

Lake, Louis

From: Lake, Louis *ll*
Sent: Thursday, December 10, 2009 8:46 AM
To: Dan naus
Subject: Emailing: NRC Request 12 Response.docx
Attachments: NRC Request 12 Response.docx

Attached is a response to Question #12 for your review.

3 Pages

Lou

The message is ready to be sent with the following file or link attachments:

NRC Request 12 Response.docx

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NRC SIT Request #12 Question#6 Information

Q. 6: Once the construction opening is refilled with concrete, how and for how long will the concrete be allowed to cure, and what is decision process for start of post-tensioning the structure?

NOTE: The response described below is based on the details as contained in EC 63016, Containment Opening. The items listed below will be reviewed and evaluated as concrete design for the de-laminated area is developed.

Response:

- Concrete will be cured for 7 days from the time of placement (Ref. 1).
- After forms are stripped a curing compound is applied (Ref. 1)
- Forms may be removed after 3 days, or sooner if the concrete has achieved a compressive strength of 3000 psi as demonstrated through strength testing (Ref. 1)
- Tendon retensioning starts with the verticals at buttress #3 and #4 (23V1 thru 23V3, 45V22 thru 45V24) after the concrete reaches a compressive strength of 5000 psi, followed by the remaining verticals outside the opening (34V18 thru 34V24, 34V1 thru 34V7) in parallel with the hoop tendons above and below the opening (42H22 thru 42H26, 53H23 thru 53H26, 42H35 thru 42H39 and 53H36 thru 53H39). After the concrete reaches 6000 psi the tendons within the opening are retensioned (34V8 thru 34V17 and 42H27 thru 42H34 and 53H27 thru 53H35). Tendon retensioning sequence is shown in detail on drawing 421-352 (Ref. 2).

The following is extracted from Ref. 3, page 86 and provides concrete mix strength information that may support removing the formwork earlier:

The use of autogenous curing containers is not planned during the containment opening concrete placement. Although autogenous containers would better represent the curing environment before formwork removal, their use involves additional resources and storage space. Therefore, standard curing methods will be used during actual concrete placement at the opening. To better understand what the difference in compressive strengths would be between the two methods, S&ME was tasked with testing a batch of concrete (concrete proportions based on results of Phase II testing i.e. Option 1A) and determining the difference in compressive strength between the two curing methods at 1, 2, 3, 5 and 28 days.

Attachment Z55R3 contains the S&ME test methodology and test results. Test results for compressive strength are reproduced below:

Age, days	Autogenous Containers	Alternative Proposed Curing	Autogenous/Alt
1	5,620 psi	4,760 psi	18% increase
2	6,450	5,930	9% increase

3	6,590	6,320	4% increase
5	6,860	6,830	0%
28	8,050	8,480	5% decrease

The results clearly indicate that the autogenous cured cylinders have higher early age strength which is as expected. The heat of hydration is (to some extent, over and above the standard cylinders) trapped inside the containers resulting in a harder concrete. These results would indicate that formwork could be removed as early as one day after completion of concrete placement.

Per Ref. 1:

Specified Concrete Strength: 6000 psi at 5 days, 7000 psi at 28 days

Slump: 6" to 9"

Air Entrainment: 0% to 3.5% maximum

Concrete Unit Wt: 145 pcf minimum

References:

1. Specification CR3-C-0003, Rev. 0, Specification for Concrete Work for Restoration of the SGR Opening in the Containment Shell.
2. Drawing 421-352, Rev. 0, RB Temporary Access Opening for SGR – Restoration – Sheet 1 of 1
3. EC 63016, Rev. 26, Containment Opening