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

OCTOBER 12, 2001

MEMORANDUM TO: Brian W. Sheron, Associate Director,
for Project Licensing and Technical Analysis

FROM: Michael R. Johnson, Chief
Inspection Program Branch
Division of Inspection Program Management

Richard J. Barrett, Chief
Probabilistic Safety Assessment Branch
Division of Systems Safety and Analysis

SUBJECT: RESPONSE TO QUESTIONS REGARDING AUGUST 1999 AND FEBRUARY 2000 EVENTS, INDIAN POINT NUCLEAR GENERATING UNIT NO. 2 (TAC NO. MB0193)

On September 27, 2000, Scott Newberry, the Steam Generator Lessons-Learned Task Group Leader, received a set of questions related to several events at the Indian Point Nuclear Generating Unit No. 2 (IP2) that occurred in August 1999 and February 2000. The questions were not signed by the individual raising the concerns. Since these questions were beyond the charter of the task force and were determined to not be allegations, the Executive Team requested a staff review. The attached response was prepared with inputs from the appropriate branches and Region I.

Attachment: Response to Questions
Regarding IP2 Events

Technical Points of Contact:

S. Long, SPSB	T. Frye, IIPB	R. Jenkins, EEIB	S. Barber, RGN-I
415-1077	415-1287	415-2985	610-337-5232

J/15/

Attachment

RESPONSE TO UNSIGNED SET OF QUESTIONS RELATED TO THE AUGUST 1999 AND FEBRUARY 2000 EVENTS AT INDIAN POINT NUCLEAR GENERATING UNIT NO. 2 (IP2)

On September 27, 2000, The following set of questions was given anonymously to the Steam Generator Lessons-Learned Task Force, a group which had responsibility for evaluating the need for improvements to our regulatory program as a result of the Indian Point-2 steam generator tube failure event of February 15, 2000.

The questions relate to the way in which events and degraded conditions at power plants are evaluated under the significance determination process (SDP). Specifically, they question whether our current way of evaluating risk significance properly accounts for conditions that exist concurrently at a given plant. In the case of Indian Point, two conditions existed concurrently, an electrical problem which was revealed as a result of an event on August 31, 1999 and a steam generator degraded condition which was revealed in the February 15, 2000 event.

Question 1:

> How reasonable are the IP2 calculations? - The first event discovered latent failures that were not picked up during surveillance testing or maintenance. Also, first trip was "spurious," it was only "luck" that trip occurred before the tube rupture event occurred. (There was no other reactor trip in between these two events.) Had the latent failures in the plant on August 15, 1999 not been corrected, then it is probable that the manual trip in response to the SGTR [steam generator tube rupture] would have triggered a LOOP [loss of off-site power] and the lockout of one EDG [emergency diesel generator] for the same "mechanistic" reasons, making the SGTR event much more difficult to control.

Response:

The evaluation of the August 1999 LOOP event determined that this would likely have been a Yellow finding, with substantial safety significance, had it occurred under the revised ROP. The SDP evaluation of the February 2000 SGTF determined that this was a Red finding, with high safety significance and a significant reduction in safety margin. Subsequent to the SGTF and the identification of degraded steam generator tubes, the staff re-evaluated the conditional core damage probability (CCDP) for both the LOOP and SGTF events to include the potential for either event to have occurred during, and complicated, the other event. The staff concluded that there would not have been a significant change to the CCDP for either event. Including the degraded tubes in the SDP for the LOOP does result in a change in the large early release frequency (ΔLERF) for the August 1999 event, and would have resulted in a Red finding instead of a Yellow.

However, this would not have changed the NRC's response or involvement at IP2 due to the numerous other significant performance issues that were identified and applied to the assessment process. The assessment process uses the "Action Matrix" to integrate performance indicator (PI) and SDP results and determine the appropriate level of NRC interaction based on these indications of licensee performance. The assessment process uses a 12-month rolling window of data to allow the accumulation of risk-significant issues, which may be indicative of systemic and pervasive breakdowns in licensee performance. As described in the IP2 Assessment Follow-up letter dated October 10, 2000, the PI and inspection finding data collected over the previous year indicated that several cornerstones of safety were degraded, principally associated with the August 1999 reactor trip and the February 2000 SGTF. As directed by the "Action Matrix," this resulted in the conduct of several NRC activities above the baseline level of oversight, such as monitoring the licensee's performance improvement plan and the conduct of an independent team inspection to diagnose the breadth and depth of the safety, organizational, and programmatic issues that led to the degraded cornerstones of safety.

The issue raised by this question might be more important for other cases where the independently evaluated risk estimates for the separate findings are not so significant. In general, when two findings affect the risk equation simultaneously, there are two possibilities for the joint risk effect. One case is that the two findings affect separate parts (cutsets) of the risk equation, in which case the total risk effect is simply the sum of the individual risk effects. The other case is that the two findings affect the same cutsets. In that case, the two effects are multiplicative, so the total risk effect is greater than the sum of the effects when they are evaluated independently. This was the case for the joint LERF effect of the two findings at IP2, but there wasn't a significant multiplicative effect on the joint CDF result.

When the risk effects of two findings are multiplicative, the joint effect sometimes can be much greater than the sum of the independently evaluated effects. For example, two findings that are evaluated independently as two "white" findings might produce a "yellow" or "red" finding when evaluated together. Therefore, the Action Matrix outcomes could be affected.

With respect to the Action Matrix, there are three important parameters: (1) the number of findings, (2) the color of each finding, and (3) the number of cornerstones affected. When two findings result in concurrent problems in the plant, there are various possible approaches to inputting them into the Action Matrix. The findings could be analyzed as a single issue, and the color assigned based on the multiplicative risk. That risk could be assessed to a single cornerstone or split between the two findings according to some formula. Alternatively, the findings could be analyzed separately and treated independently.

For concurrent findings with a common underlying cause, the NRC currently analyzes them as a single finding and uses the color appropriate to the combined risk. The color is assigned to the cornerstone which best reflects the dominant risk contributor. Findings that are determined to be due to independent causes are analyzed separately, and each receives a color based on calculation of its risk significance as if the other finding did not overlap.

In addition, risk estimates are used in NRC Management Directive (MD) 8.3, "NRC Incident Investigation," to provide a rapid agency reaction to the combined risk of an event or condition. Even if two findings are treated independently with respect to the Action Matrix, the joint effect can be considered in MD 8.3 for the purpose of initiating a Special Inspection, Augmented Inspection, or Incident Investigation, depending on the magnitude of the joint risk effect.

The staff plans to provide additional guidance to codify current practices and clarify expectations regarding the treatment of concurrent findings in order to foster greater consistency in the implementation of the ROP. The adequacy of the ROP is addressed further in response to Question 4.

Question 2:

> Will grid deregulation lead to more events where LOOPs are caused by reactor trips? - Plant under-voltage settings are determined based on expected grid response following certain known contingencies. In a deregulated environment, how can we assure proper coordination of plant under-voltage protection when power generation and grid operation are no longer under the control of the reactor licensee. Reactor plant operators, who no longer control how the grid is run, may not have the information available of the grid calculational model to know if they are running in a condition which would result in LOOP given trip. And even if they did, they may not have the authority to get the grid operator to make the necessary adjustments to compensate.

Response:

The August 31, 1999, event involved a reactor trip with complications from various system interactions that included safety-related equipment. The cause of the reactor trip was a spurious signal from the Over-Temperature Delta-Temperature (OTΔT) process instrumentation. The LOOP condition occurred because the station auxiliary transformer load tap changer (LTC) was incorrectly placed in the "manual" position. The LTC control setting led to an extended voltage drop on the 480 volt buses, causing actuation of degraded voltage relays and a LOOP to the safety buses. The Augmented Inspection Team (AIT) found that if the LTC had been placed in the "automatic" control setting the voltage response from the transformer would have mitigated the voltage transient, returning the bus voltage to normal in sufficient time to prevent the LOOP condition. Further, the "automatic" control setting for the LTC is required per the plant's licensing basis. Plant undervoltage settings are determined not by the expected grid response but the expected range of voltage necessary to power safety-related equipment. An undervoltage or degraded voltage condition can lead to premature equipment failure and the inability of the subject equipment to perform its intended safety function(s).

The February 15, 2000, event involved a SGTF which led to a manual reactor trip. Offsite power or grid reliability was not applicable to the subject event.

Although we do not anticipate that deregulation will lead to a degradation of offsite power reliability, the staff is monitoring industry developments which may potentially affect offsite power capability. Recently, the NRC issued Regulatory Information Summary (RIS) 2000-24, "Concerns About Offsite Power Inadequacies and Grid Reliability Challenges Due to Industry Deregulation," on December 21, 2000, to alert stakeholders to possible concerns regarding the voltage adequacy of offsite power sources. This RIS documents actions the industry has committed to take in order to address this issue.

Question 3:

Were the AIT charters on IP2 events too limited? - Although the LOOP was the result of a voltage dip following the reactor trip and may be an indicator of generic concerns about grid voltage behavior, no data on the voltage levels was collected. Current risk calculations do not consider increased likelihood of LOOP due to reactor trip. The focus on the tap changer diverted the investigation from the more real safety concern- that plants may be subject to more severe voltage drops following a trip than was the case before deregulation.

Response:

The content of the AIT charters is constructed based on the information that is available when dispatching the team. NRC Inspection Manual Chapter 0609 provides a sample charter which may be used when constructing for a wide variety of plant events. The charters tend to allow a fair amount of latitude and are not overly restrictive. Thus, the region would not consider the charter too narrow for either the August 1999 or the February 2000 event.

The LOOP was caused by the incorrect position for the station auxiliary transformer (SAT) tap changer. Since the tap changer was in manual, it did not "step up" the SAT voltage when it was appropriate. The recovery of on-site power was complicated by the trip of the affected EDG and subsequent lockout of all 480 volt safety busses. The lockout was the overriding factor that complicated plant recovery, not the initial LOOP.

The LOOP was not caused by the reactor trip. It was caused by the incorrect position for the SAT tap changer. This was a configuration control error made by the licensee that could exist before or after deregulation.

As stated in the response to Question 2, the cause of the LOOP during the August event was due to plant-specific factors. Therefore, no direct relationship can be attributed to grid voltage behavior or industry deregulation. It should be noted that the generic concerns stated in the question are being pursued under an NRC-NEI Industry Initiative on Grid Reliability. The principal safety concern addressed by this initiative is the maintenance of the licensing and design basis for offsite power to nuclear plants which includes the capability of plant equipment to survive expected voltage transients and to perform its intended safety function(s).

Question 4:

> Is the revised reactor oversight process faulty with its focus on a single event? - Isn't it a better indicator of the overall plant performance to include some recent past history? A "good performer" would be much less likely to have two events in a row that had significance. IP2 may be one of the worst "combination" of events ever. It wouldn't be a major effort to look back on [a] previous trip or two at a plant involved in a potentially serious event.

Response:

The new reactor oversight process (ROP) is not focused on a single event and does use recent plant history as an overall indication of plant performance. Through the use of an "Action Matrix," the assessment process integrates numerous inputs reflecting recent plant history to identify declining licensee performance that warrants increased NRC interaction. The inputs to the "Action Matrix" include both performance indicators (PIs) and inspection findings.

Each of the 18 PIs included in the ROP are based on at least 12 months of data to calculate the indicator, with several of the indicators based on 24 or 36 months of data. This allows recent plant events and issues to be integrated in a meaningful way, with the data applied against risk-informed thresholds to indicate when additional agency action is warranted. For example both the August 1999 and February 2000 reactor trips were counted in the Unplanned Scrams PI, and resulted in this PI crossing the Green/White threshold for the 2nd quarter 2000, indicating the need for increased regulatory oversight above the baseline inspection program.

In addition, each inspection finding is evaluated through the SDP to characterize the risk significance of the issue. The SDP does require that concurrent performance deficiencies be assessed collectively to determine the total contribution to ΔCDF. Although this had always been the intent of the SDP, this guidance was clarified in a recent revision to Inspection Manual Chapter 0609, "Significance Determination Process", dated December 28, 2000, following the evaluation of the February 2000 SGTF. The staff plans to provide additional guidance to codify current practices and clarify expectations regarding the treatment of concurrent findings in order to foster greater consistency in the implementation of the ROP.

The evaluation of the August 1999 LOOP event determined that this would likely have been a Yellow finding, with substantial safety significance, had it occurred under the revised ROP. The SDP evaluation of the February 2000 SGTF determined that this was a Red finding, with high safety significance and a significant reduction in safety margin. Subsequent to the SGTF and the identification of degraded steam generator tubes, the staff re-evaluated the conditional core damage probability (CCDP) for both the LOOP and SGTF events to include the potential for either event to have occurred during, and complicated, the other event. The staff concluded that there would not have been a significant change to the CCDP for either event. Including the degraded tubes in the SDP for the LOOP does result in a change in the large early release frequency (ΔLERF) for the August 1999 event, and would have resulted in a Red finding instead of a Yellow.

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Attachment: Response to Questions
Regarding IP2 Events

Technical Points of Contact:

S. Long, SPSB	T. Frye, IIPB	R. Jenkins, EEIB	S. Barber, RGN-I
415-1077	415-1287	415-2985	610-337-5232

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W.Borchardt	M. Johnson, IIPB	
J.Strosnider	B. Holian, RGN I	
G.Holahan	J. Zwolinski	

Accession Number: ML010740199 *See previous concurrence

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MEMORANDUM TO: Brian W. Sheron, Associate Director, for Project Licensing and Technical Analysis

FROM: Peter S. Tam, Acting Chief, Section 1
Project Directorate I
Division of Licensing Project Management

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If you have any questions, please contact Patrick Milano at 415-1457.

Docket No. 50-247

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MEMORANDUM TO: Brian W. Sheron, Associate Director,
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FROM: Maitri Banerjee, Acting Chief, Section 1
Project Directorate I
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MEMORANDUM TO: Brian W. Sheron, Associate Director,
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FROM: Marsha Gamberoni, Chief, Section 1
Project Directorate I
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