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GAI REPORT NO. 1913

CRYSTAL RIVER UNIT 3

FLORIDA POWER CORPORATION

REACTOR BUILDING

DOME DELAMINATION REPORT

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APPENDIX A

DOME CONCRETE

Requirements for concrete materials and concrete were set forth in SP-5569, "Specification for Furnishing and Delivering of Structural Concrete". ACI 301-66, "Specification for Structural Concrete for Buildings", is referenced and considered to be an integral part of the Specification.

MATERIAL REQUIREMENTS

Cement

All cement used was to conform to "Portland Cement, Specification for", ASTM C-150-67, Type II, for moderate heat hydration. Manufacturers were required to provide a certified copy of mill test reports for all cement provided for use on the project. Compliance of the cement to the requirements set forth in ASTM C-150 was to be verified by testing conducted by an independent testing laboratory (Pittsburgh Testing Laboratory).

Control of cement inventories and quality assurance was maintained by PTL monitoring all shipments of cement between facilities and sealed storage silos. Cement was not released for use by the contractor until all required documentation was available. A typical cement documentation package is contained in Attachment 1 (mill test report, chemical and physical test by PTL, shipping records).

Aggregates

Aggregates for concrete production were specified to meet requirements set forth in ASTM C-33-67, "Standard Specification for Concrete Aggregates", with the following exceptions stated by the specification:

1. Fine aggregate gradation is modified to allow the use of local natural sands. This exception is based on the service record of the aggregates and

the fact that both the U.S. Corp of Engineers and the Florida State Road Department have modified the ASTM Specification to allow the use of these native aggregates.

2. In addition to the modified ASTM C-33 gradation limits, the fineness modulus of the fine aggregate is required to be between 2.20 and 2.70.

3. Freezing and thawing test as required by ASTM C-33-67, paragraph 10.1.16 are waived for the qualification of coarse aggregate that fail to meet the soundness requirements, (ASTM C-88, "Test for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate"), of the specification. The aggregate is accepted on the basis of its satisfactory service record, when exposed to similar weathering conditions if the soundness criteria cannot be met.

Before use in production concrete, aggregate sources must be qualified to meet the requirements of ASTM C-33, as modified above, by the testing laboratory and approved in writing by the owner. Sources of aggregate cannot be changed without the written approval of the owner.

Attachment 2 lists applicable ASTM specifications for the fine and coarse aggregate as required by ASTM C-33. The coarse aggregate approved and used was Brooksville Crushed Limestone from Brooksville Rock Company pit by Florida Crushed Stone Company. The approved fine aggregate was from the Silver Sand Company, Clermont Mine.

Fine and coarse aggregates were tested with each brand of cement for possible alkali reactions which could cause excessive expansion of mortar or concrete. The test method utilized was ASTM C-227, "Test for Potential Alkali Reactivity of Cement-Aggregate Combinations, (Mortar Bar Method)".

Control of aggregates was maintained by checking the gradation of incoming aggregate shipments at the batch plant. Spot checks were also conducted for organic impurities in the fine aggregate and material finer than No. 200 sieve on the coarse aggregate. Any material that failed to meet the specifications was rejected and removed from the batch plant site.

Water

Mixing water and ice for concrete was required to be fresh, clean, and potable. Chloride, sulfide and nitrate ions were limited to 100 ppm each. Turbidity limits of 2000 ppm were also specified. Results of water and ice water analysis indicate that turbidity levels could not be expressed in ppm by the testing laboratories. Turbidity results were expressed in either Alph units or Jackson Candle Units.

Admixtures

Production concrete contained entrained air in the amount of 3 to 6%. DAREX, a product of W. R. Grace and Company, conforming to ASTM C-260-66T, "Air Entraining Admixtures for Concrete" was the air entraining admixture.

DARATARD, a product of W. R. Grace and Company, was used as a water reducing densifier admixture. The admixture meets requirements of ASTM C-494-67T, Type E, "Chemical Admixtures for Concrete".

Admixtures containing calcium chloride were not used in concrete. Additionally flyash was not used as an admixture in concrete for the containment building.

APPENDIX A
ATTACHMENT 2

FINE AGGREGATE QUALIFICATIONS AS PER ASTM C-33-67

Gradation	Specified Limits		Results[1]	Comments
ASTM C-136 "Test for Sieve or Screen Analysis of Fine and Coarse Aggregate"	Sieve Size	% by Weight Passing	% by Weight Passing	ASTM C-33 gradation modified to allow use of local natural aggregate
	#4	95 - 100	100	
	#8	85 - 100	99.4	
	#16	65 - 97	93.9	
	#30	30 - 70	69.5	
	#50	5 - 35	21.7	
	#100	0 - 5	2.1	
Material Finer than No. 200 Sieve ASTM C-87	1.0% by weight (max.)		0.2%	
"Test for Organic Impurities in Sand for Concrete" ASTM C-40	Color scale		Lighter than standard	
"Test for Friable Particles in Aggregate" ASTM C-142	1.0% by weight (max.)		Not available	
"Test for Soundness of Aggregate by Use of Sodium Sulfate" ASTM C-88	10% loss		1.10% Loss	

[1] Results as per PTL Report of "Proposed Sand Source at Clermont Mine", date 6-4-70.

APPENDIX A
ATTACHMENT 2

COARSE AGGREGATE QUALIFICATIONS AS PER ASTM C-33-67

Gradation	Specified Limits		Results[2]	Comments
ASTM C-136 "Test for Sieve of Screen Analysis of Fine and Coarse Aggregate	Sieve Size	% by Weight Passing	% by Weight Passing	
	1"	100	100	
	3/4"	90 - 100	99.6	
	1/2"	--	55.5	
	3/8"	20 - 55	38.4	
	#4	0 - 10	3.0	
	#8	0 - 5	1.1	
"Amount of Material Finer than No. 200 Sieve" ASTM C-87	1.5% by weight (max.)		1.1% to 1.4%[3]	Allowable percentage increased since material is a crushed aggregate
"Test for Soundness of Aggregate by Use of Sodium Sulfate" ASTM C-88	12% Loss		13.47%	Material accepted on basis of service record
Test for Friable Particles in Aggregate ASTM C-142	0.25%		Not available	
Test for Lightweight Pieces in Aggregate (coal & lignite) ASTM C-132	0.5%		Not available	
"Test for Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine" ASTM C-131	50% Loss (Max.)		41.4% Loss	
"Test for Scratch Hardness of Coarse Aggregate Particles" ASTM C-235	5.0%		Not available	

2 Results as per Law Engineering Testing Co. report on concrete mix designs dated 11/7/68

3 Range of results as reported by PTL between 12-73 and 4-74