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From: Thomas, George *NRK*
To: Hoang, Dan; Jessup, William; Uribe, Juan; Basavaraju, Chakrapani
Subject: FW: NORTH ANNA SEISMIC REPORT - Summary Report of August 23/ 2011 Earthquake Response and Restart Readiness Determination Plan North Anna Power Station Units 1 and 2 and ISFSI
Date: Monday, September 19, 2011 7:31:20 AM
Attachments: 11-520 Earthquake Summary Report and Restart Plan Final.pdf

FYI or use.

From: Martin, Robert *NRK*
Sent: Sunday, September 18, 2011 9:18 AM
To: Li, Yong; Farzam, Farhad; Tsirigotis, Alexander; Thomas, George; Uises, Anthony; Casto, Greg; Bailey, Stewart; Dennig, Robert; Evans, Michele; Lubinski, John; Taylor, Robert; Murphy, Emmett; McGinty, Tim; Pham, Bo; Murphy, Martin; Lupold, Timothy; Mitchell, Matthew; McMurtray, Anthony; Wilson, George; Mathew, Roy; Cheok, Michael; Tate, Travis; Harrison, Donnie; Circle, Jeff; Klein, Alex; Holian, Brian; Galloway, Melanie; Auluck, Rajender; Pelton, David; Rosenberg, Stacey; McGinty, Tim; Thompson, Jon; Boger, Bruce; Leeds, Eric; Khanna, Meena; Kulesa, Gloria; Howe, Allen; Boyle, Patrick
Cc: Bahadur, Sher; Weerakkody, Sunil
Subject: NORTH ANNA SEISMIC REPORT - Summary Report of August 23/ 2011 Earthquake Response and Restart Readiness Determination Plan North Anna Power Station Units 1 and 2 and ISFSI

From: Ginger L Rutherford [mailto:ginger.l.rutherford@dom.com]
Sent: Saturday, September 17, 2011 1:50 PM
To: Cotton, Karen; Davis (NMSS), Jennifer; Hiland, Patrick; Khanna, Meena; Manoly, Kamal; acmilankm@aol.com; Mendiola, Anthony; Howe, Allen; Martin, Robert; McCoy, Gerald; Boyle, Patrick; Karwoski, Kenneth; Giitter, Joseph
Subject: 11-520 - Summary Report of August 23/ 2011 Earthquake Response and Restart Readiness Determination Plan North Anna Power Station Units 1 and 2 and ISFSI

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D/193

MEMORANDUM TO: Eric J. Leeds, Director
Office of Nuclear Reactor Regulation

FROM: Patrick L. Hiland, Director
Division of Engineering

SUBJECT: ACTION PLAN TO ADDRESS NORTH ANNA POWER STATION
RESTART AS A RESULT OF AUGUST 23, 2011, EARTHQUAKE

On August 23, 2011, the North Anna Power Station (NAPS) declared an Alert due to significant seismic activity onsite resulting from an earthquake which had a measured magnitude of 5.8. On August 26, 2011, initial reviews of the data determined that the seismic activity potentially exceeded the NAPS Design Basis Earthquake magnitude value. Subsequently on August 26, 2011, the licensee declared all safety-related structures, systems and components inoperable and issued a 10 CFR 50.72 Notification.

In response to the recent seismic event, the staff is undertaking various initiatives to address plant restart activities at the NAPS, which includes an Augmented Inspection Team that was dispatched on August 31, 2011. In addition, the staff is in the process of identifying issues and questions for the licensee to consider in order to obtain NRC authorization for plant restart, in accordance with 10 CFR Part 100, Appendix A. The attached action plan describes and tracks the agency's ongoing initiatives related to the NAPS restart activities as a result of the recent seismic event.

Enclosure:
As stated

CONTACT: Meena Khanna, NRR/DE/EMCB
(301) 415-2150

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(301) 415-2150

INDICATE IN BOX: "C"=COPY W/O ATTACHMENT/ENCLOSURE, "E"=COPY W/ATT/ENCL, "N"=NO COPY

OFFICE	EMCB:DE	EMCB:DE	DORL:NRR	DSS:NRR	DCI:NRR	DLR:NRR
NAME	MKhanna	KManoly	RMartin	WRuland	MEvans	BHolian
DATE	9/ /2011	9/ /2011	9/ /2011	9/ /2011	9/ /2011	9/ /2011
OFFICE	DIRS:NRR	Region II	DE:NRR	NRR	NRR	NRR
NAME	MCheck	LWert	PHiland	BBoger	JGrobe	ELeeds
DATE	9/ /2011	9/ /2011	9/ /2011	9/ /2011	9/ /2011	9/ /2011

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NORTH ANNA POWER STATION RESTART ACTION PLAN

Last Update: 9/13/2011

Lead Division: DE

Supporting Divisions: DSS, DCI, DLR, DRA

Supporting Offices: Region II, NMSS, NRO, RES

TAC Nos. ME7050 and ME7051

Goal:

The goal of this action plan is to track the agency's ongoing initiatives related to the North Anna Power Station (NAPS) restart decision as a result of the recent seismic event on August 23, 2011.

Background:

On August 23, 2011, NAPS experienced a seismic event (5.8 magnitude earthquake reported by the U.S. Geological Survey) which resulted in a loss of offsite power and automatic reactor trip of both units. The licensee declared an Alert due to significant seismic activity at the site. Subsequent to the earthquake, the licensee stabilized both units, restored offsite power, and retrieved the recorded ground motions at the site resulting from the seismic event, which were sent to the vendor for analysis. On August 26, 2011, initial reviews of the data determined that the seismic activity potentially exceeded the Design Basis Earthquake (DBE) spectrum at frequencies above 5 Hz. Therefore, this event was reportable per 10 CFR 50.72(b)(3)(ii)(B) for the nuclear power plant being in an unanalyzed condition that may have significantly degraded plant safety.

The NAPS has two DBE, otherwise known as the Safe Shutdown Earthquake (SSE), ground motions, one for structures, systems, and components (SSCs) located on top of rock, which is anchored at 0.12 g, with the second DBE ground motion related to SSCs located on top of soil, which is anchored at 0.12 g. The NAPS has two corresponding Operating Basis Earthquake (OBE) ground motion spectra, anchored at 0.09 g for soil and 0.06 g for rock. The vendor has processed the initial seismic data. Preliminary results indicate certain measurements exceeded the SSE, at various frequencies above the limits reported in the final safety analysis report.

The current best estimate of the Peak Ground Acceleration (PGA) for the NAPS site, resulting from the recent seismic event, is 0.26 g, which contains uncertainty. This estimate indicates that the ground motion likely exceeded the DBE response spectra for NAPS Units 1 and 2 (0.12 g) over a considerable frequency range. The estimated ground motion from the earthquake was not surprising, based on the combined operating license application ground motion response spectrum for NAPS Unit 3. This preliminary estimate appears to validate the NRC's current seismic hazard assessment approaches and the basis for Generic Issue (GI)-199 reviews.

It was reported that NAPS potentially exceeded the DBE spectrum at frequencies above 5 Hz. The vibratory ground motions from the 5.8 magnitude earthquake were recorded in all three orientations (North-South, East-West, and Vertical) at several locations in the plant using two types of instruments: the Engdahl scratch plates that record 12 discrete spectral accelerations between 2 and 25.4 Hz, and the Kinometrics analog recorders that recorded time histories of the accelerations.

ENCLOSURE

The licensee has retrieved its seismic instrumentation recordings located at different elevation levels from within the plant and has processed some of the information from these recordings. Preliminary results from the seismic instrumentation indicate exceedance above the final safety analysis report (FSAR) DBE spectra at various frequencies, depending on the building, measurement direction, and elevation.

Both units are in Cold Shutdown (Mode 5) with the residual heat removal system providing core cooling. No significant equipment damage to safety-related systems (including Class 1 structures) has been identified through site walk-downs nor has equipment degradation been detected through plant performance and surveillance testing following the earthquake. The licensee indicated that the spent fuel pit cooling system also remains fully functional and the temperature of the spent fuel pit remained unchanged during the event. The licensee also indicated that the vendor will complete the analysis of the seismic data and this information will be utilized to address the long term actions following the earthquake.

It is also noted that the NAPS independent spent fuel storage installation (ISFSI) suffered minor damage from the earthquake. Twenty five of the twenty seven TN-32 casks slid up to 4.5 inches (4.5") on the concrete pad during the quake. Six cask sets (12 casks) were closer than the 16 foot separation distance specified in the FSAR. There was no damage to the pressure monitors in each cask and no pressure monitoring system alarms during or after the earthquake. There were no crack indications observed in the concrete pad or casks. For the TN-NUHOMS modules, some slight damage was identified around the outlet vents and some surface cracking indications were noted. Additionally, some modules showed gaps between them of approximately 1.5" versus the required 1.0" maximum gap.

The NRC initially dispatched a seismic and structural expert to assist the agency's resident inspectors on site. The NRC then dispatched an Augmented Inspection Team on August 29, 2011, to gather important information for the NRC's continuing evaluation of earthquake risk at US nuclear power plants.

Regulatory Outcome:

In accordance with Appendix A to Part 100, Paragraph V(a)(2), a nuclear power plant is required to be shutdown when the vibratory ground motion exceeds that of the Operating Basis Earthquake. In addition, the regulations state that, "Prior to resuming operations, the licensee will be required to demonstrate to the Commission that no functional damage has occurred to those features necessary for continued operation without undue risk to the health and safety of the public."

Licensee actions are underway to inspect, evaluate, test and repair, if necessary, systems and components to ensure they are capable of performing their required functions. The licensee is performing plant walk downs in accordance with Regulatory Guide (RG) 1.167, "Restart of a Nuclear Power Plant Shutdown by a Seismic Event," which endorses the Electric Power Research Institute (EPRI) Report No. NP-6800, "Guidelines for Nuclear Plant Response to an Earthquake," with conditions.

The staff's assessment will utilize the guidance provided in NRC's Regulatory Guide (RG) 1.167, which endorses the EPRI's guidelines. In addition, the staff will utilize the IAEA Safety Report Series No. 66, "Earthquake Preparedness and Response for Nuclear Power Plants," to determine the adequacy of the licensee's restart determinations. It should be noted that the

IAEA Safety Report acknowledges the prospect that hidden damage (especially after an SSE) is a real possibility and its effects should be evaluated with analytical evaluations. Specific actions are identified in the table below, entitled, "North Anna Nuclear Power Plant Restart Action Plan Milestones."

The acceptance criteria that will be utilized by the staff for approval of plant restart include satisfactorily addressing the following:

- (1) Confirmatory inspections by the region,
- (2) Visual walkdowns by the licensee in accordance with the EPRI guidelines,
- (3) Identification of short term evaluations by licensee (pre-restart), and
- (4) Identification of long term evaluations by licensee (post-restart).

Project Management Structure:

This project is being performed as a matrix organizational structure. Team members will support project activities directly but will report administratively through their normal management chain. Approvals will be achieved through the standard concurrence process.

Responsible Division Director (DD): Patrick Hiland, DE

Responsible Individuals: Meena Khanna and Kamal Manoly, DE

Other stakeholders and roles:

DD DORL: Joe Giitter

DD DSS: Bill Ruland

DD DCI: Michele Evans

DD DRA: Michael Cheok

DD DLR: Brian Holian

DD NMSS/SFST: Vonna Ordaz

DDD NRO/DSER: Nilesh Chokshi

DD, NRO/DE: T. Bergman

OPA: S. Burnell, Manage External Communications

OCA: E. Dacus, Congressional Liaison

Regions: R. Conte, RI; M. Franke and Gerald McCoy, RI; D. Hill, RI; G. Adams, RI; J. ...

DPR: A. Russell, Action Plan Structure, Action Plan website updates

Project Attributes:

The project will consist of five broad phases. The first phase involves continued collection of issues that the staff expects the licensee to address in the short term and long term. Objectives during this phase include assembling a catalogue of questions to request of the licensee to address in either inspection or licensing space. The first phase involves inspection and assessment of the licensee's walkdowns and activities, via the Augmented Inspection Team. The second phase involves identifying short term issues that the licensee must demonstrate prior to restart. The third phase involves identifying long term issues that the licensee must address following plant restart. These items may involve a series of public meetings, development of a temporary inspection instruction and, potentially, audits. The fourth phase addresses the development of a regulatory vehicle to ensure that the licensee adequately addresses the new design basis earthquake in its Updated Final Safety Analysis Report, as appropriate. The fifth phase includes the development of regulatory products, which includes potentially issuing an Order, generic communications, and developing communications tools, such as briefing sheets, as appropriate.

Project Success Criteria Include:

Licensee adequately implements the guidance stipulated in RG 1.167 (i.e., EPRI NP-6695 guidelines) and the initiatives within IAEA Safety Report No. 66, to effectively address short and long-term plant restart issues. Stakeholders are informed of and educated about the safety significance of this issue.

The milestones in the action plan and documents or products that result from completed milestones should be publicly available. Planning information, personnel assignments and draft documents will not, in general, be made public.

Current Status: As noted in table

Potential Problems: N/A

Closeout Criteria: N/A

Proposed Resources and Re-prioritization: Approximately 1.0 FTE is expected to be expended to address this issue. Re-prioritization may be required to support plant restart activities.

DE: G. Wilson, R. Matthew, M. Khanna
DCI: T. McMurtray, T. Lupold, M. Mitchell, and M. Murphy
DSS: G. Casto, R. Dennig, A. Ulses, A. Mendiola
DLR: B. Pham, R. Auluck, D. Pelton
DIRS: T. Tate, D. Harrison
NRO: C. Munson, R. Karas
NMSS: E. Love and E. Benner
RES: A. Kammerer
OPA: S. Burnell
OCA: E. Dicus
Region I: R. Conte
Region II: M. Franke
Region III: A. Shaikh
Region IV: G. Werner

References:

1. 10 CFR Part 100, Appendix A, Seismic and Geologic Siting for Nuclear Power Plants
2. RG 1.167, "Restart of a Nuclear Power Plant Shut Down By a Seismic Event"
3. EPRI NP-6695 Guideline, "Guidelines for Nuclear Power Plant Response to an Earthquake"
4. IAEA Safety Report No. 66, "Earthquake Preparedness and Response for Nuclear Power Plants"
5. Augmented Inspection Charter to Evaluate Total Loss of Offsite Power, Dual Unit Reactor Trips and Plant Equipment Issues Following a Seismic Event at North Anna
6. Dominion Presentation Slides, September 8, 2011(ADAMS Accession No. ML11252A006)

NORTH ANNA NUCLEAR POWER PLANT RESTART ACTION PLAN MILESTONES

Item#	Milestone	Completion Date	Lead
1	Applicable technical branches within DE, DSS, DCI, and DLR to identify questions and issues that the licensee should address for restart. This includes short term (prior to restart) and long term initiatives (post restart).	9/16/2011	DE
2	As issues are identified and finalized, weekly conference calls/meetings will be held with licensee to address short and long term actions.	Ongoing	DORL
3	Short term and long term actions and issues shall be identified and documented for issuance to the licensee via DORL.		DE
4	Questions and issues will be categorized in one of the following: (a) confirmatory inspections by the region, (b) items to be confirmed via licensee's visual inspection/walkdowns, (c) short term evaluations by licensee (pre-restart), and (d) long term evaluations by licensee (post-restart).		DORL/DE
5	Address any safety related concerns associated with the movement of the ISFSIs as a result of the earthquake, via questions and inspections.		NMSS
6	Upon Augmented Team Inspection exit, any follow-up issues/actions will be communicated and addressed by staff as appropriate. Region to seek assistance via appropriate vendor to address outstanding issues.		REGION II
7	Develop a team to address path forward in reviewing licensee's submittal for plans to restart.		DE
8	Develop the language for an Order, which could later be converted to a Confirmatory Action Letter, if needed.		DORL/DE
9	Upon receipt of licensee's formal request for restart submittal, team to assess results of their inspections and readiness reviews, with support from technical branches, as appropriate. This will include developing questions and final input to NRC restart document.		DE
10	Assess root cause for diesel generator failure and include in staff's document for restart. Any other issues shall be addressed similarly.		REGION II

Item#	Milestone	Completion Date	Lead
11	Conduct inspections at site to verify any outstanding issues.		REGION II
12	Develop template for NRC Restart Document and incorporate input from OGC, etc., as appropriate.		DORL
13	Conduct Public Meeting prior to issuance of NRC Restart Document.		DORL
14	Issue NRC Restart Document.		DORL
15	As necessary, determine the need for appropriate regulatory vehicle for long term issues, i.e., revisions to FSAR to address new DBE.		DORL/OGC/OE
16	Address any potential generic issues, e.g., seismic instrumentation power supplies, seismic monitor locations on structures as well as in the "free field," and seismic monitors on ISFSI pads.		Region II NMSS/DE/DPR
17	Continue to respond to routine communications between the resident inspectors and local officials based on public interest. See DE Communication Plan (ADAMS ML #).	Ongoing	DE
18	Address Issues for Resolution, as applicable		DE/DIRS