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From: Billy Jessup -NRR
To: Khanna, Meena; Jessup, William
Subject: Summaries of IAEA Report No. 66
Date: Tuesday, September 13, 2011 8:23:06 AM
Attachments: IAEA Report No 66_Summary for Restart Actions.docx
IAEA Report No 66_Fundamentals.docx

Meena,

I am attaching two documents which I have drafted regarding IAEA Report No. 66. I noted yesterday that you requested an introductory-type summary of the report, which I assume would be used as the front matter for any document we send off with our recommendations. I have drafted this summary and attached it as the file "IAEA Report No 66_Fundamentals." It is two paragraphs long, which is about as concise as I could get the information.

I have also attached a ~2 page document describing more key facets of the report. This would be mostly for your information, as it is too long really to include with any other information EMCB may send off. I would read the longer report prior to trying to absorb the shorter report (this may enable you to fine-tune the shorter summary to your liking).

I am going to continue reviewing this document, in addition to the other document regarding the KK actions. From the discussions yesterday, I believe all of our proposed actions are in alignment with the IAEA document and the actions taken by TEPCO following the KK incident. I think the only disagreements were surrounding what should be completed long term and what should be completed prior to restart. I have noted on the two attached documents that the IAEA Report No 66 offers the areas of aging management and hidden damage as ways to augment the inspection "requirements" which correspond to each action level. That is to say, while Action Level 5 really only requires the bare minimum prior to restart, EMCB could state that IAEA report no. 66 acknowledges the prospect that hidden damage (especially after an SSE) is a real possibility and its effects should be evaluated with analytical work. I think that is our biggest tool in trying to get the licensee to do anything past inspections prior to restart.

I am around all day for phone calls until about 3:15p, then I will be out of class after 6:00p.

Thanks.

Billy

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Guidance Regarding the Use of IAEA Safety Reports Series No. 66

"Earthquake Preparedness and Response for Nuclear Power Plants"

as Applied to the Restart of North Anna Power Station

As stated in the report's Forward section, there are recent instances where nuclear power facilities have experienced seismic events where the measured ground motions have exceeded the design or evaluation bases. While most facilities did not identify any significant damage following these events, the report acknowledges that there is a need for specific criteria and detailed procedures for addressing situations where seismic design bases are exceeded.

The objective of the IAEA report discussed here within is to provide updated and detailed guidance on the actions taken in preparation for and following a felt earthquake at a nuclear power facility, including those felt earthquakes which have exceeded the original seismic design basis. The report is based on IAEA Member States seismic safety knowledge and experience gathered up to 2010. With respect to the NRC's operations, the report acknowledges that it may be used by regulatory bodies during the decision making process for continued operations, shutdown and plant restart following a felt earthquake. Of particular importance with, respect to the restart of the North Anna Power Station (NAPS) following the August 23, 2011, Mineral, VA, earthquake, the IAEA report places a great deal of emphasis on the steps for restarting a facility following a seismic event, including those which exceed a facilities design basis earthquake (defined in the report as an SL-2 level earthquake).

Section 2 of the IAEA report, "Overview of a Post-Earthquake Action Program," notes that the emphasis of the actions described within the report focus on the physical and functional condition of the plant when making the decision to restart, as opposed to the results of analytical evaluations which can often be performed after restart of the facility. The report provides a methodical approach for the shutdown and restart of a facility following a felt earthquake. This approach is a function of three primary parameters: the earthquake level (EL), which is defined for U.S. plants in Section 2.1.2 of the report as an SL-1 for operating basis earthquake (OBE) and SL-2 for a safe shutdown earthquake (SSE); the damage level incurred at the facility following the seismic event, which range from minimal damage (DL 1) to severe damage (DL 4), with a formal definition of significant damage and examples provided in Section 3.4 of the report; and the final parameter being the effects of the event on systems, structures and components (SSCs) important to safety and not important to safety, the latter of which is divided further into SSCs required for power generation and those not required for power generation.

Based on the magnitudes of these three parameters, Table 2 of the report defines eight different action levels for which a facility should be placed following a seismic event. For each action level, Section 5 of the report, "Actions for Restart," provide prescriptive procedures to demonstrate the safety of a facility before restarting. These procedures are based on a combination of a) initial focused inspections and tests, b) expanded inspections and tests, c) comparative analyses, d) non-destructive examinations and e) surveillance tests. The action level for which a facility is placed determines the appropriate combination of items a) through e),

above, which should be performed prior to restart. For example, a facility which sees an SL-2 seismic event with no damage to important to safety and not important to safety SSCs would fall under Action Level 5. Action Level 5, as noted in the report, would only require the successful completion of initial focused inspections and tests (item a) above) before the plant restarts.

In addition to the action levels and the corresponding post-earthquake inspection and analysis procedures associated with each action level, the report provides two additional points of technical interest which could be used to augment the post-earthquake actions prescribed by the appropriate action levels. These two points are aging management considerations and hidden damage. With respect to aging management, the report notes that the effects of a seismic event should be incorporated into the evaluation of SSCs within the facility's current aging management program. For hidden damage, the report cites two types of hidden damage as those which should be given consideration: damage to hidden parts and invisible and/or undetectable damage. The former refers to damage which can only be found by disassembly of an SSC, examples of which are provided under items (1)(i) through (1)(iii) in Section 2.1.5 of the report. The latter type of hidden damage refers to hidden structural damage to components resulting from a seismic event, including a loss of fracture toughness, increased fatigue usage in metallic components, plastic deformation and cracks inside concrete (i.e., around embedded anchorages). Of particular importance, when a facility has a felt earthquake exceeding the SL-2 level, the report recommends that the integrity of SSCs be confirmed by conducting analytical evaluations of representative SSCs (i.e., limiting SSCs) or by comparing the actual seismic response of SSCs to past qualifying test results.

Section 6 of the report addresses long term actions which, in general, can be completed after restart. These long term actions include 1) the evaluation of seismic hazard and definition of seismic ground motion for evaluation purposes, 2) the evaluation of the response of soil, rock, foundation, structure and subsystems and 3) upgrades. The report notes that, in general, any earthquake exceeding SSE (SL-2) requires these long term evaluations to be performed.

Overview of IAEA Safety Reports Series No. 66

The objective of the IAEA Safety Report No. 66, "Earthquake Preparedness and Response for Nuclear Power Plants," is to provide updated and detailed guidance on the actions taken in preparation for and following a felt earthquake at a nuclear power facility, including those felt earthquakes which have exceeded the original seismic design basis. Section 2 of the report, "Overview of a Post-Earthquake Action Program," notes that the emphasis of the actions described within the report focus on the physical and functional condition of the plant when making the decision to restart, as opposed to the results of analytical evaluations, which can often be performed after restart of the facility. The report provides a methodical approach for the shutdown and restart of a facility following a felt earthquake. This approach relies on placing a plant under a designated action level (Table 2 of report), based on the seismic event magnitude and damage to the facility, with a distinction between damage to safety related and non-safety related SSCs.

Section 5 of the report, "Actions for Restart," provides detailed guidance and procedures for the restart of a facility, based on the action level prescribed for a facility. The aforementioned guidance and procedures are based on a combination of the following: a) initial focused inspections and tests, b) expanded inspections and tests, c) comparative analyses, d) non-destructive examinations and e) surveillance tests. Section 2 of the report provides additional information regarding instances where the actions for restart can be augmented, notably with respect to a facility's aging management program and for SSCs which may be susceptible to hidden damage. The report places additional emphasis on hidden damage when a seismic event exceeds a facility's design basis earthquake level, noting that representative analytical evaluations should be performed to confirm the integrity of SSCs. Section 6 of the report, "Long Term Actions," addresses long term actions which, in general, can be completed after restart. These long term actions include 1) the evaluation of seismic hazard and definition of seismic ground motion for evaluation purposes, 2) the evaluation of the response of soil, rock, foundation, structure and subsystems and 3) upgrades.