Entergy

Entergy Nuclear Northeast
Entergy Nuclear Operations, Inc.
Indian Point 3 NPP
P.O. Box 308
Buchanan, NY 10511
Tel 914 736 8001 Fax 736 8012

Robert J. Barrett
Vice President, Operations–IP3

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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop O - P1 -17
Washington, DC 20555-0001

SUBJECT: Indian Point Nuclear Generating Unit No. 3
Docket No. 50-286
Reconciliation of the Technical Bases of IP3 Leak Before Break RCS Leakage Detection Capability Licensing Design Basis Documented in March 1986 Safety Evaluation Report

REFERENCES:

1. USNRC letter to Indian Point Nuclear Generating Unit No. 3, "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Elimination of Large Primary Loop Ruptures as a Design Basis," dated March 10, 1986.

2. USNRC Generic letter, 84-04, "Safety Evaluation of Westinghouse Topical Reports Dealing With Elimination of Postulated Pipe Breaks in PWR Primary Main Loops," dated February 1, 1984.

Dear Sir:

This letter transmits Entergy's reconciliation, for NRC approval, of the technical bases for the Indian Point 3 (IP3) Reactor Coolant System (RCS) leakage detection capability related to "leak before break" (LBB) methodology criteria previously approved by the NRC. Based upon various IP3 submittals regarding elimination of large primary loop piping ruptures as justification for not installing pipe whip restraints to mitigate asymmetric LOCA loads, as well as Reference 2 guidance, NRC provided Reference 1 which summarized the subject RCS leakage detection capabilities on page 7 (section on Leak Detection Capability) of this SER. (Refer to Reference 1 for a listing of various IP3-related submittals from June 25, 1981 through April 1, 1985).

Reference 1, an NRC Safety Evaluation Report (SER), indicated a specific RCS leakage detection capability for containment air particulate and gaseous radioactivity monitors, R-11 and R-12, respectively. This capability was specified as "detecting a one gpm change in leak rate in less than four hours" for each of R-11 and R-12. This approved SER added that operability of the plant is governed by a satisfactory Technical Specification (TS) limiting condition for operation (LCO) on this overall leak detection system, where at least one of the two available RCS leak detection systems (R-11 or R-12) possess a sensitivity to radioactivity capable of detecting a one gpm leak in four hours during power operation.

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This one gpm within 4 hours leak detection capability for R-11 and R-12 was submitted by IP3 and approved by NRC based upon various assumptions of plant conditions. Key assumptions, among others, included values of 1% failed fuel and 0.4 microcuries/cc reactor coolant corrosion product radioactivity level. However, since current and historical IP3 values for failed fuel and reactor coolant system (RCS) activity level are significantly less than these values (typically on the order of approximately .0001% failed fuel and .01 to .02 microcuries/cc RCS activity level, respectively, for current RCS conditions), previously approved R-11 and R-12 leakage detection capability criteria of one gpm within 4 hours require licensing technical bases reconciliation via an NRC SER supplement/revision regarding Leak Detection Capability, as it relates to the overall LBB methodology.

The Attachment to this letter provides the technical reconciliation discussion concerning R-11 and R-12 leakage detection capability as it relates to effective support of the overall IP3 LBB technology. This Attachment also discusses the other diverse means of RCS leakage detection capability. Review of correspondence for LBB-related limitations involving similar radioactivity monitor leakage detection capability at various PWRs indicates that similar licensing design basis reconciliation requests have recently been submitted to and addressed by NRC.

Entergy respectfully requests that NRC review and approve this licensing technical bases reconciliation to result in a revised leakage detection capability portion of the subject LBB SER dated March 10, 1986. Entergy is making no new commitments in this letter. If you have any questions, please contact Mr. John Donnelly, IP3 Manager of Licensing, at 914-736-8310.

Very truly yours,

Robert J. Barrett
Vice-President, Operations
Indian Point Nuclear Generating Unit No. 3

Attachment

cc: Regional Administrator
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Resident Inspector Office
Indian Point Nuclear Generating Unit No. 3
U.S. Nuclear Regulatory Commission
P.O. Box 308
Buchanan, NY 10511

Mr. William M. Flynn, President
New York Energy, Research and Development Authority
Corporate Plaza West
286 Washington Avenue-Extension
Albany, NY 12203-6399

Mr. Paul Eddy
New York State Department of Public Service
3 Empire Plaza
Albany, NY 12223

Mr. Pat Milano, Project Manager
Project Directorate I
Division of Reactor Projects I/II
U.S. Nuclear Regulatory Commission
Mail Stop 8G9
Washington, DC 20555

Mr. Guy Vissing, Assistant to the Project Manager
Project Directorate I
Division of Reactor Projects I/II
U.S. Nuclear Regulatory Commission
Mail Stop 8G9
Washington, DC 20555

ATTACHMENT I TO IPN-01-077

RECONCILIATION OF IP3 LICENSING DESIGN BASIS REGARDING R-11 & R-12 LEAKAGE DETECTION CAPABILITY AS RELATED TO THE OVERALL LBB METHODOLGY

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 3
DOCKET NO. 50-286
DPR-64

Reconciliation of IP3 Licensing Design Basis Regarding R-11 & R-12 Leakage Detection Capability as Related to the Overall Leak Before Break Methodology

By NRC SER dated March 10, 1986, use of a "leak before break" (LBB) technology for IP3, as an alternative to providing protective devices against dynamic loads resulting from postulated ruptures of the primary coolant loops, was approved. The basis of this alternative approach and the use of LBB technology at IP3 came about as a result of Generic Letter (GL) # 84-04, " Safety Evaluation of Westinghouse Topical Reports Dealing With Elimination Of Postulated Pipe Breaks In PWR Primary Main Loops." GL # 84-04 was issued to form a basis for the issuance of partial exemptions to General Design Criteria 4 (GDC-4) of Appendix A to 10 CFR 50. These exemptions were to allow licensees, such as IP3, to remove (if installed) or not to install protection against asymmetric dynamic loads in the primary main coolant loop. Subsequent rulemaking negated the need for issuing an exemption to GDC-4 provided that licensees submit plant-specific LBB analyses for NRC review and approval. Based on the subject SER, NRC concluded that IP3 had provided sufficient alternate technical justification for not providing protective devices against the dynamic effects of postulated pipe breaks. This NRC SER for IP3 included, among other items, specifying RCS leakage detection capability. The capability for the containment air particulate and gas monitors (radioactivity methods) was specified as each having "the capability of detecting a one gpm change in leak rate in less than four hours." Further, the IP3 Technical Specifications were also referenced in the SER as requiring that "two reactor coolant leakage detection systems be operable, with at least one having a sensitivity to radioactivity capable of detecting a 1 gpm leak in four hours during power operation". Since the operability of the plant was governed by a satisfactory limiting condition on this leak detection system, the overall leakage detection capability satisfied NRC criteria and was deemed acceptable. It should be noted, however, that IP3 is not committed to Regulatory Guide 1.45, "Reactor Coolant Pressure Boundary Leakage Detection Systems," published in May 1973, that describes acceptable methods to select leakage detection systems for the RCS pressure boundary.

Upon preparation for transition to Improved Technical Specifications (TS) at IP3 in early March 2001, plant personnel performed an Operating Experience (OE) review. This review included an evaluation of a 1998 LER at Crystal River. The LER involved an "inadequate engineering evaluation resulting in a loss of diverse leakage detection capability." A subsequent evaluation of the extent and diversity of the IP3 RCS leakage detection capability, in relation to this LER, revealed that the ability of R-11 and R-12 to detect an RCS leak of one gpm within four hours is based upon assumptions that do not reflect current RCS conditions. The FSAR section (6.7.1.2) submitted with Fracture Proof Design Corporation report # 83-75, "Summary of the Tearing Stability Analysis of the Indian Point 3 Primary Coolant System," dated February 7, 1985, included certain plant assumptions to support the analysis that both R-11 and R-12 met a one-gpm

leak detection capability within four hours. These parameters involved 1% failed fuel and 0.4 microcuries/cc coolant corrosion product activity level, among others. These values represented limiting values for plant operation.

While assumption of these same values today would still result in R-11 and R-12 meeting the one-gpm leak detection capability within four hours, these assumptions are not bounding with respect to current or actual historical values of failed fuel, RCS activity, background, etc. In fact, the current and actual historical values for failed fuel and coolant activity are a fraction of the originally assumed values. As such, R-11 and R-12 detection capability of a one-gpm RCS leak within four hours is not always supported. Since the RCS leakage detection instrumentation Technical Specification, LCO 3.4.15, includes operability requirements for the various parts of the detection system, R-11 and R-12 have both been conservatively declared inoperable at present for purposes of being credited to meet RCS leakage detection Technical Specification requirements. This is due to the determination that the current plant conditions of failed fuel, background, RCS activity, etc. may not support the previously specified detection capability of one-gpm within four hours. It should be noted that the subject radiation monitors are consistent with the sensitivity values recommended in Reg. Guide 1.45 (e.g., 1×10^{-9} microcuries/cc for R-11 and 1×10^{-6} microcuries/cc for R-12) and thus provide adequate indication of RCS leakage in the containment. However, in order to minimize unnecessary nuisance alarms in the Control Room, the alarm setpoint is set at values which may challenge the one-gpm leak detection capability within four hours, at current low RCS activity levels, despite having the recommended sensitivity.

Recent review of other utilities that discovered similar radioactivity monitor detection limitations revealed that a reconciliation request to clarify the licensing basis of RCS leakage detection capability was deemed appropriate by NRC. A proposal for IP3 to follow a similar direction, for potential resolution of R-11 and R-12 detection limitations, was discussed in a conference call held between the IP3 NRR Project Manager, various NRR staff members, and several IP3 staff members on September 10, 2001.

In requesting this reconciliation of R-11 and R-12 leakage detection expectations, IP3 performed an in-depth review of R-11 and R-12 detection capabilities. In addition, a review of the capabilities of the other TS diverse leakage detection monitoring systems, specifically the VC Sump monitoring and VC Fan Cooler Unit (FCU) condensate weir monitoring systems, was completed. A comparative summary of these reviews, based upon current or historical plant conditions involving failed fuel %, RCS activity, radioactivity background, etc., vs. assumptions that formed the basis of the leakage detection capabilities specified in the 1986 SER follows:

RCS LEAK DETECTION MONITORING SYSTEM	1986 SER CAPABILITY OF LEAK DETECTION	2001 CAPABILITY OF LEAK DETECTION
R-11 (Rad. Particulate) Monitor	1 gpm within 4 hours	1 gpm within 4 hours (see Note 1)
R-12 (Rad. Gas) Monitor	1 gpm within 4 hours	1 gpm within 70 hours (see Note 2)
VC Sump Monitor	NA (see Note 3)	1 gpm within 4 hours (see Note 4)
FCU Condensate Weir Monitor (see Note 5)	0.5 to 1 gpm (per weir) with operator action (see Note 6)	0.5 to 1 gpm (per weir) with operator action (see Note 6)

RCS Leakage Detection Capability Table Notes:

Note (1): Using a source term based on six months after startup through end of cycle with little fuel defect, varying ambient background level and a Systematic Error Term (Es) of 0.2 to detect one-gpm leak. The four-hour timeframe is for "non-summer" conditions, with an increased time of approximately 7 hours for "peak summer" conditions. The least conservative detection capability for R-11 is not expected to exceed a value of 2-gpm within 4 hours. Varying detector background, RCS activity level and failed fuel conditions are contributors to changes in R-11 detection capabilities.

Note (2): RCS leak detection capability evaluations were performed based upon more bounding plant condition assumptions. Assumptions used range from approximately .0001 to .02% failed fuel corresponding to RCS gamma activity levels of approximately .01 to 3.8 microcuries/cc, as well as varying detector background levels. The ability of R-12 to detect an RCS leak is dependent upon RCS coolant activity level and a detector background count rate. The table value of 1 gpm within 70 hours is based on use of a varying detector background level of 200 cpm, with a current typical RCS gaseous activity level of .01 to .02 microcuries/cc, and approximately .0001% failed fuel. As the detector background increases above 200 cpm, either the time to detect one-gpm goes higher or the detectable RCS leak rate is greater than one-gpm within the specified timeframe. At elevated RCS activity/failed fuel conditions (e.g., .02% failed fuel), a one-gpm leak within four hours is detectable even with much higher detector background. For lesser RCS activity levels, a one-gpm RCS leak becomes more difficult to detect using R-12.

Note (3): This diverse method of RCS leakage detection capability value was not explicitly indicated in the 1986 SER. Original SER mentioned VC sump level instruments that were later removed.

Note (4): A VC sump pump-out annunciates the "VC Sump Pump Running" alarm in the Control Room. Based on nominal setpoints for the VC sump pump start/stops, RCS leakage on the order of one-gpm could be detected in approximately two hours. Under worst case assumptions regarding setpoint tolerances and onset of RCS leakage immediately following a VC sump pump-out, one-gpm leak detection within four hours is still achievable. Additionally, manual surveillance of the VC sump flow integrator can be instituted to support this function within 4 hours.

Note (5): There are five (5) FCUs, each having their own separate VC condensate monitoring system. TS 3.4.15 requires at least one of these 5 systems be able to provide leak detection capability. It should be noted that all 5 FCUs are normally in service at power. Under this condition with 5 FCUs in service, assuming equal distribution of condensation to the monitoring system, the RCS leakage detection capability could be as high as 2.5 – 5.0 GPM; it is noted that this leakage detection capability is not time dependent.

Note (6): This diverse detection method is a backup to the more sensitive R-11 and R-12 methods. Reasonably accurate measurement of RCS leakage is possible by use of this detection method. This is because VC air temperature and humidity promote evaporation of any leakage from hot systems.

Additionally, a VC humidity detector (which was credited in the1986 NRC SER leakage detection capability discussion depicting various methods and was previously credited under Custom TS prior to conversion to Improved TS) provides a means of measuring overall leakage from all water and steam systems within the containment. This detection method is less sensitive, but provides yet another backup to the more sensitive radiation monitoring systems listed in the Table above. An automatic Control Room (CR) alarm is provided for operator awareness and action. Finally, VC Air temperature and pressure monitoring methods may also be used to infer identified leakage to the containment. Containment temperature and pressure fluctuate during plant operation, but a rise above the normally indicated range of values may also indicate RCS leakage into the containment. The relevance of temperature and pressure measurements is affected by containment free volume, temperature, and detector location. Alarm signals from these instruments can also be valuable in recognizing rapid and sizeable leakage to the containment. However, VC temperature and pressure, the same as VC humidity detection instrumentation, are not current Technical Specification required leakage detection equipment.

As indicated in the Table and accompanying notes, the entire package of RCS leakage detection systems should be considered when reviewing capability and redundancy of IP3's primary coolant leakage detection process. The detection capability of radioactivity monitors (R-11 and R-12) will vary as indicated based upon several parameters including fuel condition, seasonal variations, detector background, etc. However, the overall integrated method of leak detection has essentially remained the same since the 1986 NRC SER approved IP3 leakage detection capability.

NRC approval is requested to reconcile and address the more bounding plant condition assumptions that are presented above. The overall RCS leakage detection capability remains diverse and reasonably sensitive for RCS leakage detection. The consequence that R-11 and R-12 may experience detection limitations periodically, above the 4-hour detection threshold established in the 1986 SER, is of low safety significance in the overall leak detection scheme at IP3. Additionally, the fact that there are other diverse methods of detecting RCS leakage further supports this reconciliation request. Finally, the present TS LCO 3.4.15, "RCS Leakage Detection System," patterned after NUREG-1431, "Standard Technical Specifications for Westinghouse Plants," structures a hierarchy of leakage detection method availability. The subject TS supports the overall leakage detection operability scheme discussed. It provides for operability of VC sump, FCU condensate measuring systems and either VC atmosphere grab samples or RCS water inventory balance methods as backups to both R-11 and R-12 radioactivity-monitoring systems.

Therefore, reconciliation is requested for page 7 (section on Leak Detection Capability) of the subject NRC SER dated March 10, 1986. This reconciliation is needed to clarify the technical bases of leakage detection capability regarding R-11 and R-12 based upon more bounding plant conditions and assumptions. Considering that there are other diverse leakage detection methods that provide back-up to R-11 and R-12, that the present plant TS demonstrate an operability scheme of defense-in-depth for these RCS leakage monitoring systems, that there are non-TS RCS leakage detection devices providing operator indication of a potential RCS leak, that other PWRs under similar circumstances were able to justify reconciliation surrounding radiation monitor detection limitations, and that these detection limitations are of low safety significance at IP3, this reconciliation of the subject SER for R-11 and R-12 leakage detection capability is respectfully requested.