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June 19, 1989

U. S. Nuclear Regulatory Commission
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Gentlemen:

Docket 50-305
Operating License DPR-43
Kewaunee Nuclear Power Plant
Response to NRC Bulletin No. 89-01, "Failure of Westinghouse Steam Generator Tube Mechanical Plugs

The referenced NRC Bulletin was transmitted to Wisconsin Public Service Corporation by letter dated May 15, 1989. This bulletin requested information from licensees about Westinghouse mechanical plugs. It was also requested that an action plan be implemented to ensure that these plugs will continue to provide adequate assurance of reactor coolant system pressure boundary integrity.

By attachment to this letter, WPSC provides our response to NRC Bulletin No. 89-01.

Since the proposed corrective action schedule for the Kewaunee Nuclear Power Plant is not within the general guidance provided in the reference NRC Bulletin, summary rationale and justification discussion has been included. Should further information be required in your review of this submittal, WPSC would welcome the opportunity to meet and discuss this issue with the NRC staff.

Sincerely,

- President

D. C. Hintz
Senior Vice President - Power Production

Subscribed and Sworn to
Before Me This 19th Day
of June 1989

Notary Public, State of Wisconsin

My Commission Expires:
June 23, 1991

CSS/jms
Attach.
cc - Mr. Robert Nelson, US NRC
US NRC, Region III

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Attachment

To

Letter from D. C. Hintz (WPSC) to NRC Document Control Desk

Dated

June 19, 1989

1. NRC Request

"Addressees are requested to verify that information contained in References 1 and 2 relating specifically to their plants is correct for plugs supplied from heat numbers 3279, 3513, 3962 and 4523. The specific information to be verified is the number of Westinghouse mechanical plugs installed in the hot and cold legs broken down by steam generator number, heat number, and date of installation. If information from these references is incorrect, appropriate corrections should be identified. Addressees are requested to so state if their plants have not installed Westinghouse mechanical plugs from the subject heats."

WPS Response

References 1 and 2 to NRC Bulletin No. 89-01, "Failure of Westinghouse Steam Generator Tube Mechanical Plugs," contained information specific to Kewaunee Nuclear Power Plant for Westinghouse mechanical plugs supplied from heat numbers 3279, 3513, 3962, and 4523.

The S/G location, quantity, heat numbers and installation date information was verified to be correct, and is summarized as follows:

S/G Location	Qty	Heat #	Installation Date	Remaining EFPD to Minimum Ligament
A Hot Leg	30	3962	April 1986	-158
B Hot Leg	47(45)	3962	April 1986	-158
A Cold Leg	29	3962	April 1986	4731
B Cold Leg	46	3962	April 1986	4731
A Hot Leg	44	3962	March 1987	131
B Hot Leg	79(70)	3962	March 1987	131
A Cold Leg	44	3962	March 1987	5027
B Cold Leg	79	3962	March 1987	5027
A Hot Leg	17	4523	March 1988	411

S/G Location	Qty	Heat #	Installation Date	Remaining EFPD to Minimum Ligament
B Hot Leg	26	4523	March 1988	411
A Cold Leg	17	4523	Marcn 1988	5354
B Cold Leg	26	4523	March 1988	5355

During the recently completed 1989 refueling outage, eleven (11) plugs were pulled, for analysis, from the hot leg of B steam generator. Of those pulled, two (2) were originally installed in 1986; the other nine (9) were originally installed in 1987. The parenthetic numbers in the table above reflect the currently installed quantities of the affected heat number plugs.

Records indicate that Kewaunee Nuclear Power Plant has not installed Westinghouse mecnanical plugs from heat numbers 3279 or 3513.

2.a) NRC Request

"Steam generator tube plug lifetime for plugs from heats 3279, 3513, 3962, and 4523 should be estimated using the methodology from References 1 and 2 and should be based on the Millstone Unit 2 benchmark subject to any corrections per item 1 above. Lifetime estimates in Reference 2 for plugs fabricated from heat 4523 are based on the Farley Unit 2 benchmark. These estimates should be adjusted to reflect the Millstone Unit 2 benchmark using the methodology described in Section 4.1.2 of Reference 1."

WPS Response

Westinghouse has performed lifetime estimates for the plugs installed in the Kewaunee Nuclear Power Plant steam generators from heat numbers 3962 and 4523. These lifetime estimates are shown in the table in item 1 above and reflect the conservative Millstone Unit 2 benchmark. The "Remaining EFPD to Minimum Ligament" was calculated by Westinghouse. These values constitute a revision to the data provided in WCAP-12244 Rev. I (reference 1. to NRC Bulletin 89-01); it is our understanding that Westinghouse will include these revisions in an update to that document.

2.b) NRC Request

"Addressees should implement appropriate remedial actions (i.e., repair and/or replacement) for all plugs whose estimated lifetimes in 2a, above do not extend to the next refueling outage. If operation is planned beyond a refueling outage that represents the last outage before any plug exhausts the predicted lifetime, an alternative schedule with the appropriate technical justification should be submitted to the NRC at least 30 days before the end of this refueling outage."

WPS Response

Kewaunee Nuclear Power Plant has tentatively planned a one time plug repair/replacement effort scheduled for the 1991 refueling outage (March, 1991).

As can be seen in the table in item 1 above, this schedule indicates planned operation beyond the predicted lifetime of certain installed plugs and, therefore, is not within the guidance provided in the referenced NRC Bulletin. However, several factors reviewed, or currently under review, by WPSC and Westinghouse support the WPSC position that this schedule is most cost-effective, operationally desirable, ALARA-conscious, and furthermore, does not constitute a safety concern.

Safety

In response to the North Anna Unit 1 mechanical plug failure referenced in NRC Bulletin 89-01, Kewaunee Nuclear Power Plant pulled a sample of 11 (eleven) plugs during the 1989 refueling outage. Lifetime estimates for these plugs, calculated using the extreme conservation prescribed by this NRC Bulletin, would have led to the expectation of significant (in some cases, through wall) circumferential cracking. Analysis of these plugs indicated minor axial cracking in four plugs, with no observed cracking in the remaining seven. It is important to note that the minor axial cracking observed was located below the plug expander, and thus, not in an RCS pressure boundary. As identified by Westinghouse, this is the region of highest residual stress. To reiterate, no circumferential cracking was observed, and only minor axial cracking was evidenced.

This sample analysis would seem to substantiate the generic Westinghouse claim of significant conservatism in the lifetime estimate model. Specifically, this sample analysis should serve to classify, qualify, and

following more rigorous investigation, quantify crack morphology and growth rates specific to the Kewaunee Nuclear Power Plant, in lieu of the "generic", and highly conservative growth rate benchmarked by Millstone Unit 2 observations.

Also, Kewaunee Nuclear Power Plant steam generator tubes are partial-depth expanded. On the basis of Westinghouse testing, the existence of partial-depth expanded tubes precludes a tube perforation in the event of a plug-top separation event.

ALARA

Assuming the Westinghouse plug-in-a-plug (PIP) as an example of a short term corrective action, and based on Westinghouse field experience to date, the robotic installation of 232 PIP's in the hot legs of both Kewaunee Nuclear Power Plant steam generators would incur a total radiation dose, for the 1990 refueling outage alone, of more than 23 manRem.

Since WPSC has planned a major tube recovery effort (via sleeving) for the 1991 refueling outage, PIP removal would be a mandatory sleeving precursor. Again, a duplication of efforts, with attendant duplication of radiation exposure, would be unnecessarily incurred. Thus, requiring Kewaunee Nuclear Power Plant to correctively repair the affected heat number plugs in 1990 could incur an avoidable radiation exposure on the order of 46 manRem.

Other methods of corrective actions, such as plug pulling, re-plugging, followed by plug pulling in 1991 would incur even higher radiation exposure.

Operations

It is operationally significant to note, and emphasize, that to date, Kewaunee Nuclear Power Plant has observed no indication of mechanical plug leakage. However, were primary to secondary leakage to occur, it would be identified, and trended in a manner similar to the augmented leak monitoring program implemented in response to the North Anna Unit 1 tube rupture (reference NRC Bulletin 88-02). The shutdown requirements cited in that program do not appear to be applicable to tube plug leakage, and thus, need not be implemented. Normal, Technical Specification, primary-to-secondary leakage limits would be observed and applied.

Cost

Kewaunee Nuclear Power Plant has scheduled a 1990 refueling outage of approximately 35 days. The addition of a plug repair/replacement effort would entail an estimated minimum of four days of critical path outage time extension to the 1990 outage, with attendant and replacement power costs loss of revenue. Also, the vendor/contractor cost for this service and materials would be an added expense.

Since WPSC has planned a major effort in the recovery of plugged tubes (via sleeving) for the 1991 refueling outage, plug pulling or plug-in-a-plug removal would then be a mandatory precursor to the sleeving. (Note that the effects of repeated plug pulling on the tube walls may potentially reduce the number of recoverable tubes.) Should a plug repair/replacement effort be required in 1990, in addition to the planned 1991 work, a duplication of efforts, again with attendant outage and vendor cost, would be unnecessarily incurred.

WPSC views this plug issue not as a safety concern, but rather as an operational concern to be addressed through a planned, cost-effective, ALARA-conscious effort. The implementation of corrective actions according to the NRC Bulletin prescribed schedule would:

- incur schedule losses of four (4) additional days for both the 1990 and 1991 refueling outages.

- incur additional financial expenditures for mobilization, manpower, and materials for both the 1990 and 1991 refueling outages.

- incur an estimated minimum avoidable radiation exposure of 23 manRem for each of the 1990 and 1991 refueling outages. Total exposure would be expected to be significantly higher if manual repair/replacement methods are necessary (eg., if robotic equipment is unavailable).

- not significantly enhance safe operation of the Kewaunee Nuclear Power Plant since, on the basis of Westinghouse analyses and information to

date, the existence of partial depth expanded tubes precludes a tube perforation in the event of a plug-top separation event. A conservative plug life estimate algorithm provides additional confidence in the integrity of the currently installed plugs.

In summary, WPSC believes that a planned, cost-effective, ALARA-conscious plug repair/replacement effort is most effectively implemented via the planned 1991 program.

2.c) NRC Request

"Prior to any plug repairs or replacement, addressees are reminded that their responsibilities under ALARA require analysis of the various plug repair or replacement methods available to determine which method will result in the lowest overall personnel radiation exposure while still remaining cost-effective. In choosing a plug repair or replacement method, the licensee should consider the accessibility of the plugs and the dose reduction benefit of using robotic manipulators. Prior to plug repair or replacement, the licensee should consider steam generator decontamination and/or local shielding to reduce working area dose rates."

WPS Response

Kewaunee Nuclear Power Plant is committed to the effective implementation of an ALARA-conscious plug repair/replacement effort. As has been done in the past for steam generator eddy current inspections, tube plugging, and sleeving, Kewaunee Nuclear Power Plant will give thorough

consideration to dose reduction methods such as robotic manipulators, local shielding, and job pre-planning (i.e., mock-up training) in an effort to implement a dose and cost-effective plug repair/replacement program.

However, in spite of the relatively clean primary system at the Kewaunee Nuclear Power Plant, and the above efforts not withstanding, expediting a short term remedial effort in 1990 will incur significant manRem exposures.

Preliminary dose estimates for some repair/replacement options are discussed in more detail in item 2.b) above.

2.d) NRC Request

"Installation of Westinghouse mechanical plugs from heats 3279, 3513, 3962, and 4523 should be discontinued."

WPS Response

WPS discontinued the use of Westinghouse mechanical plugs from heat numbers 3279, 3513, 3962, and 4523.

2.e) NRC Request

"Westinghouse mechanical plugs removed from steam generators, regardless of heat number, snould be examined for PWSCC on a sample basis for each heat. Addressees should maintain a record of these examinations, and the results should be provided to Westinghouse to improve the database concerning the susceptibility of plugs to PWSCC."

WPS Response

As mechanical plugs are removed from the Kewaunee Nuclear Power Plant steam generators, samples will be examined for PWSCC. Examination records will be maintained, and examination results will be made available to Westinghouse.

3. NRC Request

"Remedial actions at plants where the steam generator tubes are partially-depth-expanded within the tubesheet as described above may be deferred on a one time basis to the next scheduled refueling outage if the outage that immediately follows receipt of this bulletin ends before October 1, 1989."

WPS Response

The tubes in the Kewaunee Nuclear Power Plant steam generators are partial-depth-expanded within the tube sheet.

The next refueling outage for the Kewaunee Nuclear Power Plant is scheduled for March, 1990. Although this does not fall within the time allowed by the NRC Bulletin, the existence of partial depth tube rolls, along with the other considerations described in our response to item 2.b, provide the basis for a one time deferral of actions to the 1991 refueling outage.

4. NRC Request

"Remedial actions for "sentinel related" mechanical plugs described above may be deferred on a one time basis to the next refueling outage if the outage that immediately follows receipt of this bulletin ends before October 1, 1989."

WPS Response

Kewaunee Nuclear Power Plant has no "sentinel related" mechanical plugs installed in the steam generators.

Additionally, during the review and evaluation of Actions Requested, items 3 and 4 of this NRC Bulletin, an inequity deemed worthy of note, was identified. Specifically, those licensees operating on a one year cycle, such as the Kewaunee Nuclear Power Plant, are requested to implement corrective actions on a substantially shorter schedule than those licensees operating on an 18 month cycle. To clarify, the maximum deferral for a one year cycle license would be to the fall outage of 1990, vice deferral to the spring of 1991 for 18 month cycle licensees.