

Franke, Mark

From: Miller, Craig L [Craig.Miller@pgnmail.com]
Sent: Saturday, January 16, 2010 1:10 PM
To: Lake, Louis; Thomas, George; Carrion, Robert; 'trowe@wje.com'
Cc: Williams, Charles R.
Subject: RE: Failure Mode 5.1 for Review and Comment
Attachments: FM 5.1.pdf; FM 5.1 Exhibit 1 - SP5618 and JAJ-W5 clean forms.pdf; FM 5.1 Exhibit 2 - QC Procedures_PTL-10.pdf; FM 5.1 Exhibit 3 - Pour528RB-NCR213 sand in joints.pdf

FM 5.1 is being re-sent due to "mail delivery problems" associated with file size. There will be three emails to cover all the attachments. Please let me know if you have any questions.

Thank you,

Craig

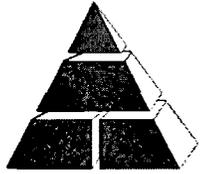
From: Miller, Craig L
Sent: Saturday, January 16, 2010 1:02 PM
To: 'louis.lake@nrc.gov'; 'George.Thomas2@nrc.gov'; 'nausdj@ornl.gov'; 'rpc1@nrc.gov'; Souther, Martin; 'trowe@wje.com'
Cc: Williams, Charles R.
Subject: Failure Mode 5.1 for Review and Comment

Mr. Lake and others,

Attached for your review is the draft of FM 5.1 and its exhibits. If you have any questions, please contact Charles Williams or myself.

Thank you,

Craig Miller



5.1 Contamination During Construction

Description:

During construction operations it is possible for contaminants to get mixed with the fresh concrete. Some of these materials have the potential to weaken the concrete and/or affect its durability. Source of contamination can be dirty aggregate that may include organic material, fine dust, or other reactive elements. Another source is construction related material such as grease/oil, nails/ties, tools and safety items, clothing, cigarettes, food, and other debris.

Foreign material can impact the concrete by either replacing sound concrete with weak/incompatible filler, or by adding reactive elements that react inside the concrete. Contamination can be detected by inspections during construction, visual inspections for signs of distress such as spalls and cracks, and analysis of concrete removed from the structure (during demolition and coring). Precautions involve strict control of aggregate sources, good construction and safety practices, and an effective Quality Control (QC) program that monitors potential for contaminations.

Data to be collected and Analyzed:

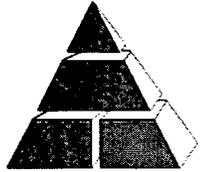
1. Review project specifications for requirements.
2. Review project QC procedures.
3. Review aggregate evaluation from original construction (FM 5.1 Exhibit 5 is a report by Law Engineering)
4. Review Non Compliance Reports. (NCRs)
5. Review Petrographic reports for signs of contamination.
6. Review inspection records (IWL), observations during demolition, and core inspections for indications of contamination.

Verified Supporting Evidence:

- a. Exhaustive review of NCR reports revealed an incidence where sand was found inside concrete forms. (FM 5.1 Exhibit 3) QC procedures failed to detect the contaminant (FM 5.1 Exhibit 4) and corrective measures were needed to repair the problem.

Verified Refuting Evidence:

- a. Project specifications included cleaning requirements. (FM 5.1 Exhibit 1)
- b. Project QC specifications provided requirements for preventing contaminations and for proper inspections and reporting. (FM 5.1 Exhibit 2)
- c. Tests on original aggregate by Law Engineering (FM 5.1 Exhibit 5) found no clay lumps. There was no mention of any organic impurities or excessive dust.



5.1 Contamination during construction (cont.)

- d. Multiple Petrographic reports on concrete cores taken in 1975 and 2009 did not encounter contaminants (FM 5.1 Exhibit 6). The Erlin Hime report (FM 5.1 Exhibit 6b) noted dusty aggregate and recommended that it be washed prior to use.
- e. Exhaustive review of inspection reports (IWL) found no indication of spalling or cracking that could be attributed to contaminants.
- f. Detailed review of cores taken during 2009 found no indication of contaminants. Thorough analysis of photos taken during and after the SGR hole cut demolition did not detect any signs of contamination in the concrete.

Discussion:

The evidence presented above describes a system that provided guidelines and inspection tools needed to prevent contamination of the concrete. The single report discussed in FM 5.1 Exhibits 3 & 4 of contaminant in the concrete also describes the methodology for removing and repairing the contaminated concrete.

Conclusion:

There is no evidence of undetected contamination during construction and it was not a contributing factor to the delamination.

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C. Field Placement Inspection

1. Testing laboratory inspectors shall perform the following inspections and shall document this inspection on each placement. (Sample inspection form attached.)
 - a. Formwork for cleanliness, tight joints, form oiling and exposed edges chamfered.
 - b. Reinforcement for cleanliness, adequate securing and clearances to forms and subgrades.
 - c. Construction joint surfaces except as noted otherwise hereinafter shall be prepared for the placement of concrete there on by cleaning thoroughly with wire brushes, water under pressure, or by other means to remove all coatings, stains, debris, or other foreign material.
 - d. Horizontal and vertical construction joints in the reactor building cylindrical shell below 250'0 level shall be prepared for receiving next pour by either sandblasting, air water jet, bush hammering, or other means to remove all coatings, stains, debris or other foreign material. The horizontal joints shall be dampened, then thoroughly covered with cement - sand mortar, of similar proportions in concrete, of approximately 1/2 inch thick and concrete placed before initial set of mortar. Vertical joints shall be dampened before concreting.
 - e. Construction joint surface in the Ring Girder and Dome at and above 250'0 of the Reactor Bldg. are to be prepared by sandblasting to produce a clean rough surface and the applying an evenly distributed film of Colma Fix 8% adhesive.
 - f. Conveyance equipment in accordance with ACI 301 Chapter 8 and ASTM C94. All transporting to point of deposit to be without segregation of concrete.
 - g. Concrete deposited in horizontal layer not exceeding 18" - avoiding inclined joints with maximum free fall of 3 feet. Each layer vibrated together.
 - h. Placing of concrete shall not cause movement or damage to embedded items.
 - i. Concrete vibrated adequately and concrete of proper workability to avoid seams or planes of weakness.

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5:01.2 The CONTRACTOR shall be responsible for the preparation of written procedure(s) to set forth how the work to be performed under the specification will be carried out. The party performing the work shall also prepare a written quality control procedure setting forth what tests will be executed to substantiate compliance with the specification. Such written procedures shall be submitted to the ENGINEER for review and comment. These procedures shall be written prior to the starting of any of the work.

5:01.3 Prior to placing of concrete on compacted fill, the fill shall be checked for the percentage compaction required under Section 2:01.1. The subgrade shall be free of debris and organic material and shall be wetted thoroughly.

5:01.4 Before concrete is placed on a hardened concrete surface, it shall be free of laitance and foreign material. Horizontal and vertical construction joints in the reactor building cylindrical shell and dome shall be prepared for receiving the next pour by either sand-blasting, air water jet, bush hammering, or other means to remove all coatings, stain, debris, or other foreign material.

5:01.5 In conveying of concrete from mixer to concrete in place, only those methods and arrangements of equipment should be used which will reduce to a minimum any separation of coarse aggregate from the concrete. Equipment should be capable of expeditiously handling and placing concrete of such a proper consistency, grading, and maximum size of aggregate, at the rate most favorable to good quality and workmanship. The conveying equipment shall be in accordance with ACI 301-67, Chapter 8 and ASTM C-94-67.

☆☆☆☆ 5:01.6 If concrete is deposited on a hardened concrete surface, a 1/2 inch layer of neat grout shall be applied before concrete is deposited. Concrete shall be deposited continuously and in horizontal layers not exceeding 18 inches, avoiding inclined construction joints. It is important that each layer be shallow enough so as to be placed while the previous layer is still soft and that the two layers be vibrated together. No concrete shall be deposited in concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. Concrete shall be placed with the required consistency to assure proper workability. The placing of concrete around reinforcing and embedded items shall be by methods that will not cause movement or damage. The maximum free fall of concrete shall be three feet.

5:01.7 All concrete shall be consolidated by vibration, spading, or rodding so that the concrete is thoroughly worked around the reinforcement, embedded items, and into corners of forms, eliminating all air or rock pockets which may cause honeycombing, pitting, or planes of weakness. If vibrators are used, they shall have adequate power and be of high frequency, rugged, and reliable. When immersed in concrete, the vibrator shall have a minimum frequency of 7000 rpms. Over-vibrating and the use of vibrators to transport concrete within the

☆☆☆☆ All Add. 10
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4:01.2 Horizontal and vertical construction joints in the reactor building cylindrical shell and dome shall be prepared for receiving the next pour by either sandblasting, air water jet, bush hammering, or other means to remove all coatings, stains, debris or other foreign material. The horizontal joints shall be dampened (but not saturated), then thoroughly covered with a coat of neat cement mortar of similar proportions to the mortar in the concrete. The mortar shall be at least 1/2 inch thick and fresh concrete shall be placed before the mortar has attained its initial set. The vertical joints shall be dampened (but not saturated) before concrete is placed.

4:02 Expansion Joints

- 4:02.1 Premolded expansion joint filler shall conform to "Spec. for Pre-formed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Non-bituminous Types)," ASTM D 1752-66.
- 4:02.2 The location size and detail of fillers shall be as shown on the Drawings.
- 4:02.3 The expansion joints shall be sealed with a material compatible with the premolded expansion joint filler.

4:03 Water Stops

4:03.1 Water stops shall be polyvinyl chloride water stop of the dumbbell, bulb or serrated type as manufactured by W. R. Grace & Co. or approved equal. The location, size and detail of water stops will be as shown on the Drawings.

★ 4:03.2 Vulcanizing of water stop shall be inspected and approved by the Inspector or OWNER. Nailing of water stop shall be free of oil, grease, grout, or any other material that prevents good seal.

5:00 QUALITY CONTROL

★ ★ ★ ★ 5:01 Concrete

5:01.1 Each week the CONTRACTOR shall submit to the ENGINEER a concrete pour schedule. (This schedule will give the ENGINEER advance notice so he may check the drawings ahead of time and help eliminate possible problems before pour time.)

The CONTRACTOR shall initiate a concrete pour checkout form to assure that all crafts have completed their work prior to concrete placement. After the form has been signed by each craft, it shall be given to the TESTING LABORATORY and/or ENGINEER prior to concrete placement. This form shall be kept as a record for that pour. Each pour shall have a checkout form.

★ See add. a

★ ★ ★ ★ See addendum b

See Art. 8. ★ ★ ★ ★ ★

2. Do not remove forms in less time than shown, unless approved by the FPC Structural Supervisor.

6.4 Joints

- A. Locate Construction Joints as shown on drawings or as directed by the FPC Structural Supervisor.

B. Clean horizontal, vertical and/or overhead concrete surfaces, against which fresh concrete is to be placed, by sandblasting, bush-hammering or high pressure water jet.

1. For Reactor building shell joints below elevation 250'; dampen joints and remove standing water, place 1/2" thick cement mortar on the horizontal joints, prior to placing the concrete.
2. For concrete other than Reactor building shell, 1/2" mortar "buttering" is not required.
- C. Construct Expansion joints according to the location and of materials shown on the drawings or as directed by the FPC Structural Engineer.
- D. Construct water stops of WR Grace PVC material as shown on the drawings or as directed by the FPC Structural Supervisor.
 1. Obtain FPC Structural Supervisor's approval of vulcanization of water stop.
 2. Do not make penetrations through or allow objectionable materials on water stop.

6.5 Placement

- A. Place slabs on grade, supported basement floor slabs, and slabs on structural steel framing as shown on the drawings with the top of all finished slabs a true plane with a tolerance of 1/8" in 10' unless otherwise noted.
- B. Place concrete walls as shown on the drawings with a maximum deviation of 1/4" in any bay of 20' maximum.
- C. Place concrete in such a manner to facilitate bulkheading and covering should the pour be terminated before completion.
 1. Have sufficient materials readily available to bulkhead and/or cover pour.
 2. Have a spare gas powered vibrator available on the job site.

5-8-70
ORIGINAL DATED
2 REVISION 12/4/72 EFFECTIVE

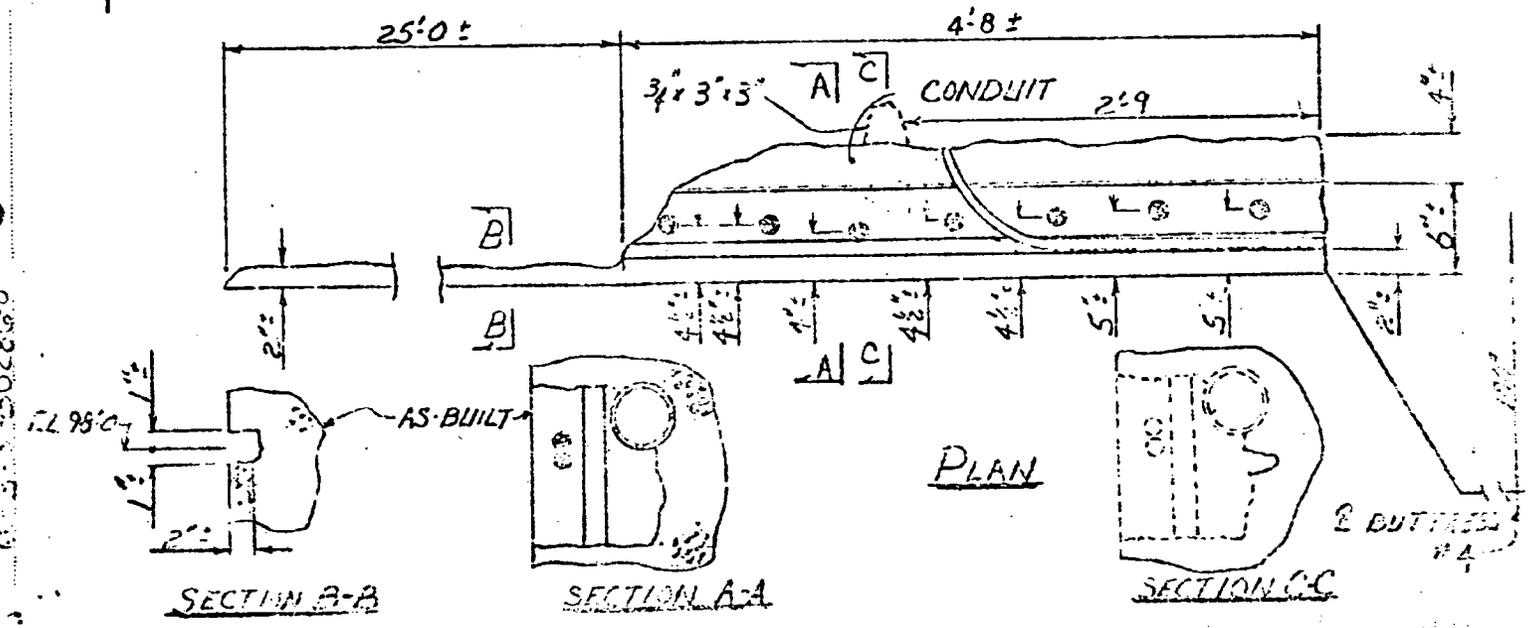
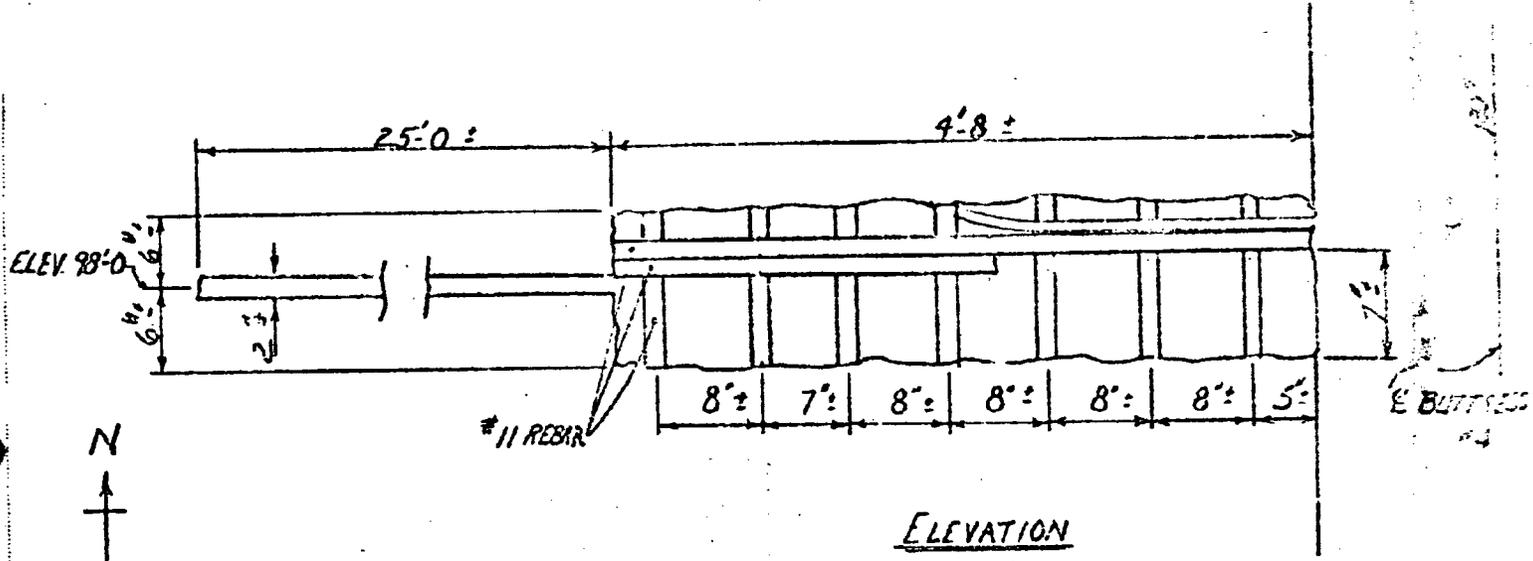
J. A. JONES CONSTRUCTION CO.
DOCUMENT CONTROL

JAJ-W5
DOCUMENT NO.
PAGE 4 OF 18

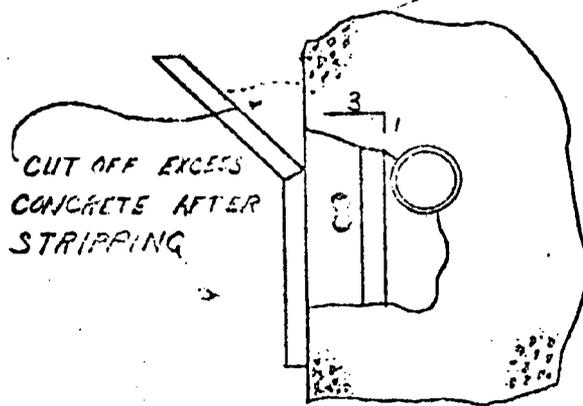
PROJECT: CRYSTAL RIVER UNIT NO. 3 OR OTHER: _____		FLORIDA POWER CORPORATION NONCONFORMANCE AND CORRECTIVE ACTION REPORT		DISTRIBUTION: White: Quality Engineer Green: Dir. Gen. Construction Pink: Mgr. Gen. Q. & S. Blue: Extra Copy Goldenrod: Extra Copy	
ITEM: <u>CONCRETE VOID</u>		QTY: <u>1</u>	VENDOR/CONTRACTOR: <u>J.A. JONES CONSTRUCTION</u>		
P.O. NO. ACCT NO. <u>3120410</u>	RMR NO.: <u>NA</u>	R.O. / SPEC. NO.: <u>SP 5618</u>	DWG. NO.: <u>SC 481083</u>		
NONCONFORMING CHARACTERISTICS:		NONCONFORMANCE DESCRIPTION: <u>REJECT TAG # 720</u>			
<u>VIOLATION OF JAS-WS,</u>					
<u>SAND IN CONSTRUCTION</u>		<u>SAND AND DIRT IN CONSTRUCTION JOINT</u>			
<u>JUNT OF CONCRETE</u>		<u>OF REACTOR BLDG OUTER WALL BETWEEN BUTT</u>			
<u>POUR # 528 RB</u>		<u>B AND 4 AT EL. 98', APPROXIMATELY. CONS.</u>			
		<u>POUR # 528 RB ON 7-25-72 - FULL EXTENT</u>			
		<u>OF VOID TO BE DETERMINED</u>			
		INSPECTOR: <u>[Signature]</u> DATE: <u>12-14-72</u>			
REQUIRED DISPOSITION AND CORRECTIVE ACTION:					
DISPOSITION: Waiver #243 was issued to permit exploratory concrete removal; end product is "as built" shown on dwg. CR3-S-30286, sheet 1 of 2. Required disposition is method of repair, as outlined on sheet 2 of 2, copy attached.					
CORRECTIVE ACTION: Instructed foremen, PTL & QC to perform final cleanliness inspection immediately before concreting. See copy of letter attached.					
ATTACH REQUEST FOR WAIVER FORM NO. Q-010 IF APPLICABLE				WAIVER SER. NO. <u>243</u>	
SITE ACCEPTANCE		SITE REVIEW APPROVAL:		BOARD REVIEW APPROVAL:	
DIR. GEN. CONST. <u>[Signature]</u>		DIR. GEN. CONST. _____		DIR. GEN. CONST. _____	
QUALITY ENGR. <u>[Signature]</u>		QUALITY ENGR. _____		DIR. GEN. ENG'RG. _____	
10 JAN 1973		CONTR. - MGR. _____		MGR. GEN. Q. & S. _____	
REPAIR/REWORK-ENGRG. APPROVAL: <u>None</u>			REPAIR COMPLETE QUALITY ACCEPTANCE BY: INSPECTOR: <u>[Signature]</u> DATE: <u>2-19-73</u>		
REPAIR/REWORK PROCEDURE REQUIRED: <u>Yes</u>			REPAIR/REWORK PROCEDURE NO.: <u>See attached</u>		
<u>File Pour 528</u>			NO 0213 <u>See attached NR 0221</u>		
FORM NO: Q-008 - Rev. December 15, 1971					

SHEET NO. 1 OF 3
JOB NO. CR UNIT 3

DATE 12-73 SUBJECT AS-BUILT
DRAWN BY DATE 01/01/00 REFER TO 1127 R 021
65502860

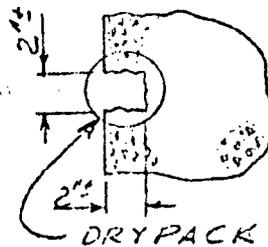


DATE 10/15 SUBJECT: REPAIR OF CONCRETE SHEET NO. 2 OF 2
 CHN BY DATE 11/10/11 JOB NO. CP UNITS



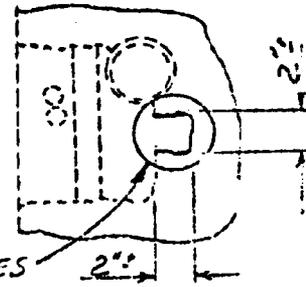
SECTION A-A

- 1) CHIP CAVITY SUCH THAT TOP SLOPES 1:3 OR STEEPER
- 2) COAT DUST-FREE, DRY SURFACES WITH EPOXY BONDING COMPOUND.
- 3) POUR WITH DM-7, 3/8" STONE MIX, 5000 PSI, 70°F, 3" SLUMP MIX
- 4) MOIST CURE FOR 7 DAYS



DRYPACK THESE SPACES

SECTION B-B



SECTION C-C

- 1) WET CONTACT SURFACES, & FILL WITH PORTLAND CEMENT & SAND DRYPACK

FLORIDA POWER CORPORATION
INTER-OFFICE CORRESPONDENCE

906 205 (5)

Generation Construction
(OFFICE)

SUBJECT

DATE January 10, 1973

To General Foremen & Foremen
PTL
QC

ATTENTION OF

Pour #528 R.B. buttress 3 to 4, @ el. 98, contained a "lens" type void, approximately 6' long x $\frac{1}{2}$ " thick x about 12" deep.

This "lens" was caused by failure to remove sand blast sand from the depression into which it accumulated, prior to concreting. Similar condition occurred in pour #614 R.B.

To avoid recurrence, it is vital that a final thorough cleanliness inspection be made immediately before actual placement of concrete.


C. Pachos


E. P. Shows

CP/ES/rc

JJR - copy
file - copy

FLORIDA POWER CORPORATION
CRYSTAL RIVER UNIT #3

REQUEST FOR WAIVER

THE UNDERSIGNED REQUESTS TO
PERFORM THE FOLLOWING ACTIVITY

WITH/ON POUR #528 - BETWEEN BUTTRESS #3
AND #4 (EL. 98') I.E. CENTER OF EQUIP. HORN
TO BUTTRESS #4.

ACTIVITY IS SCORE WITH A SKILLSAW
1" DEEP ON EACH SIDE OF CONSTRUCTION
JOINT. REMOVE SCORED CONCRETE
BY CHIPPING AND INSPECT THE CONSTRUCTION
JOINT.

WAIVER TAG # 633 NCR # 0215 — FILE

FPC - POWER CONSTRUCTION ASSUMES RESPONSIBILITY FOR ANY AND
ALL CONSEQUENCES OF THIS ACTION AND UNDERSTANDS THAT, EXCEPT
FOR THE ABOVE ACTIVITY, SUBJECT ITEM REMAINS IN A "H O L D"
STATUS UNTIL SUCH TIME AS A "R E L E A S E" TAG REPLACES THE
"H O L D" AND "W A I V E R" TAGS.

RESPONSIBILITY: C. Pechon 21 DEC 72 FPC/PC
APPROVED: D. W. Redrick, PD 21 Dec 72 FPC/QP

DISTRIBUTION:

White Original FPC SITE QUALITY ENGINEER
Green FPC CONSTRUCTION SUPT.
Goldendrod FPC MGR. - QUALITY PROGRAMS

N9

243