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Subject: Give it a read.

Give it a read.

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Summary of the Indian Point Unit 2 Special Steam Generator Team Preliminary Red Inspection Finding

On August 21, 2000, the NRC issued its report (Inspection Report No. (IR) 05000247/2000-010) detailing the causes for the February 15, 2000, steam generator tube failure (SGTF) at Con Edison's Indian Point 2 Nuclear Power Station. The NRC conducted a Special Team Inspection focused on the causes of the SGTF, between March and July 2000 using the guidance provided in the revised reactor oversight program (ROP). The SGTF causes were outside the scope of previous NRC inspections concerning the February 15, 2000, event, which included: an Augmented Inspection Team (AIT), to promptly establish the event facts; and an emergency preparedness inspection, and an AIT followup inspection to review Con Edison's short term corrective actions for issues identified during the AIT.

The ROP assesses inspection findings and resulting conditions using the significance determination process (SDP) to quantify the change in the core damage frequency over a reactor year of operation (RY). This is referred to as the delta-CDF. For inspection findings that relate to potential releases of radioactive material, the change in large early release frequency (delta-LERF) is also determined. The SDP classifies the risk associated with inspection findings into four color categories (green, white, yellow and red; from very low to high risk, respectively) by comparing the inspection finding delta-CDF or delta-LERF to risk-ranking criteria. The ROP allows Con Edison the opportunity to provide additional information related to inspection findings and the preliminary risk assessments at a Regulatory Conference.

The NRC SG Inspection team determined that following the 1997 refueling outage Con Edison operated Indian Point 2 for approximately 19-months with SG tube that contained defects that deteriorated with time to the point that one tube failed on February 15, 2000. The SGTF caused reactor coolant to leak into the secondary side of a SG (primary-to-secondary leakage) at about one-quarter of the design basis steam generator tube rupture (SGTR) flow rate.

A failure of the SG inspection program oversight resulted in Con Edison not identifying significant performance issues during the 1997 SG inspection and not ensuring an adequate, integrated technical understanding of the SG conditions; significantly increasing the likelihood of a SGTR during the following operating cycle.

Con Edison did not recognize and take appropriate corrective actions for three significant conditions that adversly affected the quality of the1997 SG inspection. Collectively, failure to modify and adjust the inspection based on these conditions decreased the probability of detection of flaws in the SG tubes and increased the probability that detectable flaws would be left in-service. Specifically, (1) the extent of degradation in the SG tube U-bend areas was not assessed after finding and correcting a the first flaw in this area; (2) the condition of the upper SG tube support plates was not evaluated based on inspection data, as a precursor to tube U-bend degradation; and (3) the effect of high signal noise on the quality of data used to detect flaws in SG tubes was not understood and compensated for. This finding represents an apparent violation of NRC regulations, which require that Con Edison take appropriate actions to correct significant conditions adverse to quality.

The following discussions place the February 15, 2000, event safety consequence and risk associated with the event and the inspection finding in context.

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1. **The actual consequence of the event** - There were no actual consequences of the event. No radioactivity above normal background levels was measured off-site. The licensee's staff acted appropriately to protect the health and safety of the public. Specifically, the operators and mitigation systems performed properly.

2. **Risk significance of the event (the probability of core damage at the time of the event)** - This is based on the actual plant conditions and the probability that operators and/or mitigation systems would not perform properly. This is referred to as the Conditional Core Damage Probability (CCDP) and equates to the chance that a core damage accident will happen in a given number of events.

   The initial NRC determination of CCDP was approximately one core damage accident in 10,000 SGTRs. Con Edison's risk assessment reached a similar conclusion, with a CCDP of approximately one core damage accident in 13,000 SGTRs.

   Subsequently Con Edison conducted a more detailed risk analysis, which incorporated corrections for the actual primary to secondary leak rate experience during the event, finding that the CCDP to be approximately one core damage accident in 500,0000 SGTFs with primary-to-secondary leakage of the February 15, 2000, magnitude. Events with CCDP in this range would be considered to have low to moderate risk significance.

3. **Risk significance of an inspection finding** - A SGTR breaches the reactor coolant system boundary and can cause a release of radioactive material to the environment if additional barriers become degraded. Therefore, the SDP conservatively assumes that the delta-CDF and delta-LERF are equivalent (i.e., if there is core damage following a SGTR, there will be a large early release).

   Based on the program deficiencies identified during the inspection (the inspection finding) the preliminary NRC analysis modified the frequency for a SGTR to 1 per RY, resulting in a delta-CDF/LERF for an SGTR of approximately one in 10,000 RYs. The Indian Point 2 individual plant examination (IPE) assumes a frequency of 1 SGTR per approximately 80 RYs and a resulting CDF/LERF of one in one million RYs for SGTRs.

   Using the ROP risk criteria, the inspection finding was preliminarily characterized as a red, high risk significant issue, because the delta-CDF/LERF was higher than the SDP criterion of one in 100,000 RYs.

Con Edison disagreed with the NRC inspection findings, as summarized in the Preliminary Team Findings letter, dated July 27, 2000. A Regulatory Conference is currently scheduled for September 26, 2000, in NRC Region I and will be open for public observation.

Indian Point 2 is an NRC agency-focus plant and Con Edison has in progress a broad-based Long Term Improvement Program for the station. In accordance with the NRC letter issued May 23, 2000, (subsequent to the NRC Senior Management Meeting), the NRC will meet with Con Edison to review progress at implemeting this program. This meeting will be held September 11, 2000, at the Indian Point 2 site and will be open for public observation.

Indian Point 2 - Steam Generator Special Inspection - Communication Plan
Questions & Answers

1. Conduct of the Inspection

Why was a public exit not held for this inspection?

The Preliminary Team finding letter was viewed as the best way to make the public initially aware of the issues.The Regulatory Conference will also be open for public observation.

I understand that Con Edison has made several arguments against these findings. Why are these not available to the public? Are there secret negotiations going on?

Con Edison's objections are listed in the preliminary finding letter dated July 27, 2000. The NRC has evaluated the positions taken by Con Edison, concluding that from a technical perspective the information did not change the preliminary findings.

The NRC does not negotiate its findings with licensees but considers information supplied by licensees in an attempt to arrive at a conclusion that gives fair weight to all the views expressed.

We have heard that Con Ed will fight these findings in court - what is the NRC's position on this?

The Reactor Oversight Program has built into it ways that a licensee can dispute findings one of which is the Regulatory conference - which we plan on having with Con Edison. Following that conference we will issue our final significance determination and any violation as determined by NRC management.

If Con Edison still disagrees with the NRC's decision - they may appeal the decision through the Enforcement Process or through the Federal Court system.

Will the NRC take any action against the contractor that did the eddy current examinations?

The plant owner has the responsibility to ensure that NRC requirements are met by contractor that they hire.

If Con Ed could not do the eddy current examination correctly how does the NRC know they will do the replacements correctly?

The NRC has planned inspection of the SG replacement. This will include a review of the Con Edison pre-service examination which included eddy current examination.

With the possible sale of the IP2 how will NRC ensure that Con Ed keeps it's eye on safety, until the sale?

The NRC's reactor oversight program provided for NRC inspections and oversight based on licensee performance. The NRC has classified Indian Point 2 as an "Agency Focus" plant, which entails increased inspection and oversight activities.

2. Technical SG Issues

What has been done to prevent recurrence of a similar problem at Indian Point 2?

The SG are being replaced. Con Edison has completed a pre-service eddy current inspection of the new SGs..

What does hour-glassing mean?

The inward bulging of the tube support plate flow slots caused by denting of a tube. When this happens there can be stresses place on the tube that make it more susceptible to stress corrosion cracking

How will the replacement SG compare to the ones that will be removed?

The replacement SGs have some improvements over existing SGs. The replacements have improved tubes and tube support plates. The tube material improves the resistance to cracking through stress relieving and the TSP material reduces the effects of denting.

Con Edison stated that PWSCC was an expected condition and no notice was provided to analysts other than through the normal disposition process.

The NRC has concluded that Con Edison should have taken additional steps upon discovery of a tube with PWSCC. Con Edison should have disposed of the indication with more engineering consideration then used in the normal process. More emphasis on the discovery of PWSCC in the Steam Generator might have lead to the discovery of other examples of the degradation and a better understanding of the Steam Generator's condition before it was returned to service.

3. ROP Issues

Would IP2 be allowed to operate if they have a red finding or multiple degraded cornerstones? If these conditions exist, doesn't this mean that the plant is unsafe?

While a red finding in a cornerstone does indicate that safety margins have been reduced to an unacceptable (but not unsafe) level, some safety margin does remain. This is the point where NRC scrutiny would be at a very high level to ensure that adequate corrective actions are taken to restore margins to an acceptable level. When the NRC identifies the degradation of multiple degraded cornerstones, certain actions are recommended by the action matrix of the reactor oversight program.

Per the action matrix, the extensiveness of the NRC actions increases as the risk significance of the condition increases. At the multiple degraded cornerstone level, many significant regulatory actions are considered including orders, CALs, and intensive inspections. The NRC's goal is to ensure that the extent and nature of the underlying problems are fully understood to make an informed decision about whether additional more stringent measures are needed. A red finding or multiple degraded cornerstone finding does not automatically mean that the plant is unsafe to operate, but the NRC will consider this option during its further deliberations.

What is the difference between the NRC's risk assessment and the one produced by the Con Ed?

The NRC's analysis evaluates the risk increase caused by the degraded ***condition*** of the steam generator tubes. The most severely degraded tube could have ruptured for a variety of reasons under a variety of circumstances. The NRC's analysis considers all of the circumstances in which the tube might have been induced to fail or might have failed spontaneously. For each circumstance, the NRC evaluated the frequency of the circumstance, the probability that the tube would fail under that circumstance, and the probability that the circumstance, when complicated by tube failure, would lead to core damage. The NRC used the sum of the results for all circumstances as the measure of the risk created by the tube degradation.

The licensee's analysis considered only the specific features of the spontaneous tube failure ***event*** as it occurred on February 15, 2000. Credit was taken for the specific leak rate that occurred being less than the leak rate assumed in most Probabilistic Risk Assessments. For the lower leak rate, there is more time for the plant personnel to take the actions that are necessary to prevent core damage. This makes the probability of human error lower. Because the probability of core damage following a steam generator tube rupture is dominated by the probability of human errors (which is higher than the probability of equipment failures), the licensee's re-evaluation of the human error probabilities led to substantially lower results. However, it neglects the potential for the tube failure to have a much higher flow rate. It also neglects the potential for the tube failure to have been induced by other circumstances that would have complicated the recovery process that the plant personnel needed to accomplish to prevent core damage. Therefore, the NRC does not consider the licensee's approach to be appropriate for establishing the risk significance of the tube degradation that occurred.

Will the Regulatory Conference be open for public observation?

Yes, as stated in the Cover Letter for the IR the meeting is scheduled for September 26 and will be open to public observation.

Con Ed declined to attend a regulatory conference on the emergency preparedness findings. Will they attend one this time?

Con Ed wants to discuss theses issues at the regulator conference. However, it is the companies option whether to attend , to provide the NRC with additional information, or not.

What does a "Potential Red" finding mean? Assuming that it remains red following the Reg Conference what will the NRC do?

It must be clear that the SDP focuses on potential risk of a conditions over its period of existence. The NRC will assess the necessary actions in accordance with the action matrix in the ROP, following the Reg Conference..

The Potential Red finding means that as the NRC put the issue through the significance determination process, to quantify the amount of risk that the issue causes, it came out as a significant risk issue, based on the probability of a steam generator tube rupture being increase above the normally assumed 1 per 80 Reactor year of operation. Because of the tube flaws we assumed that a full SGTR would occur once per year, and adjusted that frequence to .5 per year based on the flow rate being lower for the actual event at IP2.

Following the Regulatory Conference the NRC will take Con Edison's information into account and determine the final significance.

Within the past months, IP2 has had "more than three White inputs in a performance area" and a red input. What does that mean in terms of NRC response?

The three white issues indicate a degraded cornerstone in the Emergency Preparedness area.

The NRC following the Reg Conference and a determination of the final finding on the SG inspection will continue to use the Action Matrix to guide our response.

Will the utility be fined for this violation?

Under the new enforcement policy, which goes hand-in-hand with the ROP there are no civil penalties for this type of issue.

Why haven't you issued a violation, civil penalty or shut down order?

The action taken by the NRC will be based, on the final significance determination that will be developed following the Regulator Conference on September 26, 2000.

How does the designation of IP2 as an agency focus plant fit into the ROP and how is it affected by the findings of this report?

The designation of the "Agency Focus" plant was made with the knowledge of the February 15, 2000 event. The NRC is still transitioning in to the ROP, recognizing this the SMM was conducted in May 2000 using the previous guidance. At that

meeting the Senor NRC staff decide that performance problems including the February event and past issues were significant enough to require additional NRC management attention.

The Agency Focus designation indicates that increased management attention. Following the Regulatory Conference and our final determination of significance, we will decide the additional actions that may be required in accordance with the ROP action matrix.

The May 23, 2000 letter says that Con Edison has taken actions to turn around performance. What were they and how do you know they will/are effective?

Con Edison has taken actions to improve performance by increasing the internal standards of personnel performance. The NRC has not determined the effectiveness of these improvements, but inspection plans are underway.

When will the NRC be scheduling the diagnostic type inspection at IP2?

A decision to conduct or not conduct a diagnostic type of team inspection would come after determination of a Red inspection finding following the Regulatory Conference.

Will the Agency Focus meeting between NRC and Con Ed be open for public observation?

Yes it will be a meeting open to public observation.

Generally the ROP requires less inspection effort by the NRC - how has the inspection of the SG examination process changed? If you did not find it in 1997 how would you with a reduced level of effort?

The NRC continues to review the SG issues and will be taking the necessary actions to adjust the inspection program.

4. Indian Point 2 Actions

How can you consider allowing Indian Point 2 to startup given the significant management and program problems?

The NRC continues to question Con Edison's programmatic corrective actions. In addition Indian Point 2 is the focus of increased NRC attention and will be into the near future as part of the revised oversight program.

Aren't you going to keep Indian Point 2 shut down until the issues identified in your inspection are fixed?

Con Edison decided to replace SGs.

Why does Con Edison say the exact opposite that "they met all requirements?" Are you going to pursue the "wrongdoing" implications because they are misleading the NRC and the Public?

Overall the specific requirements are in the TS, 10 CFR 50.55a, and ASME Section XI. And 10 CFR 50, Appendix B, Criteria IX Special Processes and XVI Corrective Actions. The NRC, in Part 50 Appendix B, holds the licensee to a broad standard by establishing a framework of expected levels of performance. The NRC has preliminarily concluded that Con Edison failed to meet these levels of performance.

What Con Edison is quoting as requirements is a generally accepted industry prepared document (EPRI) process for conducting a generic SG examination. The NRC believes that Con Edison did not modify and adjust this generic program appropriately to compensate for identifable significant adverse conditions in their SGs.

5. Past NRC Performance

Why didn't the NRC know there were problems with IP2's program in 1997?

The NRC is reviewing the 1997 inspection as part of the lessons learned task force.

In 1997 the NRC inspection was directed toward the broad area of in-service inspection a portion of which is the Steam Generator inspection program. The current inspection team took a much closer look at the Steam Generator program using specialists and contractors to delve deeply into the causes of the recent tube leak event.

Why should we have confidence in the NRC's ability to regulate these plants?

The NRC depends, in part, on defense-in-depth in order to assure an appropriate framework of safety barriers exist. The NRC uses its inspection program, license review, and regulatory oversight program, to assure the defense-in-depth is being maintained by a licensee.

While an actual situation may increase risk it does not mean that at the time there was a specific safety consequence. Risk looks at the probability of an event and the potential consequences.

Who in the NRC is responsible and being held accountable?

As with any organization the inspectors are responsible to their Branch Chief who are responsible to the Division Director who are responsible to the regional administrator and so on up the chain of command. Ultimately the Commission is responsible for implementing the requirements of the Atomic Energy Act and the Reorganization Act. Any authority exercised by the NRC staff is at the discretion of the Commission.

The Lessons Learned Task force continues to review the issue.

What have you done to correct problems with NRC effectiveness?

In order to correct a problem it needs to be understood first. The NRC has assembled a team in order to ascertain the lessons the NRC can learn from this incident. The team will make recommendations that can be considered for implementation as improvements in the NRC process.

Does this inspection finding validate the NRC's Research conclusion about the adequacy of the review conducted prior to allowing the extension of the operating cycle?

6. Generic Implications

What other plants have similar problems with detection of tube flaws?

Although, to varying degrees, other plants may have some form of steam generator degradation the agency is not aware of a plant facing problems similar to those faced by Indian Point 2.

What are you going to do about the steam generator issue?

The NRC continues to work with the Nuclear Energy Institute in developing guidelines that provide a consistent industry approach for managing steam generator programs and for maintaining steam generator tube integrity. (See Secy 00-0078)

How can you ensure that other plants are safe?

Currently the NRC is conducting its baseline inspection program for In-service inspection once every two yeas or once per refueling cycle. Any actions to enhance the inspection program will come after the lessons learned task force has completed its work and NRC management has had time to develop corrective actions, as necessary.

What confidence do we have of steam generator tube inspections in general when there is so much uncertainty.

There is always the potential for a SGTR at all operating plants, however, the assumption on the rate of occurrent is on the order of 1 in 100 year of reactor operation. This occurrence rate is based generally on a past good performance of eddy current inspection at identifying and allowing evaluation of defects. However, even with the best techniques and performance there will be tubes with flaws that are missed. The most important part of the is that the plant are designed for the occurrence of a tube rupture (i.e, it is a design basis accident). Further operators are trained in the symptoms and the actions needed to shut down the unit and keep

the reactor safe. These systems and the operator actions protect the public from releases of radiation as they did here at IP2.

The NRC estimates that a SGTR would occur causing core damage and a significant release once in 1,000,000 years of operation. This is based on an assumption that a SGTR would occur once per 100 years of operation assuming the normal detection of flaws. In the IP2 case given the existence of flaws the NRC assumed that there was an increased risk to once in 10,000 years of operation, because the assumed occurrence of a SGTR was taken from once in 100 years to one in one to two years.

What is the NRC's position on NEI and EPRI saying that the noise data was worse in IP2 vice similar to other plants as Con Ed has stated.

The NRC staff appreciated the work done by NEI and EPRI., but we have not reviewed the data and have no general comment.

7. General Issues

What is the NRC's position on Gov. Pataki signing the bill that prohibits Con Ed from passing the cost of the outage along to the rate payers?

The NRC's actions following the inspection were taken absent involvement with NY State officials.

Was NY state involved in the inspection?

A NY State PUC engineer accompanied the team through its first week, and a PUC representative was at the team's exit meeting.

What do you think of Con Edison's statement that the NRC is coming down hard on them because the Congress came down hard on the NRC.

This event did receive significant attention by the public and local, state and federal elected officials. The inspection activities and the findings were not influenced by these concerns. The licensee responded well to the SG tube failure minimizing any actual consequence to the public health. The SG inspection focused on determining how the root causes of the failure and evaluation the POTENTIAL risk of the findings. The ROP SDP has been followed and the Action Matrix will be followed.