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SUBJECT: Application for amend to License DPR-58, addressing applicable requirements of NRC GL 95-05, "Voltage-Based Repair Criteria for Repair of Westinghouse SG Tubes Affected by Outside Diameter Stress Corrosion Cracking."

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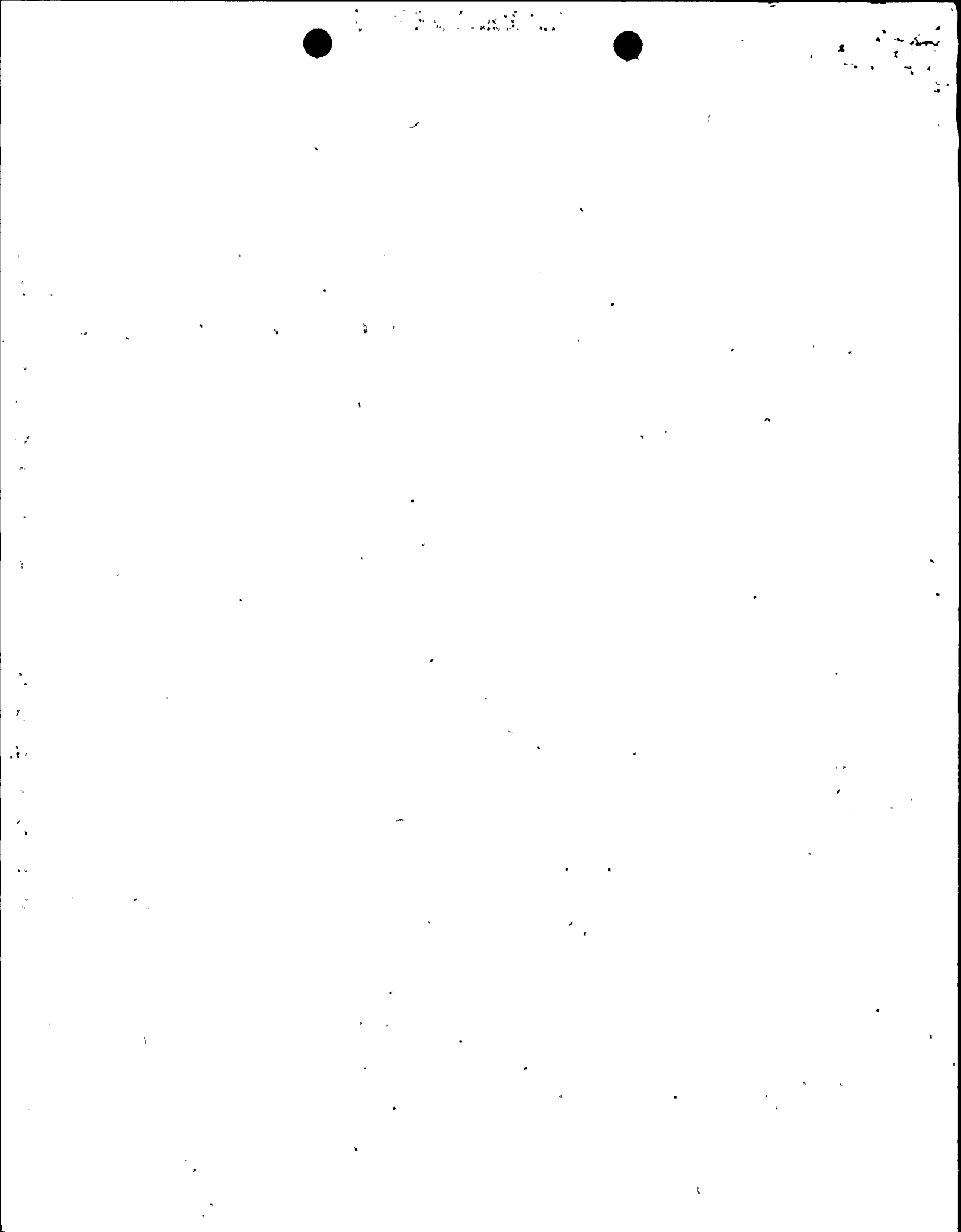
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American Electric Power  
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June 19, 1996

AEP:NRC:1166AA

Docket Nos.: 50-315

U. S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, D. C. 20555

Gentlemen:

Donald C. Cook Nuclear Plant Unit 1  
TECHNICAL SPECIFICATION CHANGES TO INCORPORATE  
2 VOLT STEAM GENERATOR TUBE SUPPORT PLATE  
REPAIR CRITERION

This letter and its attachments provide application for amendment to the technical specifications (T/Ss) of Donald C. Cook Nuclear Plant Unit 1. Specifically, this information addresses the applicable requirements of NRC Generic Letter (GL) 95-05 "Voltage-Based Repair Criteria for the Repair of Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking."

Attachment 1 provides a technical summary of the specific inspection practices and calculation methodologies outlined in GL 95-05 and the 10 CFR 50.92 no significant hazards evaluation. The evaluation and results support continued use of the 2 volt plugging criteria as allowed by GL 95-05 for future operating cycles. Attachment 2 contains existing T/S pages marked to reflect the requested changes. Attachment 3 provides the proposed revised T/S pages.

We believe the proposed changes will not result in (1) a significant change in the types of any effluent that may be released offsite, or (2) a significant increase in individual or cumulative occupational radiation exposure.

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These proposed changes have been reviewed by the Plant Nuclear Safety Review Committee and the Nuclear Safety and Design Review Committee.

In compliance with the requirements of 10 CFR 50.91(b)(1), copies of this letter and its attachments have been transmitted to the Michigan Public Service Commission and to the Michigan Department of Public Health.


Sincerely,



E. E. Fitzpatrick  
Vice President

SWORN TO AND SUBSCRIBED BEFORE ME

THIS 19th DAY OF June 1996

  
\_\_\_\_\_  
Notary Public

My Commission Expires: 6-28-99

llg

Attachments

cc: A. A. Blind  
G. Charnoff  
H. J. Miller  
NFEM Section Chief  
NRC Resident Inspector - Bridgman  
J. R. Padgett

bc: S. J. Brewer/M. S. Ackerman/K. J. Toth  
J. A. Kobyra  
D. R. Hafer/J. R. Jensen  
J. B. Shinnock  
J. S. Wiebe  
J. B. Hickman, NRC - Washington, D.C. - w/attachment  
PRONET - w/attachment  
DC-N-6015.1



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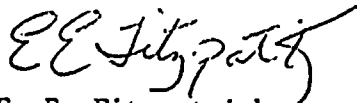
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DC-N-6015.1

ATTACHMENT 1 TO AEP:NRC:1166AA

DESCRIPTION OF CHANGES  
TO THE DONALD C. COOK NUCLEAR PLANT  
UNIT 1 TECHNICAL SPECIFICATIONS

10 CFR 50.92 EVALUATION

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## I. INTRODUCTION

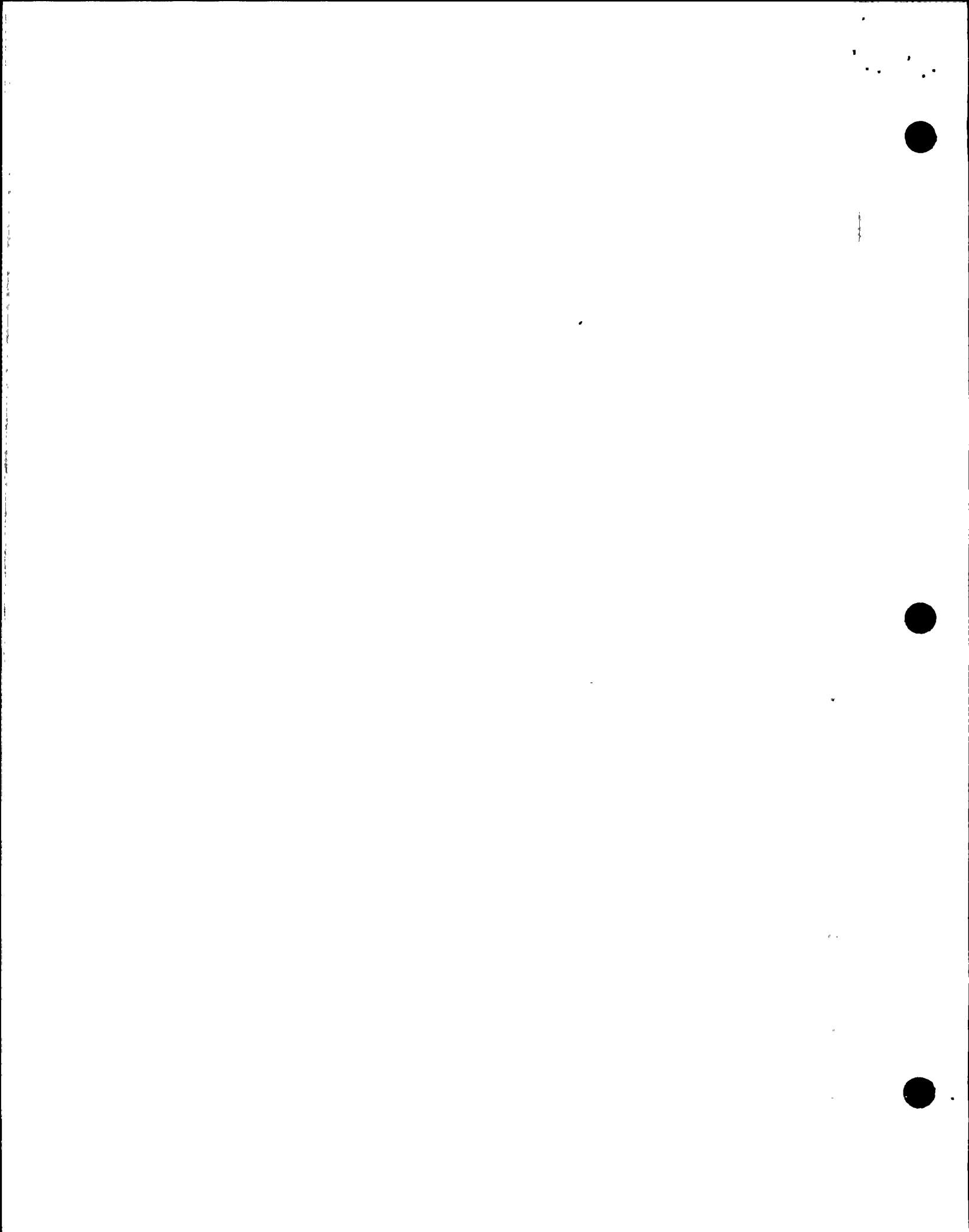
This amendment request proposes a change to Cook Nuclear Plant Unit 1 steam generators (SG) T/Ss 4.4.5.2, 4.4.5.4, 4.4.5.5, 3.4.6.2 and Bases 3/4.4.5 and 3/4.4.6.2 to allow use of GL 95-05 voltage-based SG tube support plate (TSP) plugging criteria. The change allows SG tubes with bobbin coil eddy current indications less than or equal to 2 volts at TSP intersections to remain in service, regardless of the apparent depth of tube wall penetration if, as a result, the projected end-of-cycle (EOC) distribution of crack indications is shown to result in primary-to-secondary leakage less than 8.4 gpm in the faulted loop during a postulated steam line break (SLB) event. Indications greater than 2 volts but less than or equal to the upper voltage repair limit ( $V_{URL}$ ) may remain in service if a motorized rotating pancake coil (MRPC) probe inspection does not detect degradation. The  $V_{URL}$  will be determined each outage using the most recent, NRC-approved industry tube burst data base to determine the voltage corresponding to the tube structural limit ( $V_{SL}$ ).

This amendment would reduce the number of SG tubes plugged due to indications at support plate intersections. Reducing the number of plugged tubes provides ALARA benefits and maintains reactor coolant system (RCS) flow margin.

Assessment reports addressing the effectiveness of the voltage-based plugging criteria methodology are described in WCAP-13187, Revision 0, which was completed following fuel cycles 13 and 14. This information was reported in submittal documents AEP:NRC:1166J and AEP:NRC:1166AC. The reports concluded that the voltage distribution found by inspection at EOC 13 and EOC 14, in 1994 and 1995, respectively, were in good agreement with the projections. The voltage growth rates continue to be very small.

No in-service tubes were found for which the bobbin coil voltage exceeded the 2 volt plugging criteria repair limit at EOC 13 or EOC 14.

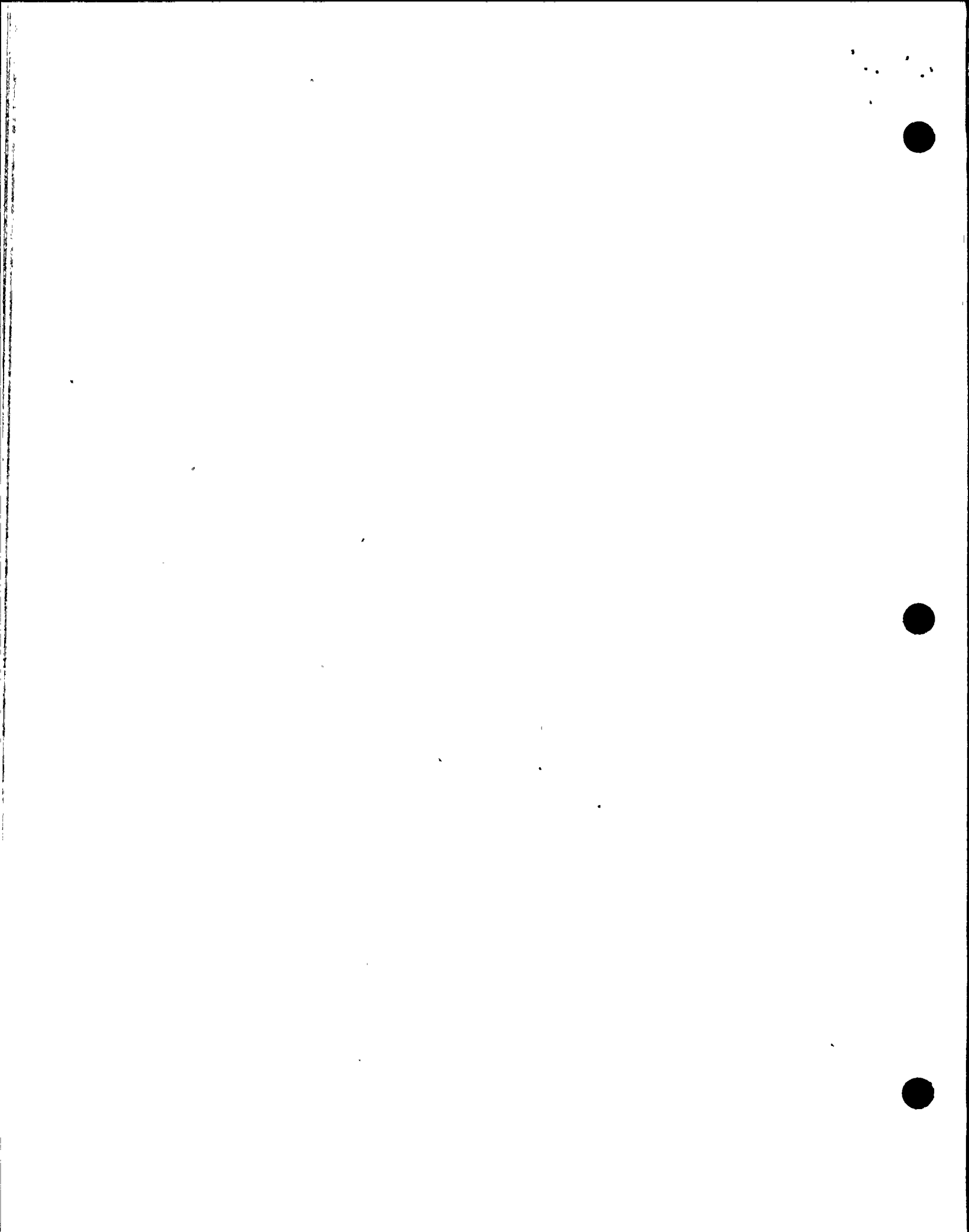
Considering the results of the aforementioned reports, continued use of the 2 volt plugging criteria is justified. Similar assessment and projection reports based on GL 95-05 reporting requirements will be prepared at each EOC.



II. APPLICATION OF GL 95-05 TO THE COOK NUCLEAR  
PLANT UNIT 1 SG' LICENSE AMENDMENT

The Cook Nuclear Plant Unit 1, 2 volt plugging criteria will be implemented per the guidance of GL 95-05 along with the latest industry data for tube burst and leakage. NRC GL 95-05 will be factored into the Cook Nuclear Plant Unit 1 plugging criteria as follows:

- 1) Analysts will be briefed regarding the possibility of primary water stress corrosion cracking (PWSCC) at TSP intersections. If PWSCC is found at the support plate intersections it will be reported to the NRC staff prior to startup.
- 2) The use of supporting data sets for calculation of burst probability and estimation of primary-to-secondary leakage during a postulated main SLB for each outage will be based on the most current, NRC-approved industry data base. The latest industry data base was transmitted to the NRC under Beaver Valley Power Station's, Unit 1, March 27, 1996, letter transmitting supplemental information in support of a requested T/S change, for a voltage-based SG tube repair criteria, originally proposed in their letter dated December 7, 1995. That data base was used in the preparation of this submittal.
- 3) Main steam line burst probability and leakage calculations will be performed following the guidance of GL 95-05, Section 2, "Tube Integrity Evaluation." Calculations performed in support of the voltage-based repair criteria will follow the methodology described in WCAP-14277, "Steam Line Break Leak Rate and Tube Burst Probability Analysis Methods for Outside Diameter Stress Corrosion Cracking at Tube Support Plate Intersections," dated January 1995. The calculations, using the as-found voltage distribution, will be performed prior to returning the SGs to service. The projected EOC voltage distribution results will be reported in the 90 day report.
- 4) Inspection scope, data acquisition, and data analysis will be performed following the guidance of GL 95-05, Section 3, "Inspection Criteria" and referenced Appendix A, "NDE Data Acquisition and Analysis Guidelines." An MRPC inspection will be done on all indications exceeding 2 volts. An MRPC inspection will also be done on all intersections where copper signals, large mixed residuals, or dents larger than 5 volts interfere with detection of flaws.



Probe wear inspections and re-inspections will be performed using the following guidelines:

If any of the last probe wear standard signal amplitudes, prior to probe replacement, exceed the  $\pm 15\%$  limit by a value of "X%," then any indications measured since the last acceptable probe wear measurement that are within "X%" of the plugging limit will be reinspected with the new probe. For example, if any of the last probe wear signal amplitudes prior to probe replacement were 17% above or below the initial amplitude, then the indications that are within 2% (17%-15%) of the plugging limit must be reinspected with the new probe. Alternatively, the voltage criterion may be lowered to compensate for the excess variation; for the case above, amplitudes  $\geq 0.98$  times the voltage criterion could be subject to repair.

- 5) Tube removal and examination will be performed based on the guidance contained in GL 95-05, Section 4, "Tube Removal and Examination/Testing." Plans are to pull a tube specimen with at least two intersections during the 1997 refueling outage.
- 6) Application of GL 95-05, Section 5, "Operational Leakage Requirements," will be continued. The SG tube leakage limit of 150 gallons per day through each SG will be maintained as previously approved by the NRC for our present fuel cycle. Cook Nuclear Plant leakage monitoring methods provide timely leak detection, trending, and response to rapidly increasing leaks.
- 7) GL 95-05, Section 6, "Reporting Requirements," will be implemented. As stated previously for Section 2, the calculation of leakage and burst probability required prior to returning the SGs to service will be performed using of the as-found EOC voltage distribution.

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III. AEP COMMENTS TO GL 95-05 AND ASSOCIATED IMPACT TO AEP LICENSE AMENDMENT REQUEST FOR SG PLUGGING CRITERIA

- 1) GL 95-05, Section 1.b: Analyses performed by Westinghouse have shown that no tubes in the Cook Nuclear Plant Unit 1 SGs would be subject to collapse during a loss of coolant accident (LOCA) plus safe shutdown earthquake (SSE) event. Therefore, no tubes are excluded based on this criteria. Series 51 SGs, designed by Westinghouse, do not have flow distribution baffle plates; therefore, Section 1.b.5 is not applicable.
- 2) GL 95-05, Section 3.c.3: The requirement to reinspect all tubes prior to the last probe changeout if the wear measurement exceeds 15% is unnecessary. Reinspection of indications necessitated by out-of-specification probe wear will be conducted according to item 4 of page 2 of this attachment.

IV. 10 CFR 50.92 EVALUATION

BACKGROUND

Cook Nuclear Plant Unit 1 T/S Amendment 200 permitted the implementation of a 2 volt SG tube plugging criteria. That license amendment, applicable only for the current operating cycle (cycle 15), requires the repair of flaw-like bobbin indications above 2 volts. We are proposing use of a similar 2 volt repair criterion without the cycle-specific limitation.

The proposed plugging criteria program for the Cook Nuclear Plant Unit 1 SGs follows the guidance and general intent of GL 95-05 to maintain tube structural and leakage integrity.

DESCRIPTION OF THE PLUGGING CRITERIA REQUEST

As required by 10 CFR 50.91 (a)(1), an analysis is provided to demonstrate that the proposed license amendment to implement a plugging criteria for the TSP elevation Outside Diameter Stress Corrosion Cracking (ODSCC) occurring in the Cook Nuclear Plant Unit 1 SGs involves a no significant hazards consideration. The plugging criteria utilizes correlations between eddy current bobbin coil probe signal amplitude (voltage) and tube burst and leakage capability. The plugging criterion is based on testing of laboratory induced ODSCC specimens and on extensive examination of

pulled tubes from operating SGs (industry wide -- including three tubes pulled in 1992' representing nine intersections from Cook Nuclear Plant Unit 1).

Consistent with GL 95-05, the plugging criteria program for Cook Nuclear Plant Unit 1 will include the following elements as listed under "1. Overview of the Voltage Repair Limit Approach," page 3 of GL 95-05.

- *Perform an enhanced inspection of tubes, particularly at the TSP intersections.*

A 100% bobbin coil inspection of hot leg TSP intersections and cold leg intersections, down to the lowest cold leg support plate with known ODSCC indications, will be performed. All flaw indications with bobbin voltages greater than 2 volts will be inspected by MRPC.

- *Utilize Nondestructive Examination (NDE) data acquisition and analysis procedures that are consistent with the methodology used to develop the voltage-based repair limits.*

The inspection scope, data acquisition, and data analysis will be performed using the guidance of Section 3 of the GL.

- *Repair tubes that exceed the voltage limits.*

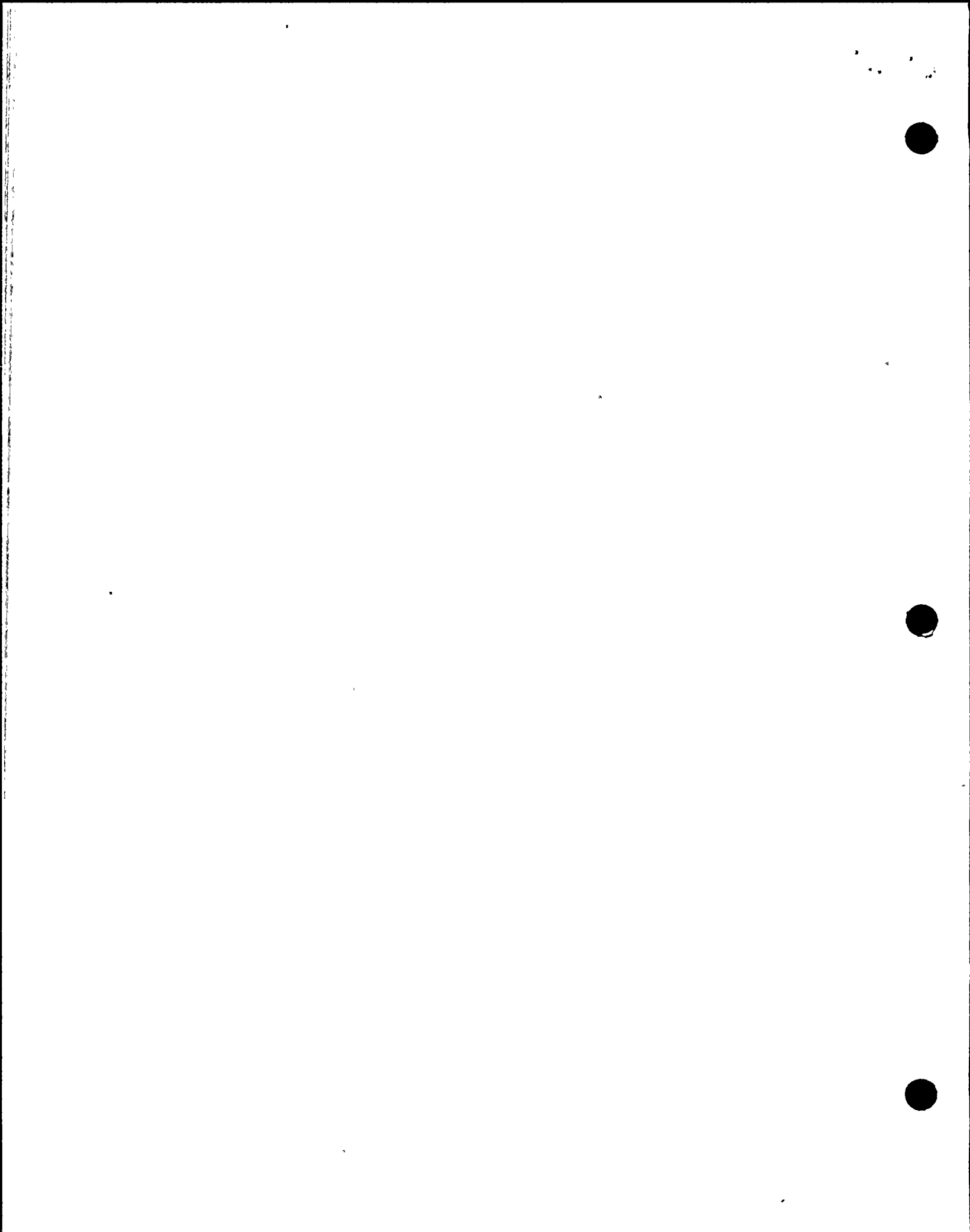
Flaw-like signals adjacent to the TSP, with bobbin voltages less than or equal to 2 volts, will be allowed to remain in service. Flaw-like indications adjacent to the TSP, with a bobbin voltage of greater than 2 volts but less than or equal to upper voltage repair limit, may remain in service if MRPC inspection does not detect a flaw. Flaw indications with a voltage of greater than the upper voltage repair limit will be repaired.

- *Determine the Beginning of Cycle (BOC) voltage distribution.*

Beginning of Cycle voltage distribution will be established from the actual tube inspections to be performed and will be established using current program methodology.

- *Project the EOC distribution.*

An EOC voltage distribution will be established based on the EOC eddy current test data. EOC voltage distribution will be projected using Monte Carlo techniques as described in WCAP-



14277 and will include allowance for eddy current uncertainty as defined in GL 95-05 and a conservative voltage growth rate allowance.

- *For the projected EOC voltage distribution, calculate both the primary-to-secondary leakage under postulated accident conditions and the conditional tube burst probability. As an alternative, the actual measured EOC voltage distribution can be used when it is impractical to complete the projected EOC calculation prior to returning the SGs to service for the purpose of determining whether the reporting criteria in GL 95-05 Sections 6.a.1 and 6.a.3 apply.*

Steam line break leakage will be calculated, as described in WCAP-14277, based on the EOC projected voltage distribution. Projected leakage must remain below 8.4 gpm in the faulted loop for permissible offsite dose estimates to remain acceptable within 10% of the 10 CFR 100 guidelines. The 8.4 gpm leakage for offsite dose estimates is smaller than the leakage number calculated for acceptable control room dose per General Design Criteria (GDC) 19. Therefore, the offsite dose is more limiting.

Conditional tube burst probability will be calculated according to the methodology described in WCAP-14277. Consistent with GL 95-05, if burst probability is found to be greater than  $1 \times 10^{-2}$  the NRC will be consulted.

As prescribed in GL 95-05, an evaluation of primary-to-secondary leakage (and subsequently offsite dose) is required for all plants implementing the plugging criteria. All bobbin coil indications are included in the SLB leakage analyses, along with consideration of the probability of detection. If the projected leakage exceeds 8.4 gpm in the faulted loop during a postulated SLB event, the number of indications to which the plugging criteria are applied is reduced, through tube repair, until the primary-to-secondary leakage limits are satisfied.

## EVALUATION

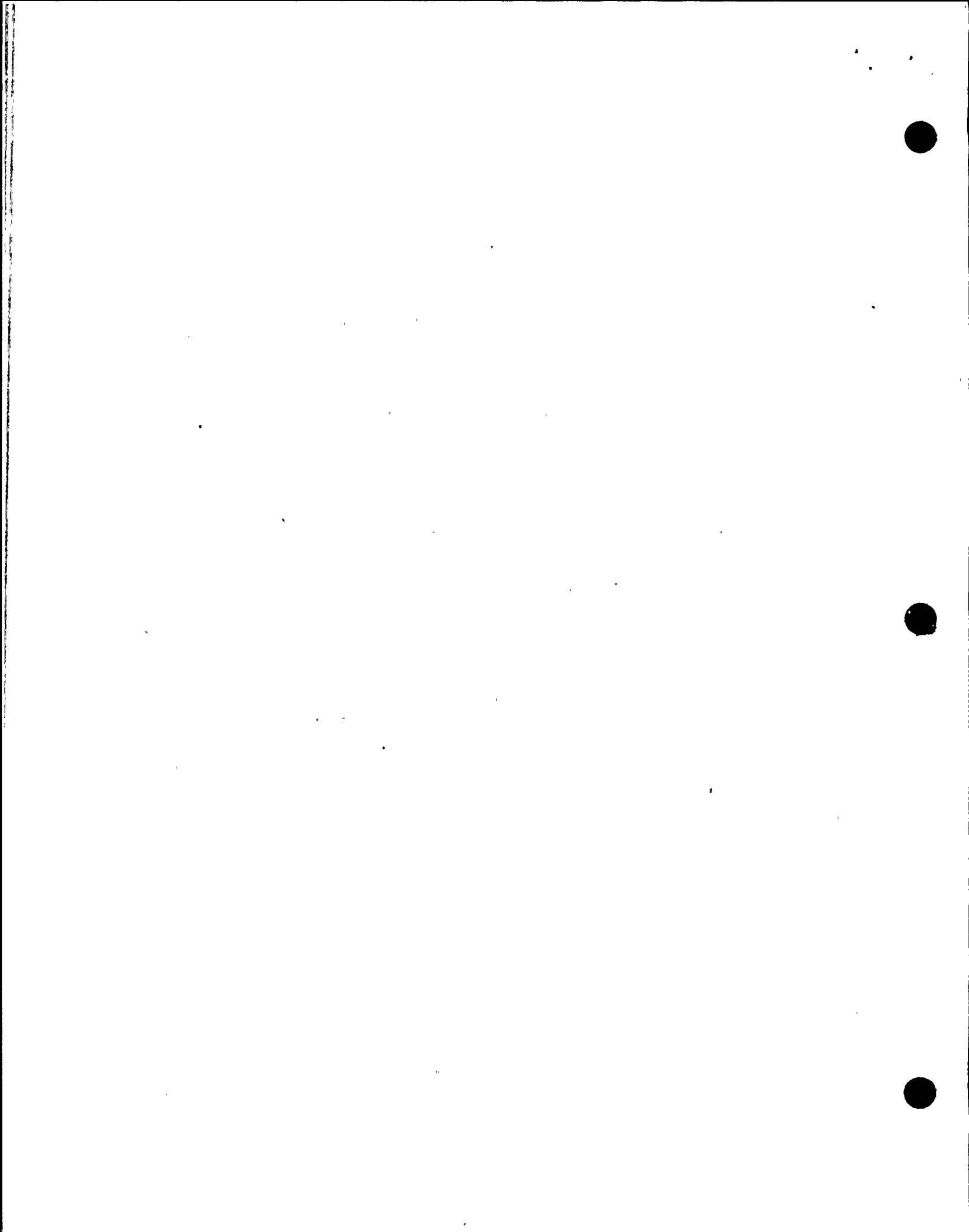
### Tube Degradation Characterization

In general, the degradation morphology occurring at the TSP intersections at plants in the U.S. can be described as axially oriented ODSCC. The degradation morphology at Cook Nuclear Plant Unit 1 is entirely compatible with the overall industry data base.

### Steam Generator Tube Integrity

In the development of a plugging criteria for Cook Nuclear Plant Unit 1, Regulatory Guide (RG) 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes" and RG 1.83, "In-service Inspection of PWR Steam Generator Tubes" are used as the bases for determining that SG tube integrity is maintained within acceptable limits. Regulatory Guide 1.121 describes a method acceptable to the NRC staff for meeting GDC 14, 15, 31, and 32 by reducing the probability and consequences of SG tube rupture by determining the limiting safe conditions of tube wall degradation beyond which tubes with unacceptable cracking, as established by in-service inspection, should be removed from service by plugging. This regulatory guide uses safety factors on loads for tube bursts that are consistent with the requirements of Section III of the ASME Code. For the TSP elevation degradation occurring in the Cook Nuclear Plant Unit 1 SGs, tube burst criteria are inherently satisfied during normal operating conditions by the presence of the TSP. The presence of the TSP enhances the integrity of the degraded tubes in that region by precluding tube deformation beyond the diameter of the drilled hole, thus precluding tube burst. Conservatively, no credit is taken in the development of the plugging criteria for the presence of the TSP during accident conditions. Based on the existing database for 7/8 inch tubing, burst testing indicates that the safety requirements for tube burst margins during accident condition loading can be satisfied with EOC bobbin coil signal amplitudes less than 8.8 volts, regardless of the depth of tube wall penetration of the cracking.

Upon implementation of the proposed plugging criteria program, tube leakage considerations must also be addressed. It must be determined that the cracks will not leak excessively during all plant conditions. For the 2 volt interim tube plugging criteria developed for the Cook Nuclear Plant Unit 1 SG tubes, no leakage is anticipated during normal operating conditions even with the presence of potential throughwall cracks. No primary-to-secondary leakage at the TSP has been detected in U.S. plants. Relative to the expected leakage during accident condition loading, the limiting event with respect to differential pressure experienced across the SG tubes is a postulated SLB event. For 7/8 inch tubing, pulled tube data supports no leakage up to 2.81 volts and low probability of leakage between 2.81 and 6.0 volts, for both pulled tubes and model boiler specimens, at the bounding SLB pressure differential of 2560 psi. Steam line break primary-to-secondary leakage will be calculated as prescribed in GL 95-05 and WCAP 14277, using projected EOC eddy current data. This calculated leakage must be shown to be less than 8.4 gpm in the faulted loop.



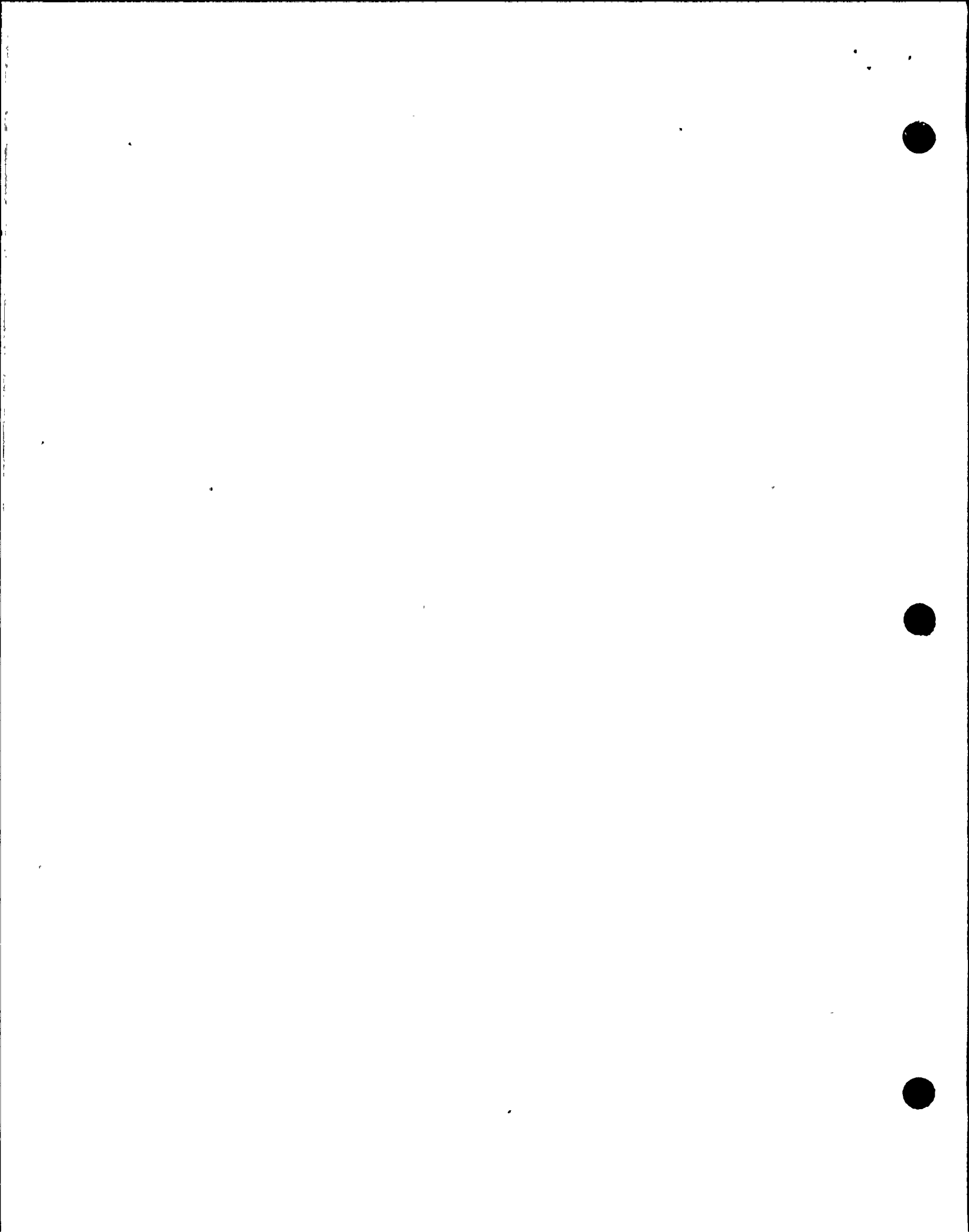
### Additional Considerations

The proposed amendment would preclude occupational radiation exposure that would otherwise be incurred by personnel involved in tube plugging or repair operations. By reducing non-essential tube plugging, the proposed amendment would minimize the loss of margin in the reactor coolant flow, through the SGs, used in LOCA analyses. The proposed amendment would avoid loss of margin in reactor coolant system flow and, therefore, assist in maintaining minimum flow rates in excess of that required for operation at full power. Reduction in the amount of tube repair required can reduce the length of plant outages and reduce the time that the SGs are open to the containment environment during an outage. A 100% eddy current bobbin coil probe inspection associated with implementation of the plugging criteria program will help to identify new areas of concern which may arise, by providing a level of in-service inspection which is far in excess of the T/S requirements utilizing the 40% depth-based plugging limit for acceptable tube wall degradation.

### SIGNIFICANT HAZARDS ANALYSIS

In accordance with the three factor test of 10 CFR 50.92(c), implementation of the proposed license amendment is analyzed using the following standards and found not to: 1) involve a significant increase in the probability or consequences of an accident previously evaluated; 2) create the possibility of a new or different kind of accident from any accident previously evaluated; or 3) involve a significant reduction in margin of safety. Conformance of the proposed amendment to the standards for a determination of no significant hazards as defined in 10 CFR 50.92 (three factor test) is shown in the following paragraphs:

- 1) Operation of Cook Nuclear Plant Unit 1, in accordance with the proposed license amendment, does not involve a significant increase in the probability or consequences of an accident previously evaluated. Testing of model boiler specimens for free span tubing (no TSP restraint) at room temperature conditions show burst pressures in excess of 5000 psi for indications of outer diameter stress corrosion cracking with voltage measurements as high as 19 volts. Burst testing performed on pulled tubes from Cook Nuclear Plant Unit 1 with up to a 2.02 volt indication shows measured burst pressure in excess of 10,000 psi at room temperature. Burst testing performed on pulled tubes from other plants show burst pressures in excess of 5,300 psi at room temperatures. Correcting for the effects of temperature on material properties and minimum strength levels (as the burst

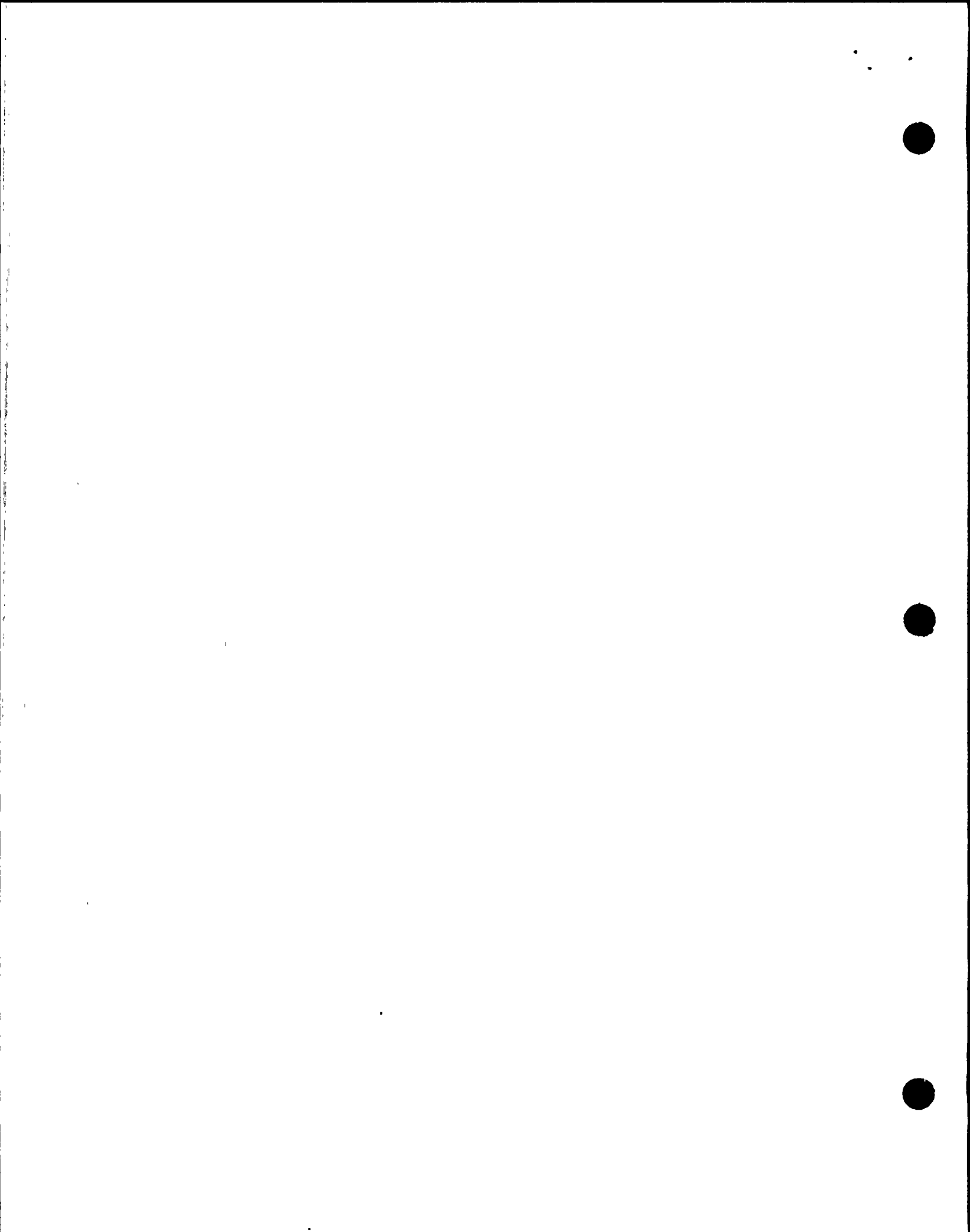




testing was done at room temperature), tube burst resistance significantly exceeds the safety factor requirements of RG 1.121. As stated earlier, tube burst criteria are inherently satisfied during normal operating conditions due to the proximity of the TSP. Test data indicates that tube burst cannot occur within the TSP, even for tubes which have 100% throughwall electric-discharge machined notches 0.75 inch long, provided the TSP is adjacent to the notched area. Since tube-to-tube support plate proximity precludes tube burst during normal operating conditions, it follows that use of the proposed plugging criteria must, therefore, retain tube integrity characteristics which maintain the RG 1.121 margin of safety of 1.43 times the bounding faulted condition (steam line break) pressure differential.

During a postulated main SLB, the TSP has the potential to deflect during blowdown, thereby uncovering the intersection. Based on the existing data base, the RG 1.121 criterion requiring maintenance of a safety factor of 1.43 times the SLB pressure differential on tube burst is satisfied by 7/8 inch diameter tubing with bobbin coil indications with signal amplitudes less than  $V_{SL}$ , regardless of the indicated depth measurement. A 2 volt plugging criteria compares favorably with the current  $V_{SL}$  (8.8 volt) structural limit, considering the previously calculated growth rates for ODSCC within Cook Nuclear Plant Unit 1 SGs. Considering a voltage growth component of 0.8 volts (40% voltage growth based on 2 volts BOC) and a nondestructive examination uncertainty of 0.40 volts (20% voltage uncertainty based on 2 volts BOC), when added to the BOC plugging criteria of 2 volts, results in a bounding EOC voltage of approximately 3.2 volts for a cycle operation. A 5.6 volt safety margin exists (8.8 - 3.2 volt EOC = 5.6 volt margin).

For the voltage/burst correlation, the EOC structural limit is supported by a voltage of 8.8 volts. Using this  $V_{SL}$  of 8.8 volts, a BOC maximum allowable repair limit can be established using the guidance of RG 1.121. The BOC maximum allowable repair limit should not permit a significant number of EOC indications to exceed the  $V_{SL}$  and should assure that acceptable tube burst probabilities are attained. By adding NDE uncertainty allowances and an allowance for crack growth to the repair limit, the structural limit can be validated. The previous plugging criteria submittal established the conservative NDE uncertainty limit ( $V_{NDE}$ ) of 20% of the BOC repair limit. For consistency, a 40% voltage growth allowance ( $V_{GR}$ ) to the BOC repair limit is also included. This allowance is extremely conservative for Cook Nuclear



Plant Unit 1. Therefore, the maximum allowable upper voltage repair limit  $V_{URL}$  for BOC, based on the  $V_{SL}$  of 8.8 volts, can be represented by the expression:

$$V_{URL} + (V_{NDE} \times V_{URL}) + (V_{GR} \times V_{URL}) = 8.8 \text{ volts, or,}$$

the maximum allowable BOC repair limit can be expressed as,

$$V_{URL} = 8.8 \text{ volt structural limit}/1.6 = 5.5 \text{ volts.}$$

This structural repair limit supports this application for plugging criteria implementation to repair bobbin indications greater than 2 volts based on RPC confirmation of the indication. Conservatively, an upper limit of 5.5 volts will be used to repair bobbin coil indications which are above 2 volts but do not have confirming RPC calls.

Relative to the expected leakage during accident condition loadings, it has been previously established that a postulated main SLB outside of containment, but upstream of the main steam isolation valve, represents the most limiting radiological condition relative to the plugging criteria. In support of implementation of the plugging criteria, it will be determined whether the distribution of crack indications at the TSP intersections at the EOC are projected to be such that primary-to-secondary leakage would result in site boundary doses within a small fraction of the 10 CFR 100 guidelines. A separate calculation has determined this allowable SLB leakage limit to be 8.4 gpm. Although not required by the Cook Nuclear Plant design basis, this calculation uses the recommended Iodine-131 transient spiking values consistent with NUREG-0800, and the T/S reactor coolant system activity limit of 1 micro curie per gram dose equivalent Iodine-131. Control room dose calculations were also performed and found to be less limiting than the offsite dose calculation leakrate. Therefore, the more conservative offsite dose leakrate is used. The projected SLB leakage rate calculation methodology prescribed in GL 95-05 and WCAP 14277 will be used to calculate EOC leakage, based on actual EOC distributions and EOC projected distributions. Due to the relatively low voltage growth rates at Cook Nuclear Plant Unit 1 and the relatively small number of indications affected by the plugging criteria, SLB leakage prediction per GL 95-05 is expected to be significantly less than the permissible level of 8.4 gpm in the faulted loop.

The inclusion of all intersections in the leakage model, along with application of a probability of detection of 0.6,



will result in extremely conservative leakage estimations. Close examination of the available data shows that indications of less than 2.8 volts will not be expected to leak during SLB conditions.

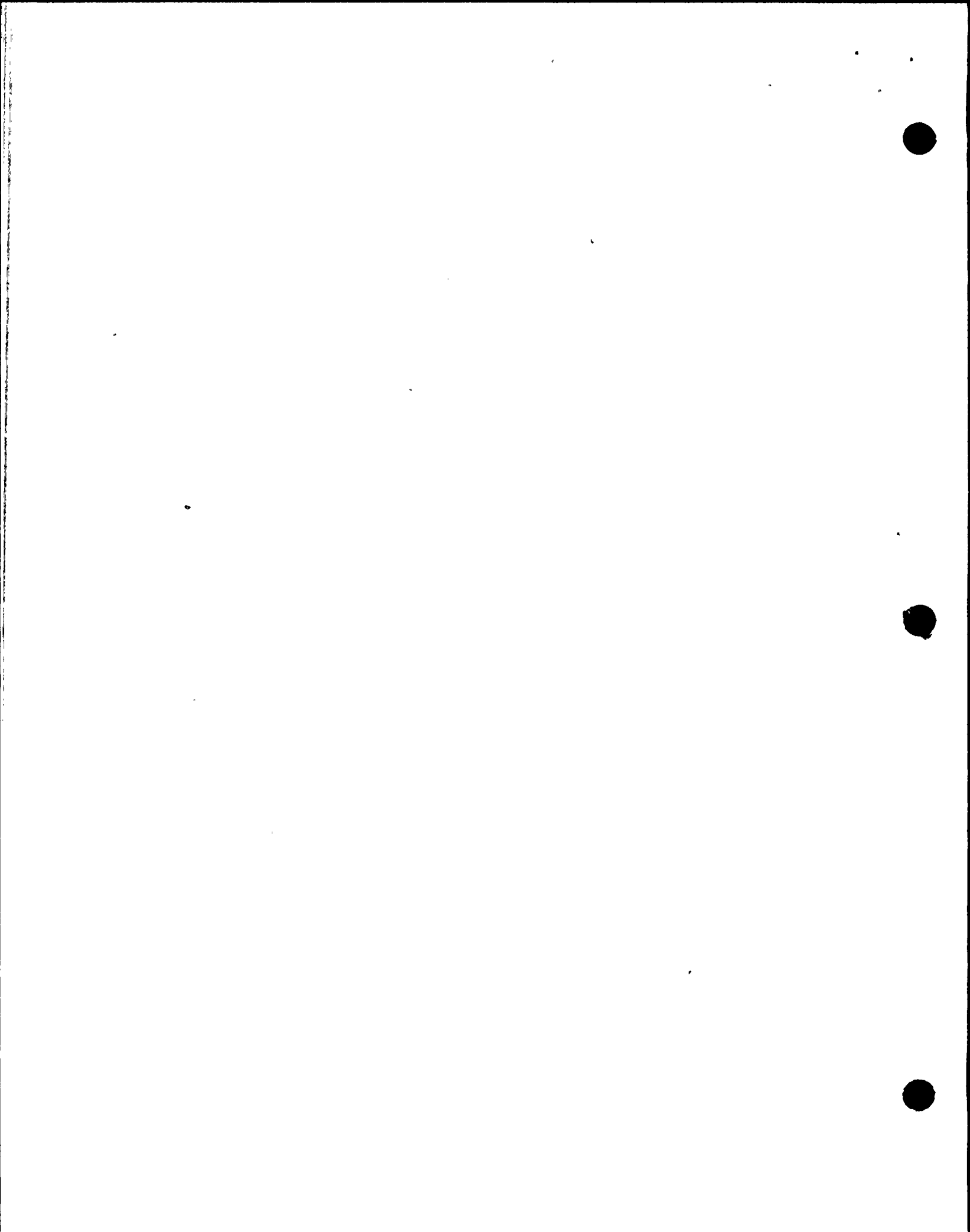
The proposed amendment does not result in any increase in the probability or consequences of an accident previously evaluated within the Cook Nuclear Plant Unit 1 Final Safety Analysis Report (FSAR).

- 2) The proposed license amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.

Implementation of the proposed SG tube plugging criteria does not introduce any significant changes to the plant design basis. Use of the criteria does not provide a mechanism which could result in an accident outside of the region of the TSP elevations. Neither a single nor a multiple tube rupture event would, under any plant conditions, be expected in a SG in which the plugging criteria has been applied.

Specifically, we will continue to implement a maximum leakage rate limit of 150 gpd (0.1 gpm) per SG to help preclude the potential for excessive leakage during all plant conditions. The T/S limits imposed on primary-to-secondary leakage at operating conditions are a maximum of 0.4 gpm (600 gpd) for all SGs with a maximum of 150 gpd allowed for any one SG.

The RG 1.121 criteria for establishing operational leakage rate limits that require plant shutdown are based upon leak-before-break (LBB) considerations to detect a free span crack before potential tube rupture during faulted plant conditions. The 150 gpd limit should provide for leakage detection and plant shutdown in the event of the occurrence of an unexpected single crack resulting in leakage that is associated with the longest permissible crack length. Regulatory Guide 1.121 acceptance criteria for establishing operating leakage limits are based on LBB considerations such that plant shutdown is initiated if the leakage associated with the longest permissible crack is exceeded. The longest permissible crack is the length that provides a factor of safety of 1.43 against bursting at faulted conditions maximum pressure differential. A voltage amplitude of 8.8 volts for typical ODSCC corresponds to meeting this tube burst requirement at a lower 95% prediction limit on the burst correlation coupled with 95/95 lower tolerance limit material properties. Alternate crack morphologies can correspond to



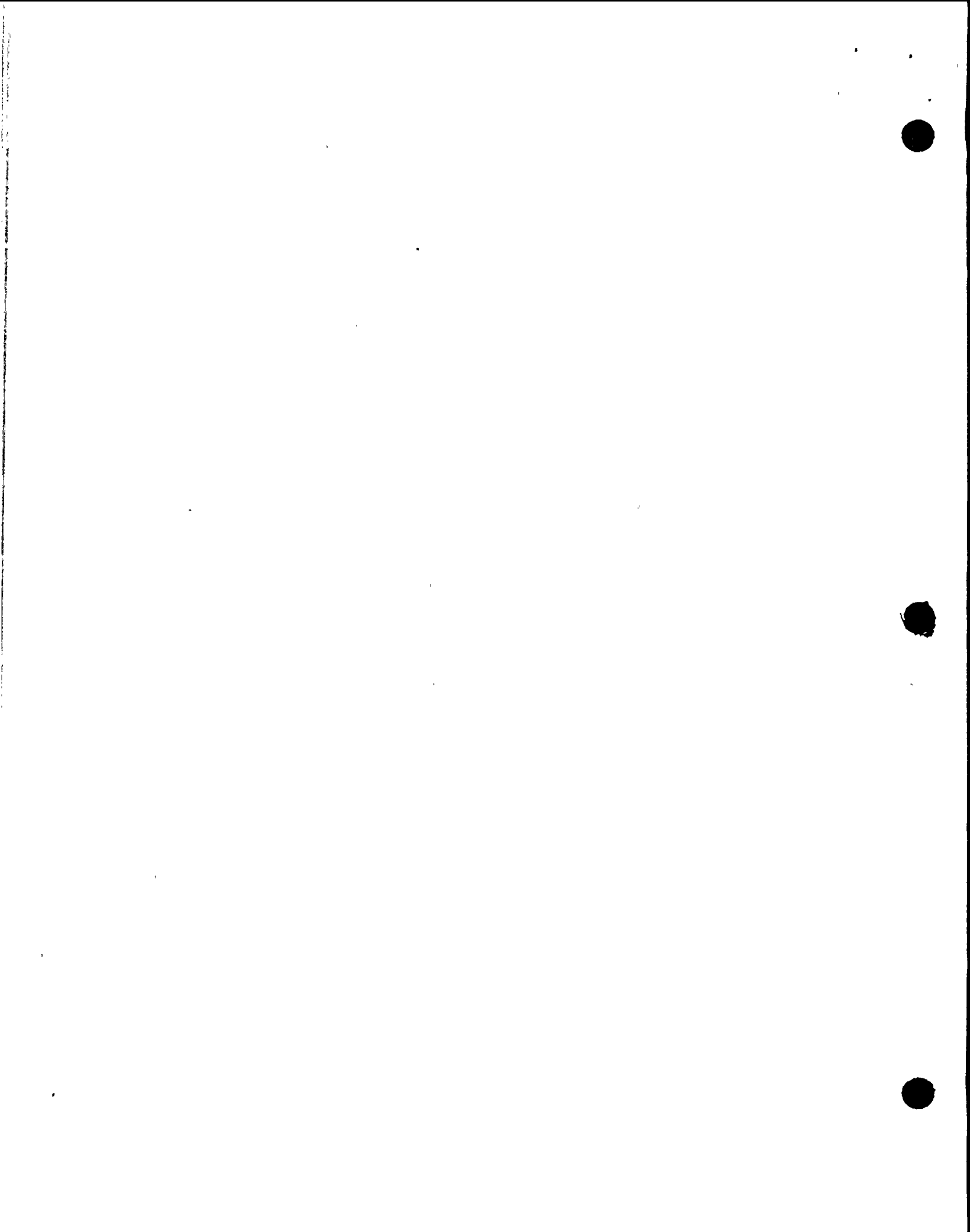
8.8 volts so that a unique crack length is not defined by the burst pressure versus voltage correlation. Consequently, typical burst pressure versus through-wall crack length correlations were used to define the "longest permissible crack" for evaluating operating leakage limits.

Consistent with the cycle 13, 14 and 15 license amendment requests for plugging criteria, and Section 5 of Enclosure 1 of the GL, operational leakage limits will remain at 150 gpd per SG. Axial cracks leaking at this level are expected to provide LBB protection at both the SLB pressure differential of 2560 psi and, while not part of any established LBB methodology, LBB protection will also be provided at a value of 1.43 times the SLB pressure differential. Thus, the 150 gpd limit provides for plant shutdown prior to reaching critical crack lengths for SLB conditions. Additionally, this LBB evaluation assumes that the entire crevice area is uncovered during blowdown. Partial uncover will provide benefit to the burst capacity of the intersection.

- 3) The proposed license amendment does not involve a significant reduction in margin of safety.

The use of the voltage-based bobbin probe interim TSP elevation plugging criteria at Cook Nuclear Plant Unit 1 is demonstrated to maintain SG tube integrity commensurate with the criteria of RG 1.121. Regulatory Guide 1.121 describes a method acceptable to the NRC staff for meeting GDC 14, 15, 31, and 32 by reducing the probability or the consequences of SG tube rupture. This is accomplished by determining the limiting conditions of degradation of SG tubing, as established by in-service inspection, for which tubes with unacceptable cracking should be removed from service. Upon implementation of the criteria, even under the worst case conditions, the occurrence of ODSCC at the TSP elevations is not expected to lead to a SG tube rupture event during normal, or faulted plant conditions. It will be confirmed by analysis and calculation that EOC distribution of crack indications at the TSP elevations will result in acceptable primary-to-secondary leakage during all plant conditions and that radiological consequences are not adversely impacted.

In addressing the combined effects of a LOCA and SSE on the SG component (as required by GDC 2), it has been determined that tube collapse may occur in the SGs at some plants. The postulated tube collapse results from a deformation of TSPs as a result of lateral loads at the wedge supports at the periphery of the plate. The lateral loads result from the





combined effects of the LOCA rarefaction wave and SSE loadings. The resulting pressure differential on the deformed tubes may then cause some of the tubes to collapse.

There are two issues associated with a postulated SG tube collapse. First, the collapse of SG tubing reduces the RCS flow area through the tubes. The reduction in flow area increases the resistance to flow of steam from the core during a LOCA which, in turn, may potentially increase peak clad temperature. Second, there is a potential that partial through-wall cracks in tubes could progress to through-wall cracks during tube deformation or collapse.

Consequently, since the LBB methodology is applicable to the Cook Nuclear Plant Unit 1 reactor coolant loop piping, the probability of breaks in the primary loop piping is sufficiently low that they need not be considered in the structural design of the plant. The limiting LOCA event becomes either the accumulator line break or the pressurizer surge line break. Loss of coolant accident loads for the primary pipe breaks were used to bound the Cook Nuclear Plant Unit 1 smaller breaks. The results of the analysis using the larger break inputs show that the LOCA loads were found to be of insufficient magnitude to result in SG tube collapse or significant deformation.

Addressing RG 1.83 considerations, implementation of the bobbin coil probe, voltage-based interim tube plugging criteria of 2 volts is supplemented by enhanced eddy current inspection guidelines to provide consistency in voltage normalization, a 100% eddy current inspection sample size at the TSP elevations per T/S, and MRPC inspection requirements for the larger indications left in-service to characterize the principal degradation as ODSCC.

As noted previously, implementation of the TSP elevation plugging criteria will decrease the number of tubes which must be repaired. The installation of SG tube plugs reduces the RCS flow margin. Thus, implementation of the plugging criteria will maintain the margin of flow that would otherwise be reduced in the event of increased tube plugging.

Based on the above, it is concluded that the proposed license amendment request does not result in a significant reduction in margin with respect to plant safety as defined in the FSAR or any Bases of the plant T/Ss.

