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April 29, 2011

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Dr. Kaye D. Lathrop
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Atomic Safety and Licensing Board
190 Cedar Lane E.
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Re: Indian Point Nuclear Generating Station, Unit 2 and Unit 3
Docket Nos. 50-247-LR/50-286-LR; ASLBP No. 07-858-03-LR-BD01

Dear Administrative Judges:

The State submits this letter to bring two recent documents to the attention of the Board and the parties in connection with NYS Contention-25.

On September 15, 2010, New York State filed State of New York's Motion for Leave to File Additional Bases for Previously-Admitted Contention NYS-25 In Response to Entergy's July 14, 2010 Proposed Aging Management Program for Reactor Pressure Vessels and Internal Components, ML103050402. Included with the Motion was Additional Bases for Previously-Admitted Contention NYS-25 (Embrittlement of Reactor Pressure Vessels and Associated Internals). *Id.* Attachment. Among the proposed additional bases was:

> 3.4 Entergy's recently-proposed aging management program is also inadequate because it:
>
> (a) does not specify with any meaningful precision when the replacement or repair of embrittled reactor vessel internal components will take place (NL-10-063 at 88);
> (b) disavows taking any preventative action to manage the effects of embrittlement aging of reactor vessel internal components (NL-10-063 at 86);

> (c) relies on less reliable remote-control VT-3 examinations to examine baffleformer assembly plates and edge bolts instead of the more reliable volumetric ultrasonic testing (UT) (which Entergy states it will use to examine the nearby baffle-to-former bolting) (NL-10-063 at 87; EPRI MRP-227 at 4-4 to 4-5, 4-14 to 4-16).
>
> These deficiencies in the proposed aging management program violate 50 C.F.R. § 54.21 (c)(1) (iii) and could have profound safety consequences for the State and its citizens.

Id. Attachment at 2. In support of these bases the State provided, *inter alia,* the following:

> 7.5 Entergy did not disclose that certain visual examinations (class VT-3 examinations) would be done by remote control. EPRI MRP-227 at 4-4. Moreover, Entergy did not disclose that other visual examination methodologies (class VT-1 and class EVT-1) have a greater degree of detection than class VT-3 examinations. Compare NL-10-063 at 87 with EPRI MRP-227 at 4-4.

Id. Attachment at 3-4.

The State has found two documents on ADAMS, which according to ADAMS are dated March 22, 2011 and were posted on ADAMS on March 30, 2011, that provide additional direct support for proposed basis ¶ 3.4 (c) and that are supplemental to Supporting Evidence ¶ 7.5. The two documents, which are attached to this letter, are:

> Reasons for Non-concurrence on "Draft Safety Evaluation for the Electric Power Research Institute's Topical Report (TR) Materials Reliability Program (MRP) Report 1016596 (MRP-227), Revision 0, 'Pressurized Water Reactor (PWR) Internals Inspection and Evaluation Guidelines.'" R.L. Tregoning RES/DE, ML110770169
>
> Comments for the Document Sponsor to Consider Pertaining to Non-Concurrence on "Draft Safety Evaluation for the Electric Power Research Institute's Topical Report (TR) Materials Reliability Program (MRP) Report 1016596 (MRP-227), Revision 0, 'Pressurized Water Reactor (PWR) Internals Inspection and Evaluation Guidelines.'" Michael J. Case RES/DE, ML110810787

Thank you for consideration of these documents.

Respectfully submitted,

s/
John J. Sipos
Assistant Attorney General

cc: All individuals, parties, or NRC offices on the Service List

NYS April 29, 2011 letter Attachment

Reasons for Non-concurrence on "Draft Safety Evaluation for the Electric Power Research Institute's Topical Report (TR) Materials Reliability Program (MRP) Report 1016596 (MRP-227), Revision 0, 'Pressurized Water Reactor (PWR) Internals Inspection and Evaluation Guidelines.'"

R.L. Tregoning

RES/DE

ML110770168

&

Comments for the Document Sponsor to Consider Pertaining to Non-Concurrence on "Draft Safety Evaluation for the Electric Power Research Institute's Topical Report (TR) Materials Reliability Program (MRP) Report 1016596 (MRP-227), Revision 0, 'Pressurized Water Reactor (PWR) Internals Inspection and Evaluation Guidelines.'"

Michael J. Case

RES/DE

ML110810787

Reasons for Non-concurrence on "Draft Safety Evaluation for the Electric Power Research Institute's Topical Report (TR) Materials Reliability Program (MRP) Report 1016596 (MRP-227), Revision 0, 'Pressurized Water Reactor (PWR) Internals Inspection and Evaluation Guidelines.'"

R.L. Tregoning
RES/DE

The Materials Reliability Program's Report 1016596, Revision 0, "Pressurized Water Reactor (PWR) Internals Inspection and Evaluation" (MRP-227) provides the nuclear industry's requirements for conducting inspections of reactor vessel internals to satisfy commitments to conduct such inspections during the period of extended operation (i.e., license renewal). Recognizing that many of these components have never been inspected throughout the first 40 years of operation, these commitments are necessary to provide the Nuclear Regulatory Commission (NRC) with reasonable assurance that the RVI components will continue to have acceptable performance under all licensing basis conditions. Inspection of components with high safety significance is especially important, even if the expectation is that degradation of these components is unlikely.

MRP-227 summarizes the results of industry's evaluation to identify the components that should be inspected. The industry first evaluated the susceptibility of each reactor vessel internal (RVI) component to one, or more, of eight degradation mechanisms. Components were judged to either be susceptible or not susceptible to one or more of these mechanisms. Then, a failure, modes, and effects analysis (FMECA) was conducted for those components initially identified as susceptible to degradation. The FMECA was used to further evaluate the likelihood of the materials susceptibility (e.g., low, medium, or high) and identify the severity of the damage that could occur if the component were to fail by the susceptible mechanism(s). Additional finite element simulation and engineering evaluations were also conducted for selected components to both verify and further evaluate the initial FMECA recommendations. These analyses, in total, were used to develop the MRP-277 recommended inspection categories for each RVI component.

The MRP-227 approach is generally adequate except that there is a high premium placed on a material's susceptibility. If a component is not deemed to be susceptible to one of the eight degradation mechanisms, then that component is not inspected regardless of the safety significance of the component. The potential deficiency with this rationale is that service failures tend to be driven by the local conditions (i.e., environment, stress, materials) at the failure location within the component and not the global conditions associated with the particular component. It is possible to have a good understanding and expectation of the global conditions, but much more difficult to accurately assess the local conditions that often lead to failure. One of the principal reasons for conducting inspections is to verify the expected component degradation and performance over the period of extended operations. The inspections also demonstrate the adequacy of relevant evaluations of component performance that are typically based on either laboratory or simulation testing.

The safety evaluation of MRP-227 (SE), in general, imposes several conditions and plant-specific action items that address many of the concerns that NRC staff has raised about possible gaps and inconsistencies in MRP-227 related both to the approach and the subsequent inspection recommendations. These conditions and action items are both appropriate and needed to provide NRC staff with reasonable assurance that the RVI components will perform their intended function under all licensing basis conditions. However, I believe that there is an additional condition which should be imposed to assure that the inspections are appropriate for identifying the degradation mechanism of concern in all components.

This additional condition is related to the recommended inspection methods. Of the eight degradation mechanisms, there are several that could lead to cracking within a component. These mechanisms are fatigue, stress corrosion cracking (SCC), and irradiation-assisted stress corrosion cracking (IASCC). Often, MRP-227 recommends that either ultrasonic testing (UT) or enhanced visual testing level 1 (EVT-1) be performed to identify cracking due to these mechanisms. Both of these methods have been used in previous BWR and PWR RVI inspections and have generally been successful in identifying cracking before the ultimate failure of the inspected components. In my opinion, both of these examination methods are acceptable to identify such cracking during RVI inspections.

However, for several components, MRP-227 recommends that a less-sensitive visual inspection method (i.e., VT-3) be used to identify cracking in the PWR RVI components. The VT-3 method, as identified within American Society of Mechanical Engineers (ASME) Section XI, Examination Category B-N-3 (and summarized in MRP-227), provides a set of relevant conditions (i.e., it is acceptable) for identifying

1. Structural distortion or displacement of parts to the extent that component function may be impaired;
2. Loose, missing, cracked, or fractured parts, bolting, or fasteners;
3. Corrosion or erosion that reduces the nominal section thickness by more than 5%;
4. Wear of mating surfaces that may lead to loss of function; and
5. Structural degradation of interior attachments such that the original cross-sectional area is reduced more than 5%

As indicated by the list, a VT-3 inspection is typically used to identify (1) gross deformation in a component, (2) missing or failed components, or (3) portions of a component or system that are missing or have failed (i.e., locking devices).

Conversely, the EVT-1 method, as summarized in MRP-227, contains additional requirements that are intended to improve the detection and characterization of discontinuities. As a result, EVT-1 inspections are capable of detecting small surface breaking cracks and sizing surface crack length when used in conjunction with sizing aids. As stated in MRP-227, EVT-1 is the appropriate non-destructive examination (NDE) method for detecting cracks in plates and their welded joints.

Part of the rationale provided by the industry, and accepted within the SE, is that those components that have been recommended for VT-3 and are susceptible to cracking have significant margin prior to failure. Therefore, the cracking will be extensive and the associated component deformation will be large enough such that a VT-3 examination will identify this degradation before component integrity has been comprised. However, the industry did not provide an evaluation of any of the components recommended for VT-3 examination to substantiate this claim. Further, operating experience has shown that extensive cracking in welds, heat-affected zones, and other susceptible locations can occur with little component deformation as the crack grows, especially if the component is subjected to a combination of relatively high residual stress fields and relatively low operating stresses. These conditions are anticipated for many of the RVI components that are susceptible to SCC and fatigue. Some of the RVI components may, over time, experience partial or total relief of high residual stresses due to the effects of radiation. While radiation lowers the applied stresses that can lead to cracking, it also decreases the material's inherent resistance to cracking such that IASCC may still occur. Like SCC and fatigue cracking, IASCC typically exhibits tight cracks with little gross component deformation at the relatively low applied stress levels expected within RVI components under normal operating conditions.

As described previously, my opinion is that the characteristics of the cracking which may occur due to fatigue, SCC, and IASCC mechanisms in RVI components are not amenable to discovery using the VT-3 method in a timely manner. The RVI components subjected to such mechanisms should be examined using EVT-1 or UT examination methods. Alternatively, other non-visual surface inspection methods such as eddy current testing are potentially acceptable for identifying cracking in RVI components, but no other such methods have been recommended within MRP-227. Therefore, my recommendation, which was not adopted in the SE, is that either the EVT-1 or UT examination methods should be required for inspecting all RVI components that are susceptible to cracking as identified in MRP-227. I propose that this condition be imposed on those applicants/licensees that utilize MPR-227 as the basis for their aging management program for RVI components during the period of extended operations.

Comments for the Document Sponsor to Consider Pertaining to Non-Concurrence on "Draft Safety Evaluation for the Electric Power Research Institute's Topical Report (TR) Materials Reliability Program (MRP) Report 1016596 (MRP-227), Revision 0, 'Pressurized Water Reactor (PWR) Internals Inspection and Evaluation Guidelines.'"

Michael J. Case
RES/DE

I agree with Mr. Tregoning on the inadequacy of VT-3 inspection method for reactor internal inspections identified in MRP-227 for the following reasons:

- In the context of the regulatory application of this topical report (license renewal), it is the industry's (or licensee's) burden to present sufficient information as to why the particular inspection technique is effective in managing aging in the period of extended operation. Given the lack of PWR internal inspections results, it is uncertain whether the VT-3 technique is effective as part of an aging management program to identify cracking in RVI components.

- Given this uncertainty and given the breadth of this program (all PWRs) and its potential application in the extended term and subsequent renewal periods (i.e. over the next 40 years), I believe it is premature to use a more relaxed inspection method until sufficient data on this issue is developed.

- The NRC can always relax its inspection requirements when new data is presented. Conversely, by initially adopting a relaxed inspection method, the staff would have to demonstrate that a significant safety issue is involved in order to increase the requirements should experience demonstrate problems with the VT-3 technique.

- If the relaxed inspection method is adopted, the NRC has no regulatory means to collect the results of these inspections to assess their effectiveness as an aging management program.

In conclusion, given the uncertainty of the effectiveness of the VT-3 technique, I agree with Mr. Tregoning that the EVT-1 or UT technique should be adopted to identify cracking in RVI components until such time that the industry provides sufficient operational experience to substantiate the VT-3 technique as an effective aging management technique for identifying cracking in reactor vessel internal components.