



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION**  
WASHINGTON, D.C. 20555-0001

March 8, 2017

Vice President, Operations  
Entergy Nuclear Operations, Inc.  
Indian Point Energy Center  
450 Broadway, GSB  
P.O. Box 249  
Buchanan, NY 10511-0249

**SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE  
INDIAN POINT NUCLEAR GENERATING UNIT NOS 2 AND 3, LICENSE  
RENEWAL APPLICATION, SET 2017-01 (CAC NOS MD5407 AND MD5408)**

Dear Sir or Madam:

By letter dated April 23, 2007, as supplemented by letters dated May 3, 2007, and June 21, 2007, Entergy Nuclear Operations, Inc. (Entergy), submitted an application pursuant to Title 10 of the Code of Federal Regulations Part 54, to renew the operating licenses for Indian Point Nuclear Generating Unit Nos. 2 and 3, for review by the U.S. Nuclear Regulatory Commission (NRC). The NRC staff documented its findings in the Safety Evaluation Report (SER) related to the license renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3, which was issued August 11, 2009, and supplemented August 31, 2011 (SER Supplement 1), and July 31, 2015 (SER Supplement 2).

On July 25, 2016, the NRC staff issued Request for Additional Information (RAI) SET 2016-01, requesting additional information pertaining to LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation." By letter dated December 2, 2016, Entergy responded to RAI SET 2016-01. Based in its review of the information contained in Entergy's letter, the NRC staff requests additional information as described in the enclosure.

These RAIs were discussed with Mr. Richard Louie, and a mutually agreeable date for Entergy's response is within 30 days from the date of this letter.

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If you have any questions, please contact me at 301-415-6332, or by email at [william.burton@nrc.gov](mailto:william.burton@nrc.gov).

Sincerely,

***/RA/***

William Burton, Senior Project Manager  
Subsequent Renewal, Guidance,  
and Operations Branch  
Division of License Renewal  
Office of Nuclear Reactor Regulation

Docket Nos. 50-247 and 50-286

Enclosure:

As stated

cc w/encl: Listserv

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ADAMS Accession No.:ML17046A231

\*Concurred by e-mail

<b>OFFICE</b>	PM:DLR/RSG	LA/DLR	BC:DLR/RARB	BC:DLR/RPB1	PM: DLR/RSRG
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<b>DATE</b>	3/2/2017	3/2/2017	3/2/2017	3/2/2017	3/8/2017

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Subject: REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE INDIAN POINT NUCLEAR GENERATING UNIT Nos 2 AND 3, LICENSE RENEWAL APPLICATION, SET 2017-01 dated on March 8, 2017.

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PUBLIC

RidsNrrDir Resource

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RidsNrrDirRERB Resource

RidsNrrDirRSRG Resource

RidsOgcMailCenter Resource

RidsNrrPMIndianPoint Resource

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RChazell

WBurton

WHolston

JGavula

BAllik

AMink

DPickett

STurk, OGC

DRoth, OGC

BHarris, OGC

SBurnell, OPA

DMcIntyre, OPA

JWeil, OCA

MGray, RI

GDentel, RI

DJackson, RI

MModes, RI

NSheehan, RI OPA

DScrenci, RI OPA

DTifft, RI

NMcNamara, RI

BHaagensen, RI

GNewman, RI

SRich, RI

REQUEST FOR ADDITIONAL INFORMATION, FOLLOWUP TO SET 2017-01  
RELATED TO INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2 AND 3  
LICENSE RENEWAL APPLICATION  
DOCKET NOS. 50-247 AND 50-286  
REGARDING LR-ISG-2012-02

**RAI 3.0.3-9a**

Background

The response to RAI 3.0.3-9 dated December 2, 2016, states the following changes to the “acceptance criteria” and “corrective actions” program elements of the Fire Water System Program and Periodic Surveillance and Preventive Maintenance Program:

- a. Additional wall thickness measurements will be conducted when degraded conditions are detected.
- b. “[i]n addition to the above, for areas of piping that are found degraded and returned to service, the remaining service life will be calculated and the piping will be re-examined prior to the end of calculated life.”
- c. “[i]n addition, Entergy will revise the IPEC Fire Water System Program procedures to specify that when individual piping segments are found with multiple leaks or degraded areas that align to indicate selective seam corrosion, then corrective action will be taken to replace the affected piping segment.”

By letter dated July 25, 2016, the staff submitted RAI 3.0.3-9. In this RAI, the staff noted September 30, 2003, and December 29, 2014, leaks in the fire protection-water system that resulted in the affected header being out of service for multiple hours.

Issue

In regard to bullets (a) and (b), as demonstrated with the two events where leakage resulted in the fire water header being removed from service, use of a service life calculation based on structural integrity might not be adequate to provide reasonable assurance that future leaks will not result in a loss of intended function. During a supplemental audit conducted on February 23-25, 2016, the staff reviewed several of the applicant’s calculations associated with wall thickness measurements of the fire protection-water system. The staff conducted an independent projection of corrosion rates and compared the result to structural integrity requirements. It would appear that structural integrity requirements would have been met in the days preceding the two events. The staff reiterated this point during a public meeting conducted on October 4, 2016. The meeting summary states:

Regarding the additional inspections, the NRC staff asked Entergy what the acceptance criteria [for wall thickness measurements] would be. Entergy stated that the degradation would be evaluated by performing a calculation to determine the remaining useful life for the piping relative to structural integrity. The staff stated that acceptance criteria for structural integrity does not address future leaks, as discussed during the staff’s February audit regarding a fire water system leak.

In regard to bullet (c), the staff lacks sufficient information to confirm that the additional corrective action, “when individual piping segments are found [in the fire protection-water system] with multiple leaks or degraded areas that align to indicate selective seam corrosion...” is sufficient to encompass all future potentially degraded configurations. A single leak could result in the need to remove the header from service for repairs. Also, the additional criterion is not applicable to the city water system, which is constructed of a similar material, exposed to the same environment, and has experienced multiple leaks.

In regard to bullets (b) and (c), as stated with the leak that occurred on September 10, 2003, “[t]he rate of discharge and potential for runoff to adjacent safety-related equipment areas mandated that the fire water supply system be secured...” at least one fire water system leak had the potential for a nonsafety-related component to affect the function of safety-related components. No basis was provided for why piping segments with multiple leaks or degraded areas are acceptable to be returned to service without evaluating the potential effect on the intended function of the system, or safety-related components or systems in the vicinity of the leak.

In summary, if it is demonstrated that structural integrity requirements would have been met in the days preceding the leaks, the staff lacks sufficient information to conclude that the proposed acceptance criteria and corrective actions associated with recurring internal corrosion (RIC) in the fire protection-water system and city water system will be adequate to: (a) provide reasonable assurance that the systems will meet their intended function and (b) that failure of one of the systems will not impact the intended function of a safety-related component or system. For example the “acceptance criteria” and “corrective actions” program elements should discuss:

- Acceptance criteria for the maximum size pit or general corrosion that would be accepted as well as the acceptable proximity for multiple pits or multiple regions of general corrosion beyond the acceptance criteria.
- Physical compensatory actions (e.g., leak limiting device) that will be implemented until repairs can be completed, including: (a) how the need for the extent (i.e., axial length) of the physical compensatory actions will be determined; (b) timing of installation of the physical compensatory actions; and (c) followup inspections that will be conducted during the time period prior to the repair of the piping.

#### Request

1. Provide a summary of the results (e.g., wall thickness measurements, required wall thickness) that would or would not support a conclusion that the degradation of the piping associated with the September 30, 2003, and December 29, 2014, leaks in the fire protection-water system would have met structural integrity requirements in the days preceding the leak.

2. If it is demonstrated that structural integrity requirements would have been met in the days preceding the leaks:
  - a. State the basis for why the proposed acceptance criteria and corrective actions for RIC in the fire protection-water system and city water systems are adequate.
  - b. State the basis for why piping segments with multiple leaks or degraded areas are acceptable to be returned to service.
  - c. Alternatively, propose additional acceptance criteria and corrective actions, and the basis for these changes, sufficient to provide reasonable assurance that the fire protection-water system and city water system will meet their intended function(s) and not impact the intended function of a safety-related component or system.

### **RAI 3.0.3-9b**

#### Background

1. The response to RAI 3.0.3-9 dated December 2, 2016, states that wall thickness measurements will be conducted on the fire protection-water system and city water systems “until recurring internal corrosion has subsided.”
2. The response to RAI 3.0.3-9 dated December 2, 2016, states, “[i]n addition, Entergy will revise the IPEC Fire Water System Program procedures to specify that when individual piping segments are found with multiple leaks or degraded areas that align to indicate selective seam corrosion, then corrective action will be taken to replace the affected piping segment.”
3. The response to RAI 3.0.3-9 dated December 2, 2016, states that the Periodic Surveillance and Preventive Maintenance Program will be revised to include periodic internal visual or ultrasonic wall thickness measurements.

#### Issue

1. The term “until RIC has subsided” as used in association with conducting wall thickness measurements is undefined. LR-ISG-2012-02, Section 3.3.2.2.8, “Loss of material due to Recurring Internal Corrosion,” defines RIC as, “if the search of plant-specific operating experience (OE) reveals repetitive occurrences (e.g., one per refueling outage cycle that has occurred over: (a) three or more sequential or nonsequential cycles for a 10-year OE search, or (b) two or more sequential or nonsequential cycles for a 5-year OE search) of aging effects with the same aging mechanism in which the aging effect resulted in the component either not meeting plant-specific acceptance criteria or experiencing a reduction in wall thickness greater than 50 percent (regardless of the minimum wall thickness).” It is not clear how “subsided” would be integrated with the criteria in LR-ISG-2012-02.
2. In regard to replacing piping segments that are found with multiple leaks or degraded areas that align to indicate selective seam corrosion, the changes to the program and updated final safety analysis report (UFSAR) supplement do not specify the timing of the replacement.
3. It is not clear to the staff how internal visual inspections conducted for the Periodic Surveillance and Preventive Maintenance Program will be capable of quantifying wall loss.

#### Request

1. State the basis for using the term “until RIC has subsided.”
2. State the maximum time from discovery until when piping segments that are found with multiple leaks or degraded areas, that align to indicate selective seam corrosion, will be replaced.
3. State the basis for how internal visual inspections will be able to quantify wall loss.

### **RAI 3.0.3-10-1a**

#### Background

In its response dated December 2, 2016, for Request 1, Indian Point Energy Center (IPEC) stated that its OE reviews identified instances similar to the condition described in LER 286/2002-001 and noted that the “corrosion at the crevice of the cement lining on the carbon steel piping welds has occurred and in some cases has resulted in a loss of intended function [emphasis added].” The response also states that a key element of the Service Water Integrity (SWI) program is the use of predictive monitoring. It also notes that IPEC personnel conduct an ongoing program of volumetric non-destructive examination (NDE) of service water welds to “ensure welds are repaired or re-inspected, thereby ensuring structural integrity is maintained and no loss of function occurs during the predicted remaining service life [emphasis added].”

#### Issue

The staff is concerned about IP’s predictive monitoring methodology as it relates to identifying areas of concern with nondestructive examination (NDE) and predicting the remaining service life of the welds in cement-lined piping. See IPEC relief request 3-43 for illustrative example of issues.

Although IPEC’s recent response discusses additional inspections if degraded conditions are found, the response did not discuss what programmatic actions will be taken if any additional loss of intended function is identified. Loss of intended function has occurred in the past and it is unclear whether any consequent changes were made to the program.

#### Request

1. For each of the examples identified during IPEC’s OE search, where loss of intended function occurred (or where the predictive monitoring methodology did not prevent a loss of structural integrity for the predicted remaining service life), discuss any changes made to the SWI program’s predictive monitoring process. Include any changes to either the NDE process for identifying areas of interest, or to the methodology for predicting the remaining service life of welds in the cement-lined piping that address the apparent causes for these failures of the SWI program.
2. If changes were not made in response to any of the examples identified above, provide justification for the lack of changes to the predictive monitoring methodology to demonstrate that the effects of aging will be adequately managed so that the intended functions will be maintained. Also discuss how you are consistent with LRA Sections B.0.4, A.2.1, and A.3.1, as clarified in RAI responses dated July 14, 2011, and July 27, 2011, regarding appropriate program enhancements for past program failures if additional age-related losses of intended function occur in components managed by the SWI program.

### **RAI 3.0.3-10-2a**

#### Background

The response to Request 2 states that the majority of the service water system leaks have been minor and do not result in a leak rate large enough to cause a loss of the system's intended function. This statement indicates that apparently there have been multiple instances where an excessive leak rate caused a loss of intended function in the past. During its onsite audit and review of past operating experience, the staff noted that several leaks resulted in more than minor leak rates (i.e., CR-IP3-2008-1318, CR-IP2-2013-1252, CR-IP2-2015-3744, and EN 52388) with leak rates between 1 gallon per minute and 15 gallons per minute. In addition, the staff notes Relief Request (RR) IP3-ISI-RR-10 which states that service water piping to a fan cooler unit must be isolated when an allowable leakage is exceeded and cites a Technical Specification 5.5.15 allowable leakage of 0.36 gallons per minute.

#### Issue

The leak associated with LER 286/2011-003 demonstrates that leak rates less than that associated with a strict pressure boundary intended function (i.e., adequate flow and pressure) can cause an alternate loss of intended function due to spatial interaction effects of the leak in specific situations. So, in addition to loss of structural integrity, some consideration must be given to the magnitude of a leak for determining the program's effectiveness to prevent a loss of intended function. Although the SWI program does not need to prevent all leakage, it needs to prevent leak rates that could cause a loss of intended function. It is unclear to the staff if the predictive methodology in the SWI program includes measures to ensure leak rates do not exceed some acceptance limit as an indication of a program failure.

In addition, it is not clear whether there would be different acceptance limits for the portions of the service water system in different parts of the plant. If different acceptance limits are applicable (inside containment/outside containment, safety-related/nonsafety-related), then it is unclear if the SWI program manages aging differently for each of the various portions of the service water system to ensure the leak rates are not exceeded for each applicable part of the plant. As noted in SRP-LR Section 1.2.3.10, a past failure would not necessarily invalidate an Aging Management Program (AMP) because the feedback from operating experience should have resulted in appropriate program enhancements [emphasis added] or new programs.

Request

1. For any past operating experience alluded to in the RAI response (where the leak rate was large enough to cause a loss of function), describe the circumstances for each occurrence and provide any changes that have been or will be made to SWI program activities to ensure future loss of intended function due to large leak rates will not occur.
2. Provide the allowable leak rate limit and its bases, which the SWI program will use to determine whether aging is being adequately managed to prevent a loss of intended function. If different allowable leak rates will be used for different portions of the plant, provide the bases for each limit and address how aging will be managed differently in each portion of the plant.

### **RAI 3.0.3-10-6a**

#### Background

Based on information in RR 3-43 (2007) and RR IP3-008 (2013), IPEC determined that the average corrosion rate for the weld joints in the cement-lined piping was 0.012 inches per year.

#### Issue

Based on the average corrosion rate cited by IPEC, the staff is concerned about the overall structural integrity of the service water system piping. The performance of additional inspections in response to a leak does not appear to address the broader structural integrity issue of the ongoing corrosion in the service water system. Since some large diameter service water piping has a nominal wall thickness of 0.375 inches, with a corrosion rate of 0.012 inches per year it is unclear how piping code minimum wall thickness will be met based on the current years of operation. Although the cited corrosion rate is an average value, there are situations where the corrosion rate will be greater. Unless every pipe weld has been restored to a nominal value through ongoing maintenance activities, aging management does not seem adequate.

#### Request

1. Discuss how the average corrosion rate of 0.012 inches per year was developed.
2. Explain how the SWI program assures intended functions are maintained for any in-scope weld that has not been inspected within the timeframe where the average corrosion rate could reduce the wall thickness to a value less than that needed for structural integrity.

### **RAI 3.0.3-10-7a**

#### Background

The RAI response dated December 2, 2016, states “Entergy has identified no past SW system through-wall leakage issues at either IP2 or IP3 that have not been evaluated under the Corrective Action Program,” and identifies the need to revise procedures as one aspect for implementing the enhancement. The staff notes that the response moved up the implementation date of the previous enhancements from December 31, 2019, to December 31, 2017.

#### Issue

Based on the response, when combined with Management (CRG) request in CR-IP3-2009-1929, it is unclear to the staff whether any reviews were conducted of the work order system or other corrective maintenance processes to identify whether there were other instances, comparable to CR-IP3-2009-1929, where a condition report had not been initiated for service water system leaks.

The current response now shows the implementation of the enhancements in IPEC letter NL-14-147 as December 2017 whereas prior correspondence showed December 2019. The staff is unsure if IPEC intended to make this change.

#### Request

1. State whether work orders or other corrective maintenance processes were reviewed to confirm that all service water leaks have been captured and evaluated through the corrective action program. If reviews of work orders or other corrective maintenance processes were not conducted as the basis of the response, provide the bases for confidence that the causes of all past leakage that resulted in a loss of intended function have been addressed by the current program.
2. Confirm the implementation date for the enhancement discussed in IPEC letter NL-14-147. Since the enhancement is not scheduled to be completed for many months, provide interim actions that will provide assurance that all service water system leaks will be captured and evaluated through the corrective action program, or provide the bases for not needing any interim actions.