. pour inspection slips

4/19/74 Received 6-14 day core (dry) breaks from B. Brown

Sample No. 1 - 3740 psi
3 - 3260 psi
5 - 2750 psi
7 - 3040 psi
9 - 2700 psi
11 - 3610 psi Avg. 3185 psi

Normal expected 7 day strengths have been 73% of 28 day or 3650 psi min.

4/20/74 Received the following data from J. Artuso via telephone:

a. Wet core test results (15 dry)
4120 psi
4140 psi
3440 psi
2840 psi
2820 psi
4010 psi Avg. 3560 psi

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b. 28 day cement tests - Silo #19 (psi)

5320	5160	5200
5310	5180	5200
5320	5230	5220
5330	5320	

c. Grab sample of cement taken from C.R. #3 site showed less than 20 min. set time.

d. Mr. Artuso's evaluation thus far is that the concrete will evaluate at 4000 psi 28 day cylinder strength. To justify this, additional cores may be necessary and the 85% strength factor (from ACI) applied. He estimates reaching 4300 psi at 90 days again based upon a core break analysis.

4/22/74 Mr. Dobreff's preliminary analysis of the dome design indicates a minimum acceptable 28 day cylinder strength is 4250 psi. He is proceeding to further refine this design investigation.

Met with JTR, WAS RSB - briefed them on the above - Will wait for 28 day evaluation. Advised C.P. also.

Message from J. Artuso - results of grab sample of cement - 3 day break 1890 psi, sample failed false set requirement (ASTM).

4/26/74 Mr. Dobreff said their preliminary analysis thus far indicates if we partially prestress the dome and complete the prestress 3 months later 4200 - 4300 would be acceptable. Work by GAI is continuing.

4/29/74 Advised JTR and CEJ of information in paragraph immediately above - AM.

5/1/74 Mr. Dobreff and Mr. Cronberger advised by phone that a minimum acceptable f'c is 4500 psi.

5/2/74 Advised JTR of above. He requested a letter from GAI in confirmation. Advised by B. Black of 28 day cylinder breaks - 4570 avg.

5/3/74 Received GAI confirming letter; gave to WAS for approvals.

W02

FLORIDA POWER CORPORATION

CRYSTAL RIVER, FLORIDA

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May 14, 1974

G. B. Brown
Pittsburg Testing Lab.

Re: Cement Corrective Action

Bennett,

As per your recommendations, the following corrective actions are authorized to be put into effect as of this date for closer control fo cement used on this project:

1. PTL to provide full time inspection at General Portland and during the grinding of cement for Florida Power Corp.

2. PTL to provide approximately 50% coverage during the transfer of cement from the production silo to the storage silo.

3. PTL to seal both top and bottom of storage silo after transfer is complete.

4. PTL to break bottom seals prior to first shipment to Red Level.

5. PTL during use of the silo to periodically verify that top seals are intact.

6. PTL to perform routine setting time on the cement delivered to Red Level.

D. B. Black

DBB/bn

PITTSBURGH TESTING LABORATORY

INSPECTING ENGINEERS AND CHEMISTS

850 POPLAR STREET

PITTSBURGH, PA. 15220

PLEASE REPLY TO:
P. O. BOX [illegible]
PITTSBURGH, PA. 15230

[illegible]

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May 15, 197[illegible]

To: Paul [illegible] Tampa

From: G. B. Browne Crystal River

Subject: Cement inspection Florida Power Corp.

Florida Power has requested we increase our cement inspection per the attached letter. Items 1 through 5 will have to be performed by the Tampa office. Item 6 will be done here. If you are unable to cover these inspections contact me as soon as possible.

G. B. Browne

Attachment: 1

GBB/djb

cc: Joe Browne - Pittsburgh
cc: [illegible]
cc: [illegible]

This copy to:

LBERT ASSOCIATES, INC.

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May 22, 1974

FPC - 110517

EXTRA COPY NOT FOR FILING

Mr. W. A. Szelistowski, Director
Generation Engineering Department
Florida Power Corporation
P. O. Box 14042
St. Petersburg, Florida 33733

Re: Dome Pour L-9
Reactor Building
Crystal River - Unit #3
Florida Power Corporation

Dear Mr. Szelistowski.

As requested by your Mr. J. R. Duran enclosed is a copy of the structural engineering input for the proposed report to AEC in regard to Dome Pour L-9.

Please review and comment.

Very truly yours,

S. N. Dobreff
Project Structural Engineer

SND/MF
Enc.

cc: W. A. Szelistowski (7) (Enc.)
C. E. Jackson

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Concrete Strength in Dome Pour 1-9

Forward

F.S.A.R. Section 5.2.2.1 records that the strength of the concrete selected for the Reactor Building prestressed concrete is 5000 psi at 28 days and in 5.2.3.1 the building design is to be in accordance with ACI-318-63.

The following test result evaluation of the actual concrete strength relative to the maximum stress levels expected in pour 1-9 of the Dome concludes that the concrete strength is less than 5000 psi, however, the concrete does meet the required strength of 4500 for the critical stress at this location including the safety factors demanded by ACI-318-63.

Evaluation of Concrete Strength Test Results

The concrete cylinders representing the subject concrete consisted of 3 sets. The average 28 day strength of each set was 4890 psi, 4550 psi and 4280 psi.

ACI-318-63 states that the running average of all results be equal to, or greater than, f_c' and that not more than 10% of the results should fall below f_c'. This requirement can be usefully applied for strength control throughout construction but is not applicable for evaluating the concrete strength in a localized pour area such as the one in question.

Based on ACI-318-71 paragraph 4.3 "Evaluationand Acceptance of Concrete" the concrete represented by these cylinders would meet a requirement for 4570 psi strength at 28 days.

The ACI-318-71 method of evaluation is directly applicable to the circumstances encountered in the subject pour and the test results available.

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Review of the Structural Analysis to Determine the Maximum [illegible] the Dome Location L-9

General

All load cases were reviewed to establish the maximum shear, tension and compressive stresses at Pour L-9 which is located approximately mid-way between the Dome crown and the ring girder anchorage zone.

Tensile and Shear Stresses

To resist bending tensile stresses in the concrete during pouring, reinforcement is provided, and the compressive and shear stresses in the concrete are insignificant. For all test, operating and accident loading conditions the shears and moments approach zero in location L-9 of the Dome, see figures 5-6 to 5-8 in the F.S.A.R. No contribution from the tensile capacity of the concrete was relied upon when the required maximum prestress force was determined.

It is concluded that since the tensile and shear stresses in the location of pour L-9 are low, their evaluation is not critical for establishing the minimum concrete strength required.

Compressive Stresses

ACI-318-63 Section 2605 divides the allowable compressive stress levels into two requirements: a) The allowable compressive stress immediately following transfer before prestress losses due to creep and shrinkage is limited to $0.6\ f_c'$ b) The allowable compressive stress after all prestress losses is limited to $0.45\ f_c'$.

On this basis the critical load condition (requiring the maximum f_c' value) was found to be during operation at which the maximum stress was 2028 psi within the area of pour L-9. Equating the actual stress of 2028 psi to the $0.45\ f_c'$ requirement determined that the minimum concrete strength f_c' required is 4500 psi.