

Screen # 08-010

Facility Name: TMI-2 ISFSI Change No.: EDF No: 8724

Activity Description: This EDF No. 8724 documents the results of participation in the January 2008 World of Concrete Program and Exhibits seminars on concrete cracking.

Use of this form must be in accordance with MCP-2925. Sufficient activity description, justifications, and documents reviewed must be provided to permit an independent reviewer to reach the same conclusions. The discussions in Appendix A should be used to develop any justifications documented below.

1. License Condition or Technical Specification: (Complete this section for all Part 72 screens.)

- 1a. Does the activity require any change, even editorial, to the license or technical specifications? Yes X No
- 1b. Does the activity require an exemption to any NRC regulations? Yes X No
- 1c. Is the activity a change to or require a change to FSV SAR Section 7.7, 9.3, or Chapter 11 or TMI-2 SAR Section 7.6, 9.3, or Chapter 11? Yes X No

Justification: This activity is an information gathering activity. No changes to any license or technical specification will result from this activity. This activity requires no exemption from any NRC regulation. This activity will not require any change to the TMI-2 SAR.

Documents Reviewed: None

If the answer to 1a or 1b is "Yes" the activity may not be implemented until NRC approval is obtained. If the answer to 1c is "Yes" a **72.44 Evaluation** in accordance with MCP-2925 is required before the activity may be completed.

2. Facility Change: If the activity is a physical change (addition, modification, or removal) within a facility or to any equipment or structure, or to any design document (drawing, calculation, analysis, specification, design input or assumption, etc.), then complete this section. Also complete this section for changes to the SAR. Otherwise indicate **N/A** at the end of this section.

- 2a. Does the activity adversely affect a design function of equipment or structures described in the SAR or TS Bases? Yes X No
- 2b. Does the activity adversely affect a method of performing or controlling a design function of equipment or structures described in the SAR or TS Bases? Yes X No
- 2c. Does the activity adversely affect an evaluation which demonstrates the design functions of equipment or structures described in the SAR or TS Bases? Yes X No
- 2d. Does the activity result in a change to the Technical Specification Bases? Yes X No

Justification (include effects that are not adverse): This EDF has no affect on design function, methods or any evaluation at the TMI-2 ISFSI.

Documents Reviewed: None

If any answer in Section 2 is "Yes" then a **72.48 Evaluation** in accordance with MCP-2925 is required before the activity may be completed.

3. Procedure Change: If the activity is a change to facility operation, maintenance, transport, test, or experiment procedures, then complete this section. Also complete this section for changes to the SAR. Otherwise indicate **N/A** at the end of this section.

Is the activity a modification to, addition to, or removal from any procedure that adversely affects the operation and control of equipment or structures as described in the SAR or TS Bases? Yes X No

Justification (include effects that are not adverse): N/A

Documents Reviewed: N/A

If this answer is "Yes" then a **72.48 Evaluation** in accordance with MCP-2925 is required before the activity can be completed.

10 CFR PART 72 SCREEN

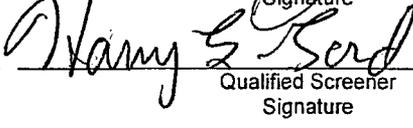
Conclusion:

If all the questions on this form are answered NO, then the signatures on this form will complete the 10 CFR Part 72 regulatory screen and the activity may proceed.

Assumptions & Limitations:

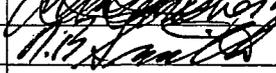
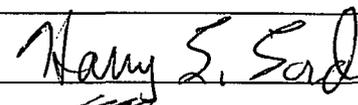
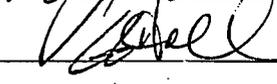
N/A

APPROVALS

M. D. Wilberg Complete By Trained Screener Print/Type Name		04/10/08 Date
H. L. Lord Independent Review By Qualified 72.48 Screener Print/Type Name		10 April 2008 Date

ENGINEERING DESIGN FILE

EDF No.: 8724 EDF Rev. No.: 0 Project File No.: N/A

1. Title: TMI HSM World of Concrete Concrete Cracking Seminar				
2. Index Codes: Building/Type <u>N/A</u> SSC ID <u>N/A</u> Site Area <u>INTEC</u>				
3 Commercial Level Calculation? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
*4. NPH Performance Category: _____ or <input checked="" type="checkbox"/> N/A SSC Safety Category: _____ or <input checked="" type="checkbox"/> N/A				
*5. (a) Affects Safety Basis: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ** (b) Affects SNF/HLW: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				
6. Summary:				
7. Review (R) and Approval (A) and Acceptance (Ac) Signatures: (See instructions for definitions of terms and significance of signatures.)				
	R/A	Typed Name/Organization	Signature	Date
Design Agent		M. D. Wilberg/ISFSI Management		04/01/08
Technical Checker	R	N. B. Smith/Engineering		4/1/08
*Independent Peer Reviewer (see instructions item 7, Note 2)	R	N/A		
*Design Authority (if applicable)	Ac			
*Nuclear Safety (only if 5(a) is Yes)	Ac	H. L. Lord/ ISFSI Management		4/1/08
Document Owner	A	K. E. Lombard/Engineering A&M		4/7/08
Requestor (if applicable)	Ac	R. L. Gardner/ ISFSI Management		4/1/08
NRC Regulation Compliance	Ac	G. G. Hall/ISFSI Management		4/1/08
8. Distribution: (Name and Mail Stop)		Document Control: R. C. Aeschbacher/ MS 1814-5105 		
9. Does document contain sensitive unclassified information? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, what category:				
10. Will document be externally distributed? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
*11. NRC related? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				
12. Registered Professional Engineer's Stamp (if required) <input checked="" type="checkbox"/> N/A				

* Not required for commercial level calculations.
 ** Refer to the Instructions for block 5 for further information.

PURPOSE

This EDF documents the participation of M. D. Wilberg in the World of Concrete (WOC) Program and Exhibits January 21 - 25, 2008 at the Las Vegas Convention Center, Las Vegas, Nevada. The purpose for participation in the World of Concrete Program and Exhibits was to receive education relating to concrete cracking and repair and identify possible causes for the cracking and solicit recommendations and solutions to repair and stop cracking of the Horizontal Module Storage (HMS) units containing Three Mile Island (TMI) storage casks.

ACTIVITIES

Attended five (5) three (3) hour Seminars in the WOC Education Program;

1. Concrete Repair Part I: Evaluation and Repair strategies
2. Concrete Repair Part II: Surface Preparation, Reinforcement Repair, Material Basics & Placement Techniques
3. Concrete Repair Part III: Structural Safety, Cement Based Material Selection, Formed Shotcrete Placement Techniques
4. Concrete Repair Part IV: Protection and Waterproofing Systems
5. Concrete Repair Part V: Structural Repairs and Strengthening Techniques.

Various parts of the seminars were presented by six (6) individuals;

- Predrag Popovic, PE; Wiss, Janney, Elstner Associates Inc.
- James Donnelly, PE; Wiss, Janney, Elstner Associates Inc.
- James E McDonald, PE; FACI; McDonald Consulting
- Jorge Costa, PE; Corrosion Restoration Technologies
- Jay Thomas, Structural Group.

I met with both Predrag (Pete) Popovic and James E McDonald separately and showed them the pictures contained in EDF No. 8465 and other photographs of the Horizontal Storage Modules (HSM) showing the cracking developing in various HSMs. Both Mr. Popovic and McDonald had similar responses to the figures in the EDF and the pictures. The cracking shown in Figure 1 page 7 of 11, Figure 2 page 8 of 11, and Figure 4 page 9 of 11 of the EDF were thought to be unusual cracking. The cracking in Figure 2 page 8 of 11 gave both men concerns about the soundness of the concrete. The cracking appears to them to be the result of concrete break down due to some chemical reaction. They would not speculate as to what specific reaction might be the cause of this break down. Both men suggested that a concrete testing laboratory with experience in determining the cause of concrete break up be consulted. They both suggested that core samples would be a good start in determining the cause of the cracking. The laboratory could also examine the other cracking and make suggestions for determining the cause of this cracking. Both men commented that the cause of all the cracking should be determined before recommendations for repairing the cracks were proposed. Both men agreed that the cracking developing in the HSMs was premature for concrete structures approximately 10 years of age.

A statement made by both Mr. Popovic and McDonald that the cause of the cracks needed to be determined before any recommendations for a repair strategy could be developed was consistent with the training presented in the Seminars. The instruction in the Seminars recommended that the first step in any concrete repair was to determine the cause of the cracking through a condition assessment or investigation. A condition assessment or investigation may include; visual survey, crack survey, delamination survey, reinforcement location, sample removal, exploration opening, non-destructive testing, or load testing followed by laboratory analysis, analysis of findings, repair strategy and final repair recommendation.

Mr. Popovic stated his company has the expertise to perform a condition assessment, analyze the results, and make the recommendation for repair. Mr. McDonald stated there was a laboratory company he was familiar with exhibiting in the WOC Exhibitions.

ENGINEERING DESIGN FILE

As part of my participation in the WOC Program I searched the Exhibitions to identify companies in the concrete coating (coating meaning any type of material being marketed to prevent water penetration of concrete) and repair business. Exhibitors I met with to obtain further information included;

- BASF Construction Chemicals
- Basic Polymers
- Carlisle Coating & Waterproofing
- Chem Masters Inc.
- Charlotte Queen Adventures
- DeNeff Construction Chemicals Inc.
- Ectoflex Coatings
- Euclid Chemical Company, The
- Pacific Polymers International.

I also met with CTL Group the laboratory suggested by Mr. McDonald.

I left my personal information with other vendors so they could send information to me. All of the coating exhibitors were anxious and willing to provide products to seal the concrete and cracks but none were willing or able to identify the cause of the cracking. The CTL Group was willing to investigate the cause of cracking in order to recommend a repair strategy.

BASIC PRINCIPLES TAUGHT IN THE SEMINARS

Concrete acts like and is compared to a hard sponge that will continue to absorb and give up water unless there is a barrier to preclude the action from continuing. All concrete is going to shrink. Concrete that goes through temperature changes will expand and contract with the temperature changes. Over time with constant loading concrete will experience creep or shape deformation. Cracks created by shrinkage, temperature changes, and creep can be controlled and minimized with proper concrete mix, proper concrete placement and proper concrete maintenance.

Cracks that become large enough to allow water to reach rebar will result in corrosion of the rebar. Corrosion of rebar will result in increased cracking of concrete, spalling of concrete, increased rate of corrosion of rebar, and eventually structure failure. Once corrosion of rebar has begun it will continue unless the conditions that cause it are eliminated (water and air).

Repairing cracking and spalling concrete without understanding and correcting the causes of the cracking and spalling will result in premature failure of the repair. Improper repair preparation and selection of repair material will result in premature repair failure. Currently industry statistics indicate approximately 50% of concrete repairs fail prematurely. One study showed a concrete slab with known concrete failure due to corrosion was left to continue to deteriorate; the damaged area increased approximately 40% in two years. Damaged concrete that is not repaired will continue to deteriorate and over time will deteriorate at an increasingly faster rate.

CONCLUSION

It is apparent from the figures in EDF 8465 that the TMI HSMs are experiencing cracking that will eventually result in rebar corrosion leading to greater concrete cracking, deterioration and possible structure failure. It is not readily apparent what is causing the concrete cracking. The cracking could be the result of design oversight, material specification, materials used, construction practices, or a combination.

With an understanding of the nature of concrete cracking and the current cracking exhibited in the HSMs it is reasonable to conclude that the cracking is going to continue and the rate of deterioration will

increase unless action to mitigate the cause is taken. Before any actions to mitigate can be recommended the cause or causes of the cracking must be determined.

An examination of the HSMs by a trained and experienced professional that can develop a condition assessment plan should be subcontracted to inspect the HSMs. The condition assessment plan could include; visual survey, crack survey, delamination survey, reinforcement location, sample removal, exploration opening, non-destructive testing, load testing followed by laboratory analysis, analysis of findings, repair strategy and final repair recommendation. When the cause of the cracking has been identified a repair analysis and repair strategy can be developed.

RECOMMENDATION

In the spring of 2008 a detailed inspection should be made to document with photographs and measurements the current cracking condition of each HSM. Along with the inspection of the outside surfaces this inspection should include a visual inspection with photographs of the inside of each HSM. This inside inspection with the use of cameras could be performed by the ICP robotics organization. An inspection of the pad should also be performed.

The condition assessment to determine the cause or causes of the concrete cracking should be performed by a trained and experienced professional concrete specialist. This condition assessment should take place in the spring of 2008.

Based upon the data collected by the specialist a repair analysis and strategy should be developed to repair and protect the HSMs.

Repairs, protection, and maintenance of the HSMs and the pad should be initiated in the summer of 2008.