

Steam Generator Action Plan

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Briefing for
Commissioners Diaz and McGaffigan
December 6-7, 2000

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Agenda

- IP2 SG Tube Failure Lessons-Learned Report
- OIG Report
- SG Action Plan

Historical Overview

- 2/15/00 - IP2 Tube Failure Event
- 2/28/00 - NRR request to RES for independent review
- 3/16/00 - RES response to NRR
- 5/24/00 - Task Group Charter issued
- 8/29/00 - OIG Report issued
- 8/30/00 - Chairman's request for staff review of OIG Report
- 10/23/00 - Lessons-Learned Report issued
- 11/3/00 - Staff Review of OIG Report issued
- 11/16/00 - SG Action Plan issued

Lessons-Learned Task Group

- Assembled in accordance with Charter dated May 24, 2000
- Objective - evaluate staff's technical and regulatory processes related to assuring SG tube integrity in order to identify and recommend areas for improvement applicable to the NRC and/or the industry
- Multi-disciplined Task Group consisting of staff from NRR, RES, Region - support from OGC and others as needed

Scope of Task Group Review

- Review included technical and regulatory process issues related to assuring SG tube integrity
- Conclusions & Recommendations were developed based on reviews of documentation and discussions with NRC staff, NRC SG expert consultants, nuclear industry representatives involved in SG programs, and Con Ed staff

Scope of Task Group Review (Cont.)

- Documents reviewed included:
 - ▶ IP2 plant-specific SG documents
 - ▶ NRC generic SG-related documents
 - ▶ Nuclear industry generic SG-related documents
 - ▶ RES Independent Review dated 3/16/00
 - ▶ OIG Report dated 8/29/00

Scope of Task Group Review (Cont.)

- Scope of review did not include:
 - ▶ IP2 SG issues being addressed by other regulatory processes
 - ▶ Event follow-up issues not specifically related to SG tube integrity
 - ▶ Evaluation of Con Ed performance relative to regulatory requirements

Scope of Task Group Review (Cont.)

- Charter directed Task Group to review staff SE associated with IP2 restart following tube failure. This activity was terminated when Con Ed decided to replace their SGs before restart.
- Charter states Task Group not expected to identify the processes for resolving areas of potential weakness.

Task Group Interfaces with Stakeholders

- NRC staff and management from NRR, RES, and Region
- NRC SG expert consultants
- Con Ed
- NEI/EPRI

Recommendations

The major areas addressed in the Task Group recommendations include the following:

- Con Ed must correct the deficiencies in its SG tube integrity program.
- Industry should improve the EPRI guidelines.
- Industry should improve the SG TSs.
- Industry should improve the NEI 97-06 initiative.

Recommendations (cont.)

- NRC should improve its SG oversight and inspection process.
- NRC should improve its licensing review process.
- NRC should assign a high priority to its review of the NEI initiative and the associated EPRI guidelines.
- NRC should issue a generic communication regarding SG tube integrity program guidance.
- NRC should improve risk communication to the public.

OIG Report

- OIG issued its event inquiry (report) on 8/29/00 because of concerns from Congress and public about the IP2 event.
- OIG report addresses SG and non-SG related issues.
- Chairman's memo dated 8/30/00 directed staff to perform review and analysis of issues in OIG report. Also requested staff to provide recommendations for improving NRC processes.

OIG Report (cont.)

- Staff review of OIG Report (SG and non-SG related issues) is provided in memo dated 11/3/00 from EDO to the Commission.
- Task Group considered SG-related issues from OIG report in the lessons-learned report. A summary of the Task Group's evaluation of the OIG Report findings is included in Attachment 1 to this presentation.

SG Action Plan

- SG Action Plan was issued on 11/16/00. The purpose of the action plan is to:
 - ▶ Direct and monitor the NRC's efforts in the SG tube integrity area.
 - ▶ Ensure that the associated issues are appropriately tracked and dispositioned.
 - ▶ Ensure the NRC's efforts result in an integrated SG regulatory framework (e.g., licensing, inspection, research) which is effective and efficient.

SG Action Plan (cont.)

- The action plan consolidates numerous activities related to SGs including:
 - ▶ Evaluation and implementation of recommendations from Lessons-Learned report;
 - ▶ Evaluation and implementation of recommendations from staff review of OIG report;
 - ▶ NRC review of NEI 97-06;
 - ▶ Resolution of GSI-163; and
 - ▶ Resolution of SG DPO.

SG Action Plan (cont.)

- The action plan also includes non-SG related issues that arose out recent SG activities (e.g., EP issues from OIG report).
- The action plan does not address plant-specific reviews or industry proposed modifications to GL 95-05 (voltage-based tube repair criteria).

SG Action Plan (cont.)

- Completion of each action plan milestone will be documented via memo from lead division to associate directors in NRR.
- Resolution of issues will be coordinated with internal and external stakeholders.
- Status of action plan milestones will be updated on quarterly basis and published in the NRR Director's Quarterly Status Report.
- Overall management of the plan is the responsibility of DLPM.

Attachment 1 - Task Group Evaluation of OIG Report Findings

On August 29, 2000, the NRC's Office of the Inspector General (OIG) issued its event inquiry, "NRC's Response to the February 15, 2000, Steam Generator Tube Rupture at Indian Point Unit 2 Power Plant." The OIG initiated this inquiry (report) because of concerns from Congress and the public about the IP2 event. The Task Group addressed the findings of the OIG report related to SG issues as follows:

1) OIG finding: NRR's review of the SG inspection interval amendment request was not adequate.

Task Group comments: In hindsight, during the amendment review process, the issue regarding PWSCC degradation that was found in 1997 in the row 2 U-bend (SG 24, tube R2C67) could have been pursued further. If the staff had denied the amendment request, the next scheduled SG inspection would have been required prior to the tube failure. However, based on a review of the information available to the licensee and the staff during the amendment review, it is not clear to the Task Group if additional staff questions posed by the staff during the review would have changed the outcome of the license amendment request (i.e., NRC staff approval of amendment request).

2) OIG finding: The amendment request asked for a 1 year extension and was approved by NRR based on an SE completed by a junior engineer with limited experience in SG inspection techniques.

Task Group comments: The amendment had the effect of recapturing the time the plant was in wet lay-up (approximately 10 months) and also justified SG operation for an additional period of approximately 2 months. The SE technical considerations associated with justifying the recapture of the 10 month wet lay-up period involved assessing that chemistry conditions were maintained such that corrosion was minimized. No issues have been raised with respect to the validity of the SE conclusions regarding chemistry conditions. In addition, the additional period of approximately 2 months was considered insignificant by the NRR staff. The review was not of sufficient technical complexity such that a senior reviewer or contractor would be required. It should be noted that the IP2 SG tube failure occurred on February 15, 2000, which was approximately 8 months after the originally scheduled inspection date (i.e., less than the duration justified by the recapture of the wet lay-up period). Therefore, the SG inspection interval extension of approximately 2 months, associated with the issuance of Amendment No. 201, did not contribute to the tube failure event in February 2000. This conclusion is based on the fact that the tube failure took place in less than the number of effective full power days that was allowed between SG inspections.

Attachment 1 - Task Group Evaluation of OIG Report Findings (cont.)

3)OIG finding: During the amendment review process, the senior engineer did not review the source documents submitted by IP2 or the 1997 inspection report.

Task Group comments: Detailed review of the submittal and other source documents is normally conducted by the assigned technical reviewer (i.e., person that prepares the SE). There is no specific guidance provided in OL No. 803 as to the scope of review required by the staff providing concurrence on SEs (e.g., whether source documents are expected to be reviewed). In addition, there was no SRP guidance to perform reviews related to SG inspection interval extensions. Therefore, there was no guidance to the reviewers on whether review of previous licensee SG inspection reports was necessary. The Task Group concluded that there were two opportunities during the license review process for the NRC staff to find inadequacies in the licensee's operational assessment (i.e., during review of the RAI response and during review of the licensee's 1997 inspection report). If the amendment request had been denied, the next scheduled SG inspection would have been required before the tube failure event. However, it is not clear if further follow-up in either one of these cases would have changed the outcome of the license amendment request (i.e., NRC staff approval of amendment request). Therefore, it is also not clear that senior engineer review of the Con Ed submittal (i.e., amendment application and RAI response) and the 1997 inspection report would have yielded a different result with respect to the license amendment.

4)OIG finding: Other technical expertise available to the NRR staff was not employed to review the 1997 inspection report or the amendment request.

Task Group comments: The Task Group believes that the resources used in the review were appropriate given the complexity and safety significance of the proposed change. The review was not of sufficient technical complexity that a senior reviewer or contractor would be required.

5)OIG finding: Although the junior engineer was not completely satisfied with the response to the RAI, no additional questions were asked by the NRC of IP2.

Task Group comments: Review and interaction with the licensee during the review process was consistent with NRR OL No. 803. To meet staff timeliness goals, and to minimize unnecessary regulatory burden, a "goal" of the review process is to limit the RAIs to one round; however additional questions may be asked, if necessary. In discussions with the Task Group, the reviewer (i.e., "junior engineer") stated that the RAI response was considered "adequate" during the amendment review timeframe. The Task Group concluded that, in hindsight, had the tube degradation issue been pursued further (i.e., clarification phone call with licensee or second RAI), this was an opportunity to find inadequacies in the licensee's operational assessment directly related to the eventual tube failure. However, it is not clear if further follow-up would have yielded a different result (e.g., denial of the amendment request).

Attachment 1 - Task Group Evaluation of OIG Report Findings (cont.)

- 6) OIG finding: OIG found nearly no involvement in the amendment request review by either the NRR Project Manager assigned to IP2 or the EMCB Branch Chief.

Task Group comments: The technical complexity of the review was such that the review would not normally be done by the NRR Project Manager (PM). The review was assigned to EMCB technical staff consistent with the guidance in NRR OL No. 803. Detailed review of an amendment request is normally conducted by the assigned technical reviewer. The Task Group believes that the PM involvement was consistent with the guidance in OL No. 803, given the technical complexity of the review. Consistent with normal practices, EMCB branch supervision provided oversight of the technical reviewer, review of the RAI questions, and review of the completed SE. Note, in order to clarify NRR management expectations, the NRR staff intends to review and revise the amendment review process described in OL No. 803, as appropriate, to address concurrence responsibilities, supervisory oversight, as well as second round RAIs.

- 7) OIG finding: Had the NRC staff or contractor with technical expertise evaluated the 1997 results of the IP2 SG inspection, the NRC could have identified the flaw in the U-bend of row 2, column 5, in SG 24 that was indicated in the licensee's inspection (examination) report.

Task Group comments: The Task Group concluded that the NRC staff could not have identified the tube that failed from its review of the licensee's examination report. The report did not indicate that there was a flaw in the row 2, column 5 tube in SG 24 or provide any information on this tube. Even if the staff should have been prompted by the report's identification of a new degradation mechanism (PWSCC) in a similar tube that was plugged, it would have required further discussion with the licensee, additional staff review of the 1997 raw eddy current data of the failed tube, and identification of the flaw from the data, which clearly was of poor quality due to noise. Experts that the Task Group interviewed held different views on whether the flaw (in the row 2, column 5 tube in SG 24) could have reasonably been detected from the data. Licensees' reports in general, and this report in particular, do not provide information related to the data quality. In order for the NRC to have this information, an eddy current specialist has to review the raw data independently. This is not typically included within the scope of NRC inspection or review.

Attachment 2 - Task Group Evaluation of RES Review

In a memo from S. Collins, Director, Office of Nuclear Reactor Regulation (NRR), to A. Thadani, Director, Office of Research (RES), dated February 28, 2000, NRR requested that RES perform an independent technical review of the staff's safety evaluation (SE) for the steam generator (SG) tube inspection interval extension amendment for IP2. NRR requested this independent review to determine if the conclusions in the staff's SE were technically sound and the data presented by the licensee provided "reasonable assurance that the delayed inspection would not result in an appreciably increased probability of tube failure prior to the next scheduled inspection." NRR does not typically ask RES to review staff SEs. However, in this case, NRR requested the review as a direct result of the February 15, 2000, SG tube failure at IP2. RES provided the results of their review in a memo dated March 16, 2000.

- 1) RES conclusions: Working from the assumption that the original SG inspection interval was justified, RES concluded that granting the requested extension of the inspection interval would not have appreciably increased the probability of SG tube failure.

Task Group comments: The Task Group agrees with the RES conclusions. In interviews with the Task Group, the NRR staff involved in the review for the license amendment stated that the licensee's request to extend the SG inspection interval by approximately 2 months was not considered to be safety significant. The IP2 1997 outage SG inspections were completed in June 1997. Between the time period after completion of the 1997 outage and before the tube failure, the plant was shutdown for approximately 10 months (wet lay-up periods of 18 days and 285 days). The cumulative time that plant had operated at power, from the June 1997 inspection until February 2000 when the SG tube failed, was less than the normal 24 month inspection interval (according to IP2 Technical Specifications, SG inspections are to be conducted no more than 24 months after the previous inspection). Therefore, had IP2 operated continuously (without the 10-month time the plant was shutdown) after startup from the 1997 inspection outage, the SG tube that failed would likely have failed even without an extension of the inspection interval.

Attachment 2 - Task Group Evaluation of RES Review (cont.)

2) RES conclusions: RES characterized the licensee's response to a staff request for additional information (RAI) as "weak and incomplete." In particular, RES concluded that the case presented by the licensee on crack growth rates was technically inaccurate. In the licensee's discussion about the first time a row 2 U-bend PWSCC indication was found, Con Ed stated "[A]s this represented the first detected U-bend indication after approximately 23 years of operation, any growth rates associated with this indication would be considered minimal." RES disagreed with the licensee's contention because "it is inconsistent with the evolution of stress corrosion cracking and with other industry experience." The RES review stated that "[t]he appearance of a "first" stress corrosion crack typically indicates that an incubation phase has passed and that more cracks are likely. Studies from service experience indicate that once stress corrosion cracks initiate, the number of future indications will initially increase exponentially with time." RES also concluded that contrary to their findings, the NRR SE indicates that the licensee conducted more thorough operational assessments than were described in response to the RAI, and the SE concludes that the tubes would meet structural and leakage integrity through the end of operating cycle 14.

Task Group comments: The Task Group held discussions with Con Ed staff. With respect to the RAI response, Con Ed stated that Dominion Engineering performed a study for IP2 on SG degradation in 1995 that made PWSCC predictions, but didn't predict that a PWSCC flaw in the U-bends would occur until 1999. When Con Ed found the PWSCC flaw in the SG 24 tube R2C67 U-bend during the 1997 outage, they contacted Dominion Engineering after the outage to get them to update the report based on the inspection findings. The new projection for PWSCC indications was one additional indication per cycle, not an exponential increase in indications. Since the projections were based on the mid-range probe findings, the use of the high range probe would have led to a different result based on the increased number of indications found (i.e., not just one indication as was found with the mid-range probe). Con Ed understood that they gave a rather perfunctory response to the RAI question about PWSCC degradation and growth rates. Since they had Dominion Engineering look at this issue, they believed that they had a technical basis for their conclusion, but this part of the Condition Monitoring/Operation Assessment (CMOA) was not described in detail in the RAI response.

The Task Group interviewed the NRR staff that were involved with the review associated with the SG tube inspection interval extension amendment. The RAI response was considered adequate by the staff technical reviewer at the time the SE was being prepared. However, subsequent to the IP2 tube failure event, one NRR staff member reviewed the RAI response and stated that a licensee conclusion regarding growth rates was "ridiculous." The staff member stated that although this statement was "ridiculous," it wouldn't have affected the staff conclusions with respect to row 2 tube integrity because the reviewers believed that the 1997 SG inspection by the licensee established appropriate safety margins. The NRC review was done with the assumption that the 1997 inspection of 100% of the SG tubes was done in an adequate manner. The Task Group concluded that, in hindsight, had the RAI response issue on growth rates been pursued further by NRR staff (i.e., clarification phone call with licensee or second RAI) this was an opportunity to find inadequacies in the licensee's operational assessment directly related to the eventual tube failure. However, it is not clear if this would have changed the outcome of the amendment request (i.e., NRC staff approval of amendment request).