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From:	Khanna, Meena
To:	Boyle, Patrick
Cc:	Martin, Robert; Kulesa, Gloria
Subject:	FW: One Pager on North Anna Earthquake Issue - Updated Sept. 9, 2011
Date:	Wednesday, September 14, 2011 3:27:00 PM
Attachments:	One Pager on North Anna Earthquake Issue updated 9-9-2011 word doc.docx

From: Khanna, Meena
Sent: Monday, September 12, 2011 6:15 PM
To: Rakovan, Lance; Hiland, Patrick
Cc: Wert, Leonard; Manoly, Kamal; Wilson, George; Bowman, Gregory; Boger, Bruce; Holian, Brian; Grobe, Jack
Subject: One Pager on North Anna Earthquake Issue - Updated Sept. 9, 2011

Pat and Lance, as requested, here is the latest one pager (dated Sept. 9) regarding the North Anna earthquake issue.

Thanks,
Meena

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(17)

Summary of Earthquake Information for the North Anna Nuclear Power Plant (Last Update: September 9, 2011)

North Anna Design

The North Anna Nuclear Power Plant (NANPP) has two 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, and the other is for SSCs located on top of soil, which is anchored at 0.18 g. The NANPP has two corresponding Operating Basis Earthquake (OBE) ground motion spectra, anchored at 0.09 g for soil and 0.06 g for rock.

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

The licensee has retrieved its seismic instrumentation recordings located at different elevation levels from within the plant and has processed the initial information. Preliminary results from the seismic instrumentation indicate exceedance above the final safety analysis report (FSAR) design basis earthquake (DBE) at various frequencies, depending on the building, measurement direction, and elevation. The data will be used to inform the staff regarding actions necessary for restart as well as long term design verification.

The licensee is performing plant walk downs in accordance with RG 1.167, "Restart of a Nuclear Power Plant Shutdown by a Seismic Event," which endorses EPRI's "Guidelines for Nuclear Plant Response to an Earthquake" with conditions. The staff will assess the licensee's evaluation of SSCs that are most sensitive to ground motion in that frequency band.

Timeline

- On August 23, 2011, North Anna Power Station declared an Alert due to significant seismic activity onsite from an earthquake which had a measured magnitude of 5.8.
- The licensee conducted the 1st general walkdown of the plant as required by the North Anna Power Station abnormal procedure for seismic event.
- The licensee conducted the 2nd walkdown after the magnitude 4.5 aftershock.
- Preliminary readings of the Seismic Response Spectrum Recorder (scratch plate) and the magnetic tapes identified that the Design Basis Earthquake had been exceeded at certain frequencies. On August 26, the licensee declared all safety-related SSCs of Units 1 and 2 inoperable and issued a 10 CFR 50.72 Notification.

Post Event Response

- An Augmented Inspection Team arrived on site on August 31, 2011.
- The initial determination by the licensee was that the U1 and U2 reactor trip signals were initiated by the reactor protection system negative neutron rate flux trips that occurred prior to the loss of offsite power.

- Preliminary data provided by the licensee indicate that the DBEs at different elevation levels have been exceeded in both the horizontal and vertical directions at different frequencies (see attached sample figure).

- The licensee's inspections have not identified any safety related equipment which failed during the event except for the 2H EDG. When it became evident that the DBE had been exceeded, the licensee declared all the safety related equipment in both units inoperable and took action to place the units in cold shutdown.

- Preliminary data from the licensee's investigation with regards to the 2H EDG failure indicates that a cooling water system gasket may have been installed incorrectly.

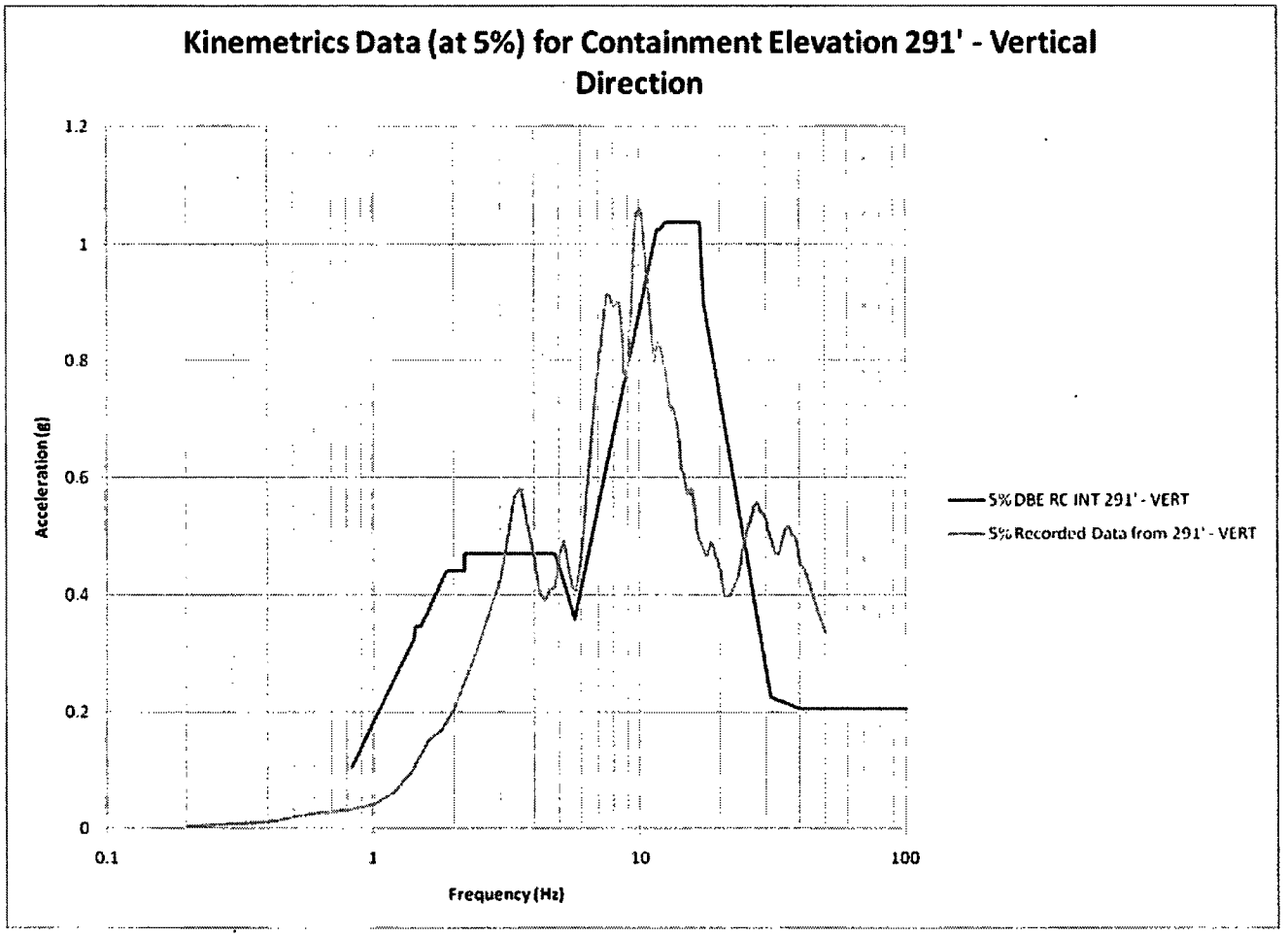
Path Forward

- A public meeting was held, at the licensee's request, on September 8, 2011. The licensee discussed its initial assessment of the earthquake's impact on the North Anna plant and presented some of its future plans.

- Staff is developing an Action Plan that will include the staff's expectations on topics or actions that will be reviewed prior to a plant restart decision.

- Licensee will submit request for restart that will provide results of their inspections and readiness reviews.

- Appropriate regulatory vehicle is being considered to assure licensee's actions are adequate.



The figure above, as submitted by the licensee, compares the observed ground motion in the vertical direction to the exceeded design motion at various frequencies. The blue curve is from the observed readings and the purple curve is the design spectrum at the same elevation level.

Refer to RAI

North Anna Independent Spent Fuel Storage Installation
Response to Earthquake

Background:

The North Anna Independent Spent Fuel Storage Installation (ISFSI) uses two spent fuel storage systems manufactured by Transnuclear (TN).

1) Twenty seven vertical TN-32 metal casks under a 10 CFR Part 72 site specific license. This system has a bolted closure lid with a pressure monitoring/alarm system, and stands freely on the ISFSI concrete pad. The design/licensing basis for the vertical TN-32 is controlled primarily by the North Anna ISFSI FSAR and NRC license (SNM-2507) and NRC certificate (1021). The FSAR defines the design acceleration values of 0.18g horizontal and 0.12g vertical, and sliding was not predicted to occur at these values.

2) Twenty six TN NUHOMS HD-32PTH horizontal storage modules (13 loaded) under a 10 CFR Part 72 general license. This system uses a welded-sealed canister and rests on horizontal rails inside the horizontal storage module. The design/licensing basis for the TN NUHOMS HD is controlled primarily by the separate TN-NUHOMS FSAR and NRC certificate (1030), as supplemented by additional site-specific evaluations that were performed by North Anna under 10 CFR 72.212. NUHOMS-HD components are designed to acceleration values of 0.3g horizontal and 0.2g vertical.

Event:

The North Anna ISFSI suffered minor damage from the earthquake:

1) Twenty five of the twenty seven TN-32 casks slid up to 4.5 inches 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.

2) 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.

Preliminary Determination of Safety Significance:

The staff believes there is no immediate safety issue. The cask designs are robust and consider severe natural phenomena. As expected, the casks withstood the earthquake at North Anna. The spent fuel continues to be surrounded by several tons of steel and concrete, and sealed in an inert helium environment. Damage to concrete components appear to be cosmetic, and does not impact structural integrity or radiation shielding capability. Additionally, the fuel assemblies are designed to withstand a maximum of 4 g axial load and 6 g lateral load. Inlet and outlet vents were inspected and no exterior blockage was found. Radiation surveys indicate no changes to cask surface dose rates. Thermal performance measurements for all loaded casks found no abnormal temperature differences.

Additionally, for the TN-32 casks, the requirement specifying a minimum distance of 16 feet between casks with a heat load greater than 27.1 kW was conservatively established so that the casks do not influence each other thermally and to allow for emplacement on the pad by the cask transporter. Currently, the two casks with the least separation (15 feet, 3.5 inches) are casks that had decay heats of 15.4 kW and 18.0 kW when loaded in 2000 and 2001, both well below the 27.1 kW requirement.

Licensee Response:

The licensee is following RG 1.166, "Pre-Earthquake Planning and Immediate Nuclear Power Plant Operator Post-Earthquake Actions," as a guide to perform their post-event assessment and has completed walkdowns of the ISFSIs.

The licensee reviewed this event for reportability under 10 CFR 72.75 (significant reduction in effectiveness of any spent fuel storage cask confinement system) and determined that the TN-32 displacement and NUHOMS-HD damage described above was not reportable.

The licensee contacted TN and provided them with all available pictures, data, and inspection results. TN requested that the licensee perform a more detailed inspection and evaluation of the current condition and sent a team to support this inspection.

NRC Response:

Item 10 of the AIT charter requires the AIT to "Assess the extent of any impact or damage to the Independent Spent Fuel Storage Installation from the seismic event." NMSS and Region II will continue to support the AIT and evaluate information related to the ISFSI to determine whether longer-term licensing or inspection actions are warranted for North Anna or generically.

On September 1, 2011, AIT completed a walk-down of the ISFSI Pads and has concluded that there are no indications of immediate safety issues associated with the movement of the vertical and horizontal ISFSI modules. Radiological conditions are normal and monitoring systems are functional. Damage as a result of the earthquake did not seem detrimental for the integrity of the casks.

On September 7, 2011, NMSS and Region II participated in technical discussions with the licensee to discuss near and long term ISFSI plans. NMSS will determine appropriate vehicle to ensure that the licensee takes appropriate action.