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Fred Dacimo
Site Vice President
Administration

October 24, 2007

Re: Indian Point Nuclear
Generating Unit No. 3
Docket No. 50-286
NL-07-098

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

SUBJECT: Request for Extension of Completion Date for Indian Point Unit 3 Corrective Actions and Modifications Required by Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors"

REFERENCES:

- 1) Entergy letter NL-05-094, 9/01/05, "Response to NRC Generic Letter 2004-02, Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors"
- 2) Entergy letter NL-05-0133, 12/15/05, "Supplemental Response to NRC Generic Letter 2004-02, Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors"

Dear Sir or Madam:

By letters dated September 1, 2005 (Reference 1) and December 15, 2005 (Reference 2), Entergy provided a response to Generic Letter (GL) 2004-02, "*Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors*", for Indian Point Units 2 and 3. In the September 1, 2005 correspondence, Entergy described plans for plant modifications that included the installation of new sump strainers during the Unit 3 spring 2007 refueling outage. Entergy also described plans for evaluating the adequacy of the strainer design and to address chemical effects once test results to quantify the effect on head-loss had been completed. In the December 15, 2005 correspondence, Entergy provided the results of the downstream effects evaluation and stated that further evaluations were being performed to resolve the issue.

During the spring 2007 refueling outage the original internal recirculation and containment sump screens were replaced by strainers. Other significant attendant modifications were also made including flow channeling. These modifications represent a significant improvement over the

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original design by providing greatly increased strainer surface areas, reduced debris transport and reduced downstream effects.

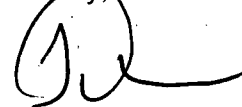
This letter requests an extension until restart following the Unit 3 spring 2009 (3R15) refueling outage, currently scheduled to start March 10, 2009, to complete modification and licensing activities determined to be needed to achieve full compliance with the regulatory requirements of GL 2004-02. The basis for the proposed extension is provided in Attachment 1. Entergy respectfully requests approval of this extension request by November 30, 2007.

There are no new commitments being made in this submittal.

Should you have any questions or require additional information, please contact Mr. R. Walpole, Manager, Licensing at (914) 734-6710.

I declare under the penalty of perjury that the foregoing is true and correct. Executed on October 24th, 2007.

Sincerely,



Fred R. Dacimo
Site Vice President
Indian Point Energy Center

Attachment:

1. Request for Extension of Completion Date for Indian Point Unit 3 Corrective Actions and Modifications Required by Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors"

cc: Mr. John P. Boska, Senior Project Manager, NRC NRR DORL
Mr. Samuel J. Collins, Regional Administrator, NRC Region 1
NRC Resident Inspector, IP3
Mr. Paul D. Tonko, President, NYSERDA
Mr. Paul Eddy, New York State Dept. of Public Service

ATTACHMENT 1 TO NL-07-098

**Request for Extension of Completion Date for Indian Point Unit 3 Corrective
Actions and Modifications Required by Generic Letter 2004-02, "Potential Impact
of Debris Blockage on Emergency Recirculation During Design Basis Accidents
at Pressurized-Water Reactors"**

ENERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 3
DOCKET NO. 50-286

Request for Extension of Completion Date for Indian Point Unit 3 Corrective Actions and
Modifications Required by Generic Letter 2004-02

1.0 Background

In Generic Letter (GL) 2004-02 (Reference 1), the NRC requested licensees to perform a mechanistic evaluation of the potential for the adverse effects of post-accident debris blockage and operation with debris-laden fluids to impede or prevent the recirculation functions of the Emergency Core Cooling System (ECCS) and Containment Spray System (CSS) following all postulated accidents for which these systems are required. By letters dated September 1, 2005 (Reference 2) and December 15, 2005 (Reference 3), Entergy provided a response to GL 2004-02 for Indian Point Units 2 and 3. In the September 1, 2005 correspondence, Entergy described plans for plant modifications that included the installation of new sump strainers during the Unit 3 spring 2007 refueling outage. Entergy also discussed plans for evaluating the adequacy of the strainer design and to address chemical effects once test results to quantify chemical debris effect on head-loss have been completed. In the December 15, 2005 correspondence Entergy provided the results of the downstream effects evaluation and stated that further evaluations were being performed to resolve the issue.

Entergy installed replacement strainers and other significant attendant modifications, including flow channeling, during the spring 2007 refueling outage. These modifications are more fully described below under *3.2 Mitigative Measures*. The evaluations of the adequacy of the strainer design to handle the predicted post LOCA debris and chemical loads have continued in accordance with Reference 4 with justifiable refinements. These evaluations show that in order to ensure compliance with the regulatory requirements of GL 2004-02 additional modifications and License Amendments are required as described in *2.1 Additional Modifications* and *2.2 License Amendments*.

2.0 Reason for the Request for Extension

There are two independent sumps in containment that provide for the recirculation function. The Recirculation Sump serves the two 100% capacity Internal Recirculation (IR) Pumps, which are the preferred source of cooling in the recirculation phase of an accident. The Containment Sump serves as a backup to the Recirculation Sump, and feeds two 100% capacity Residual Heat Removal (RHR) Pumps that are located outside Containment. The Containment Sump is not placed in service unless the Internal Recirculation Pumps (or associated equipment) are unavailable.

The current design and licensing basis for the Recirculation and Containment Sumps is that they are functionally redundant at the initiation of recirculation. This redundancy is provided to assure that the ECCS design functions are met in the event of a loss of the recirculation flow path. Recent GL 2004-02 vendor evaluations have shown that, if the additional hardware modifications identified below are made, that both the Recirculation and Containment Sumps are capable of handling the debris loads associated with ABLOCA (Alternate Break) and SBLOCA (Small Break) events. However, only the Recirculation Sump can handle the predicted LBLOCA (Large Break) debris load. These evaluations exclude chemical effects.

Entergy's strategy for the resolution of GL 2004-02 is to utilize the Alternate Break Methodology to provide a reduction in debris loading and to provide margin to accommodate chemical effects. This strategy involves demonstrating that:

- (1) For a LBLOCA (a break greater than the ABLOCA) the Recirculation and Containment Sumps, taken together, are capable of accommodating the debris and chemical loads. In accordance with the ABLOCA methodology a single failure need not be assumed when demonstrating ECCS performance for LBLOCA evaluations. However, use of this approach requires an exemption from 50.46(d) as related to single failure assumptions.
- (2) For an ABLOCA (a break with an area equal to the largest line connected to the Reactor Coolant System (RCS) piping per Chapter 6 of Reference 4), the Recirculation and Containment Sumps individually are capable of accommodating the debris and chemical loads. In accordance with the ABLOCA methodology, a single failure must be assumed when demonstrating ECCS performance for ABLOCA evaluations.

Implementation of this strategy requires additional modifications and License Amendments as discussed below.

2.1 Additional Modifications

The following modifications are considered necessary to bring the installation into full compliance with GL 2004-02:

(1) Containment Sump Buffering Agent Replacement

A measure expected to reduce the magnitude of chemical effects is the replacement of the Sodium Hydroxide buffer with Sodium Tetraborate. This replacement will require a modification and a License Amendment. Additional chemical effects options currently under review by Entergy include the reduction of debris amounts by zone of influence (ZOI) refinements, failed coatings characterization, reduction in precipitate formation by utilizing the PWROG WCAP model refinement, reduction in aluminum quantity exposed to containment spray, and chemical testing.

(2) RWST Level Setpoint Change

The RWST low-low level setpoint is the level at which the operators may begin the transfer from injection phase to recirculation phase. Because of the potential for air ingestion in the RHR pumps due to vortexing during the beginning of the post-SBLOCA recirculation phase, Entergy is proposing a reduction in the RWST low-low level setpoint range. The setpoint change is in accordance with the requirements of GL 2004-02 ensuring that, subsequent to a SBLOCA, adequate water is supplied to the containment floor to eliminate the risk of air ingestion in the RHR pumps. Entergy has evaluated the modified containment sump configuration and determined that, for the two sumps within containment (Recirculation Sump and Containment Sump), only the RHR pumps require a higher water elevation to ensure proper pump operation. The IR pumps have sufficient water depth to ensure proper pump operation.

2.2 License Amendments

(1) Buffer replacement

See 2.1 (1) above. Technical Specification SR 3.6.7.1 specifies the type and quantity of the buffering agent. A License Amendment is required to implement the change from Sodium Hydroxide to Sodium Tetraborate.

(2) RWST Level Setpoint Change

See 2.1 (2) above. Technical Specification SR 3.5.4.5 and 3.5.4.6 specify the low-low level alarm setpoint range. A License Amendment is required to implement the change.

The risk analysis, presented in section 3.4, assesses the impact of extending the time required to address chemical effects by 16 months (implementation of buffer replacement modification). In addition, a study was performed to address the incremental risk associated with a possible delay in approval and implementation of the RWST level setpoint change beyond December 31, 2007. For this study it was assumed that external recirculation was precluded for small as well as large LOCAs. The incremental core damage frequency for this case is $9\text{E-}7/\text{year}$. Thus, the impact of the RWST level setpoint change is below the Regulatory Guide 1.174 core damage frequency criterion of $1\text{E-}6$ per year and implementation of the RWST level setpoint change could be delayed for up to 6 months without exceeding the Regulatory Guide 1.177 incremental conditional core damage probability criterion.

(3) Exemption to the Single Failure Requirements of 10CFR 50.46(d)

The Entergy strategy for resolving GL 2004-02 utilizes the Alternate Break Methodology as endorsed by the NRC in Reference 4. In order to fully realize the benefits associated with the Alternate Break Methodology, Entergy proposes not to assume a single failure for the LBLOCA evaluation of sump strainer performance. Therefore, a License Amendment is required to exempt LBLOCA analysis from the single failure requirement of 10CFR 50.46(d).

3.0 Technical Basis for Proposed Extension

Entergy considers that the conditions at Indian Point Unit 3 meet the criteria identified in SECY-06-0078 (Reference 5) for extension beyond the completion date of December 31, 2007 specified in GL 2004-02. The SECY criteria are,

Proposed extensions to permit changes at the next outage of opportunity after December 2007 may be acceptable if, based on the licensee's request, the staff determines that:

- *The licensee has a plant-specific technical/experimental plan with milestones and schedule to address outstanding technical issues with enough margin to account for uncertainties.*
- *The licensee identifies mitigative measures to be put in place prior to December 31, 2007, and adequately describes how these mitigative measures will minimize the risk of degraded ECCS [emergency core cooling system] and CSS [containment spray system] functions during the extension period.*

For proposed extensions beyond several months, a licensee's request will more likely be accepted if the proposed Mitigative measures include temporary physical improvements to the ECCS sump or materials inside containment to better ensure a high level of ECCS sump performance.

Indian Point Unit 3 meets these criteria as described below.

3.1 Plant Specific Technical/Experimental Plan

In Reference 2, Entergy submitted a description of the actions it is taking to address GL 2004-02, and updated that response in Reference 3. The key actions of the plan are summarized below.

(1) Completed Actions

- (a) Installation of recirculation sump strainers, containment sump strainers and flow channeling modifications. The vast majority of the Unit 3 plant modifications to address GL 2004-02 were installed during the spring 2007 refueling outage.
- (b) Dissolution/erosion measurements of plant specific calcium silicate.
- (c) Debris generation, debris transport, and downstream effects calculations and evaluations.

(2) Actions in Progress

- (a) Development of chemical effects test protocol.
- (b) Strainer debris head loss testing.

(3) Planned Actions

- (a) Installation of the Containment Sump Buffering Agent modification, as described in 2.1 (1) above, following NRC approval of the associated license amendment, during 3R15 which is scheduled to begin on March 10, 2009.
- (b) Implementation of the RWST level setpoint change, as described in 2.1 (2) above, following NRC approval of the associated license amendment.
- (c) License Amendments as described in 2.2 above.
- (d) Chemical effects testing scheduled for November 2007.
- (e) Reevaluate downstream effects to incorporate WCAP-16406P Revision 1 scheduled for completion December 2007.
- (f) Preparation of a program to inspect and control containment coatings scheduled for completion November 2007.

- (g) Preparation of a program to inspect and control containment cleanliness scheduled for completion November 2007.
- (h) Issue strainer certification/qualification report to include chemical effects scheduled for February 2008.

The extent of the modifications and analyses already performed and those in progress and planned demonstrate that Entergy has developed a plant-specific technical/experimental plan, with milestones and schedule to address outstanding technical issues including sufficient margin to account for uncertainties.

3.2 Mitigative Measures

Entergy has put in place the following mitigative measures that minimize the risk of degraded ECCS and CSS functions during the extension period.

- (1) Installation of replacement sump strainers and replacement IR pumps

During the spring 2007 refueling outage the original IR (approx. 48 ft²) and Containment Sump (approx. 32 ft²) screens. The IR pumps were also replaced. The replacement strainers are of a modular design and have respective surface areas of approximately 3200 ft² and 1000 ft². Each strainer is a matrix of multi-tube (Top-Hat) modules fabricated from perforated plate and mounted in a horizontal orientation. The perforated plate has circular holes sized to 3/32" diameter. The strainer tube modules have four concentric, parallel perforated surfaces for straining debris from the water and the design maximizes the interstitial volume to strainer surface area ratio to better accommodate the predicted fiber to particulate debris loading. The Top-Hats feature an internal vortex suppressor which helps prevent air ingestion into the piping system. In addition, the Top-Hats also possess a bypass elimination feature that minimizes fiber debris bypass. The bypass elimination feature dramatically reduces the magnitude of fiber debris bypassing the screens. These strainers were designed to minimize fiber debris bypass to reduce downstream effects, and to provide a substantial increase in available strainer surface area. The new strainers provide increased margin against blockage and excessive wear of downstream components due to debris in the water. In addition, the original single suction IR pumps were replaced by double suction pumps. The new pumps essentially duplicate the pump performance characteristics of the original with the benefit of a significant reduction in NPSH required.

- (2) Installation of flow channeling modifications

The original containment layout was not conducive to debris settlement. Flow channeling, which involves diverting or distributing flows to reduce average velocities and turbulence levels offers a relatively efficient method for reduction of debris that is transported to the sumps. The installed flow channeling modifications divert break and containment spray flows inside the crane wall down through the reactor cavity then up and out through the in-core instrumentation tunnel and then towards the sumps. The reactor cavity/in-core instrumentation tunnel offers an expansive area that produces velocities low enough to allow settlement of small and large debris pieces, free from the turbulence inducing break flow and containment spray effect. Consequently, only fines and particulate matter may remain transportable. The flow channeling modifications provide increased margin against strainer blockage independent of the benefit of larger strainer area.

(3) Implementation of mitigative measures in response to NRC Bulletin 2003-01

In addition to the plant modifications described above, current mitigative measures in response to NRC Bulletin 2003-01, "*Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors*" (Reference 6), are in place and continue to be in effect. Entergy's response to Bulletin 2003-01 is documented in References 7 and 8. By letter dated August 22, 2005 (Reference 9), the NRC staff concluded that Entergy's compensatory measures that have been implemented to reduce the risk which may be associated with potentially degraded or nonconforming emergency core cooling system and containment spray system recirculation functions were responsive to and met the intent of Bulletin 2003-01.

These measures include:

- (a) Provision of training to the licensed operators to present the mechanisms and potential consequences of sump clogging.
 - (b) Provision of procedural guidance within the Emergency Operating Procedures (EOPs) on symptoms and identification of sump blockage.
 - (c) Development of a new EOP (ECA-1.3, "Loss of Emergency Coolant Recirculation Caused by Sump Blockage").
 - (d) Provision of procedural guidance not to start a second recirculation pump if cavitation is expected.
 - (e) Provision of procedural guidance to consider refilling the Refueling Water Storage Tank should sump blockage be a concern.
- (4) Implementation of mitigative measures that assure containment cleanliness, foreign material exclusion, and sump and flow channel/barrier operability:
- (a) Containment cleanliness is assured by procedural controls (OAP-007 "Containment Entry and Egress") that apply after each containment entry and prior to exiting mode 5 during plant startup.
 - (b) Foreign material exclusion is assured by procedural controls (IP-SMM-MA-118 "Foreign Materials Exclusion") that apply to inspection, operation, maintenance and outage activities.
 - (c) Operability of the sumps and flow channel/barrier operability is satisfied by Engineering visual inspection and procedure step signoff (OAP-007 "Containment Entry and Egress").

- (5) Implementation of mitigative measures to assure that potential sources of debris in containment are minimized:
- (a) Procedure changes to ensure that as part of the engineering change process, materials (including insulation) that are introduced to containment are identified and evaluated to determine if they could affect sump performance or lead to downstream equipment degradation (EN-DC-115 "Engineering Change Development").
 - (b) Procedure changes to ensure that configuration control of insulation inside containment is maintained in compliance with GL 2004-02 (O-SYS-404-GEN "Installation of Insulating Materials for All Plant Piping and Equipment").

These mitigative measures are already in place and minimize the risk of degraded ECCS and CSS functions during the extension period.

3.3 Generic Letter 2004-02 Basis for Continued Operation

In addition to the mitigative measures identified above the basis for continued operation provided by GL 2004-02 include a number of factors that remain applicable to Indian Point Unit 3 during the period of the proposed extension.

The NRC staff provided a justification for continued operation (JCO) (as discussed in Reference 1), that justifies continued operation of pressurized water reactors through December 31, 2007. Elements of the JCO applicable to Unit 3 include:

- (1) The containment is compartmentalized making transport of debris to the sump difficult.
- (2) Switchover to recirculation from the sump during a LBLOCA would not occur until 20 to 30 minutes after accident initiation, allowing time for much of the debris to settle in other places within containment.
- (3) The probability of the initiating event (i.e., large and intermediate-break LOCAs) is extremely low.
- (4) Leak-before-break (LBB) has been approved by the NRC in relation to breaks in the reactor coolant loop primary piping. Qualified piping is of sufficient toughness that it will most likely leak rather than rupture.
- (5) The NPSH analysis for the IR and the RHR pumps do not credit containment overpressure.

3.4 Risk Analysis

A probabilistic risk assessment was performed for IP3 that assessed the impact of extending the time required to address chemical effects, and thereby achieve full compliance with the regulatory requirements of GL 2004-02, until restart following the Unit 3 spring 2009 refueling outage (3R15).

As discussed above in section 2.0, the existing design and licensing basis for the Recirculation and Containment Sumps is that they are functionally redundant at the initiation of recirculation. Although chemical effects may impact the ability to provide sufficient flow through the recirculation sump, the onset of chemical precipitates does not occur immediately following the LOCA event.

The categorization of LOCA break sizes in the PSA include small, medium and large LOCAs, which are defined as pipe breaks with equivalent diameters of less than two inches, between two and six inches and greater than six inches, respectively. Break sizes less than two inches will not result in loss of the recirculation sump. Accordingly, for this risk assessment, the recirculation sump is postulated to be lost at 2 days following a Large or Medium LOCA due to the additional impact of chemical effects. The containment sump and external recirculation path, however, remain viable. Failures of this external recirculation path from failures unrelated to the sump clogging issue are included in the PSA model. No other modeled initiators are impacted by this phenomenon.

It is judged that the chemical precipitation, deposition on the screen and postulated blockage will not occur for at least 2 days following a Large or Medium LOCA. Consequently, it was considered reasonable to credit some degree of recovery to contributors to loss of external recirculation that may result from control circuit failures. A bounding recovery probability of 0.5 was conservatively applied to those failures.

Based on the above, the increase in core damage frequency due to the impact of chemical effects is $2.62E-7$ per year during the requested extension period. This is below the criterion of $1E-6$ in Regulatory Guide 1.174 for considering a change to have a very small impact on risk. The increase in Large Early Release Frequency (LERF) is negligible (less than $1E-10$ per year). External event contributions can also be neglected since they do not result in medium or large LOCAs.

4.0 References

1. NRC Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," dated September 13, 2004.
2. Entergy Letter NL-05-094, "Response to NRC Generic Letter 2004-02, 'Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors,'" dated September 1, 2005.
3. Entergy Letter NL-05-133, "Supplemental Response to NRC Generic Letter 2004-02, 'Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors,'" dated December 15, 2005.
4. Nuclear Energy Institute (NEI) 04-07, Volume 1, "Pressurized Water Reactor Sump Performance Methodology," and NEI 04-07, Volume 2, "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to NRC Generic Letter 2004-02," Revision 0, dated December 2004.
5. SECY-06-0078, from L. A. Reyes, NRC Executive Director for Operations, to NRC Commissioners, "Status of Resolution of GSI-191, 'Assessment of [Effect of] Debris Accumulation on PWR [Pressurized Water Reactor] Sump Performance,'" dated March 31, 2006.
6. NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors", June 9, 2003.

7. Entergy Letter NL-03-128, "60 Day Response to NRC Bulletin 2003-01 Regarding Potential Impact of Debris Blockage of Emergency Sumps" dated August 7, 2003.
8. Entergy Letter NL-04-151, "Reply to RAI Regarding Bulletin 2003-01, 'Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors,'" dated December 8, 2004.
9. NRC Letter, "Indian Point Nuclear Generating Unit Nos. 2 and 3 – Response to NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors"" (TAC Nos. MB9582 and MB9583) dated August 22, 2005.