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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 198 TO FACILITY OPERATING LICENSE NO. DPR-66

DUQUESNE LIGHT COMPANY
OHIO EDISON COMPANY
PENNSYLVANIA POWER COMPANY

BEAVER VALLEY POWER STATION, UNIT NO. 1

DOCKET NO. 50-334

1.0 INTRODUCTION

By letter dated December 7, 1995, as supplemented January 4, March 1, March 5, March 7, March 11, March 27, and March 29, 1996, the Duquesne Light Company (the licensee) submitted a request for changes to the Beaver Valley Power Station, Unit No. 1 (BVPS-1) Technical Specifications (TSs). The requested changes would revise TSs 3/4.4.5 and 3/4.4.6.2 and their associated Bases to maintain voltage-based steam generator tube repair criteria for the tube support plate elevations for future cycles of operation. The amendment would replace the 1.0 volt repair limit with a 2.0 volt repair limit. The 1.0 volt repair limit had been approved on an interim basis, for one fuel cycle only, by License Amendment No. 184, which was issued on February 3, 1995 (Reference 1). The January 4, March 1, March 5, March 7, March 11, March 27, and March 29, 1996, letters provided clarifying information that did not change the initial proposed no significant hazards consideration determination or expand the amendment request beyond the scope of the January 3, 1996, Federal Register notice. The voltage-based steam generator tube repair criteria allows tubes with axially oriented outside diameter stress corrosion cracking (ODSCC) confined within the thickness of the tube support plates (TSPs) to remain in service based on the magnitude of the bobbin coil voltage response.

On August 3, 1995, the NRC issued Generic Letter (GL) 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking," which outlined generic criteria for licensees considering implementation of an alternate repair criteria. The licensee's proposed amendment request follows the guidance provided in GL 95-05. The following is the NRC staff's evaluation of the licensee's proposed amendment.

2.0 BACKGROUND

Steam generator tube flaw acceptance criteria (i.e., plugging limits) are specified in the plant TSs. The traditional strategy for achieving adequate structural and leakage integrity of the tubes has been to establish a minimum wall thickness requirement in accordance with guidance in NRC Regulatory Guide (RG) 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes." Development of minimum wall thickness requirements to satisfy RG 1.121 was

governed by analyses assuming a uniform thinning of the tube wall. This assumed degradation mode is inherently conservative for all other forms of steam generator tube degradation. Conservative repair limits may lead to plugging tubes with adequate structural and leakage integrity for further service.

The NRC staff has developed generic criteria for voltage-based limits for ODSCC confined within the thickness of the TSPs. The NRC staff has published several conclusions regarding voltage-based repair criteria in draft NUREG-1477, "Voltage-Based Interim Plugging Criteria for Steam Generator Tubes" and in a draft generic letter titled "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes." The latter document was published for public comment in the Federal Register on August 12, 1994 (59 FR 41520). On August 3, 1995, the NRC staff issued GL 95-05 that took into consideration public comments on the draft generic letter cited above, domestic operating experience under the voltage-based repair criteria, and additional data which have been made available from European nuclear power plants.

The guidance of GL 95-05 does not set depth-based limits on predominantly axially oriented ODSCC at TSP locations, but rather, it relies on empirically derived correlations between a nondestructive inspection parameter, the bobbin coil voltage, and tube burst pressure and leak rate. The NRC staff recognizes that although the total tube integrity margins may be reduced following application of a voltage-based repair criteria, the guidance in GL 95-05 ensures that structural and leakage integrity continue to be maintained at an acceptable level consistent with requirements of 10 CFR Part 50 and the guideline values in 10 CFR Part 100. Since the voltage-based repair criteria do not incorporate a minimum tube wall thickness requirement, there is the possibility that tubes with through-wall cracks can remain in service. Because of the increased likelihood of such flaws, the NRC staff has included provisions for augmented steam generator tube inspections and more restrictive operational leakage limits.

The steam generator tube inspections in the tenth refueling outage for BVPS-1 utilized an interim plugging criteria approved by the NRC staff on February 3, 1995 [Reference 1]. The interim plugging criteria currently in the BVPS-1 TSs is only in effect for Cycle 11 operation. The licensee's proposed amendment requests a permanent change to the BVPS-1 TSs to incorporate a voltage-based repair criteria per the guidance of GL 95-05. The guidance specifies, in part, that: (1) the repair criteria is only applicable to predominantly axially oriented ODSCC located within the bounds of the TSPs; (2) licensees should perform an evaluation to confirm that the steam generator tubes will retain adequate structural and leakage integrity until the next scheduled inspection; (3) licensees should adhere to specific inspection criteria to ensure consistency in methods between inspections; (4) tubes must be periodically removed from the steam generators to verify the morphology of the degradation and provide additional data for structural and leakage integrity evaluations; (5) the operational leakage limit should be reduced; (6) licensees should implement an operational leakage monitoring program; and (7) specific reporting requirements shall be incorporated into the plant TSs.

The licensee's current proposal requests a permanent amendment to the BVPS-1 TSs and incorporates the guidance of GL 95-05 except as noted below. The amendment request is similar to the licensee's prior amendment proposals which were approved as documented in Reference 1.

3.0 EVALUATION

The licensee will follow the requested actions of GL 95-05 for implementing the proposed voltage-based plugging criteria. As permitted by GL 95-05, the licensee has: (1) proposed to use an alternative method to Section 3.c.3 of Attachment 1 to GL 95-05 to address bobbin coil probe wear; (2) included a provision to use alternative inspection techniques in proposed TS 4.4.5.4.10.a; and (3) proposed to apply a fraction of bobbin indications to the beginning of cycle (BOC) voltage distribution that were not confirmed with a rotating pancake coil (RPC) probe. These alternative methods are further discussed in Section 3.2.

3.1 Tube Repair Limits

The proposed voltage criteria pertain specifically to predominantly axially oriented ODSCC flaws, and the proposed criteria: (1) permit flaws confined to within the thickness of the tube support plate with bobbin voltages less than or equal to 2.0 volts to remain in service; (2) permit flaws confined to within the thickness of the tube support plate with bobbin voltages greater than 2.0 volts but less than or equal to the upper voltage limit to remain in service if an RPC probe or acceptable alternative inspection does not detect degradation; and (3) requires flaw indications confined to within the thickness of the tube support plate with bobbin voltages greater than the upper voltage limit to be plugged or repaired.

The licensee's proposed repair limits are based on the use of a correlation between the burst pressure and the bobbin coil voltage of pulled tube and model boiler data. In accordance with GL 95-05, the licensee will use the burst pressure versus bobbin voltage correlation containing all applicable data consistent with the guidance in GL 95-05.

The proposed lower voltage limit of 2.0 volts is consistent with the recommended value specified in GL 95-05 for 7/8-inch steam generator tubing. The upper voltage limit is based on the lower 95-percent prediction interval of the burst pressure/bobbin voltage corresponding, adjusted for lower bound material properties evaluated at the 95/95 confidence level. This voltage is further reduced to account for uncertainty in the nondestructive examination technique and flaw growth over the next operating cycle. Because licensees periodically update the burst pressure/bobbin voltage database with pulled tube data, the upper voltage limit may vary as additional data is included in the correlation.

3.2 Inspection Issues

The licensee's changes to the inspection program (TSs 4.4.5.2.b.5 and 4.4.5.2.d) are consistent with the guidance of GL 95-05. The licensee has proposed alternatives to the probe wear re-inspection requirements and to apply only a fraction of bobbin indications to the BOC voltage distribution that were not confirmed with an RPC probe. For the probe wear re-inspection requirements, the licensee proposes to use the practices proposed by the industry (i.e., Nuclear Energy Institute (NEI)). The industry approach is such that if any of the probe wear standard signal amplitudes prior to probe replacement exceed the ±15-percent limit then all indications with voltage responses measured at 75-percent or greater of the repair limit must be reinspected with a bobbin probe satisfying the ±15-percent wear standard criterion. The voltages from the reinspection should be used as the basis for tube repair.

The licensee has proposed to follow the industry proposal when approved by the NRC. The NRC staff has completed a review of the proposed alternative method and concluded that the approach is acceptable as documented in Reference 2 since it ensures tube integrity. Therefore, the licensee's proposal to follow the industry-proposed approach to address bobbin coil probe wear is acceptable.

The proposed amendment includes a modification to TS 4.4.5.4.10.c. The change would allow indications of potential degradation with bobbin coil signal voltages between the lower and upper repair limit to remain in service if they are not confirmed by either an RPC probe or an acceptable alternative inspection technique. By letter dated March 29, 1996, the licensee stated that all acceptable alternative inspection techniques will be qualified using similar criteria as used for qualifying RPC probes. The use of alternate inspection techniques potentially allows the licensee to utilize more sensitive methods to confirm the presence of degradation at the TSPs. However, the use of a consistent qualification process will maintain an acceptable level of detection comparable to that for RPC probes. The NRC staff encourages licensees to use the most sensitive inspection techniques available. As such, the staff concludes that the proposed modification of TS 4.4.5.4.10.c to allow the use of alternative inspection techniques is acceptable.

An RPC probe (or alternative inspection techniques) may not confirm all the apparent indications identified during the bobbin coil probe examinations. Because the bobbin coil probe simultaneously inspects a large volume of tube wall, all the signals may not be an indication of a flaw. Deposits on the outside of the tube and the presence of the tube support plate may lead to false calls. RPC probes are used to verify the presence of a flaw for indications over the lower voltage limit but less than the upper voltage limit. Because RPC probes inspect a localized area of a tube and are more sensitive to deeper flaws, which are of more significance to structural and leakage integrity, they are a suitable means for verifying the presence of a dominant flaw. GL 95-05 specifies that all bobbin indications not confirmed

with an RPC probe must be included in the BOC voltage distribution to assess structural integrity at the end of the next operating cycle. However, Section 2.b.1 of GL 95-05 also states that a fraction of bobbin indications not confirmed with an RPC probe may be excluded subject to NRC approval.

The licensee has proposed to include a fraction of the bobbin coil indications in the BOC voltage distribution resolved during the inspection process as "no detectable degradation" (NDD) with RPC probe (or equivalent) inspection techniques. During each inspection of the BVPS-1 steam generators, the licensee will determine the number of indications that were called NDD following an RPC examination during the previous outage that are confirmed as degradation in the current inspection. The largest fraction determined during the current or previous inspection outages or a fixed value of 0.7 will be applied to reduce the number of RPC NDDs that are included in the BOC voltage distribution. Thus, the lowest fraction that can be applied is 0.7.

The licensee's submittal dated December 7, 1995, as supplemented on March 1, 1996, includes data for the number of RPC NDDs that were subsequently confirmed at the following inspection for BVPS-1 and several other plants for recent inspections. These data indicate that the fraction of RPC NDDs that were subsequently confirmed during the next inspection is less than the proposed fixed value of 0.7. The licensee's proposal to include a fraction of the RPC NDDs in the BOC voltage distribution is acceptable to the NRC staff. In accordance with a letter dated March 27, 1996, the licensee will include the fraction of RPC NDD applied in the BOC voltage distribution and the RPC NDD confirmation rate from the inspection data in the 90-day outage report following each inspection.

Section 3.c.2 of GL 95-05 specifies that the voltage response for the 40-percent to 100-percent through-wall holes of new bobbin coils calibrated on the 20-percent through-wall holes should not differ from the nominal voltage by more than ±10-percent. The industry initially presented details for resolving the issue of new probe variability in a meeting with the NRC staff held on November 3, 1994. Since the NRC/NEI meeting, the industry has submitted additional information to the NRC by letter dated January 23, 1996 [Reference 3]. The NRC staff has reviewed the industry's plan for demonstrating acceptable probe variability and concluded that it is acceptable [Reference 2] since it ensures tube integrity. Therefore, the licensee's proposal to follow the industry proposed approach to address bobbin coil probe variability is acceptable.

3.3 Structural and Leakage Integrity Assessments

The NRC guidance for implementation of voltage repair criteria ensure that tubes will retain adequate structural integrity during the full range of normal, transient, and postulated accident conditions with adequate allowance for eddy current test uncertainty and flaw growth projected to occur during the next operating cycle. Tube structural limits based on RG 1.121 criteria

require maintaining a margin of safety of 1.43 against tube failure under postulated accident conditions and maintaining a margin of safety of 3 against burst during normal operation. Because the GL 95-05 criteria address tubes affected with ODSCC confined to within the thickness of the tube support plates during normal operation, the NRC staff has concluded that the structural constraint provided by the tube support plates ensures that all tubes to which the voltage-based criteria applies will retain a margin of 3 with respect to burst under normal operating conditions, consistent with the criteria of Regulatory Guide 1.121. For a postulated main steam line break (MSLB) accident, however, the TSPs may displace axially during blowdown such that the ODSCC affected portion of the tubing may no longer be fully constrained by the tube support plates. Accordingly, it is appropriate to consider the ODSCC affected regions of the tubes as free standing tubes for the purpose of assessing burst integrity under postulated MSLB conditions.

In order to confirm that the steam generator tubes will retain adequate structural and leakage integrity until the next scheduled inspection, GL 95-05 describes the methodology to determine the conditional burst probability and the total primary-to-secondary leak rate from an affected steam generator during a postulated MSLB event. To complete these assessments, the licensee has proposed to follow the methodology described in WCAP-14277, "SLB Leak Rate and Tube Burst Probability Analysis Methods for ODSCC at TSP Intersections." As discussed in WCAP-14277, these methods are intended to be in accordance with GL 95-05.

3.3.1 Conditional Probability of Burst

In accordance with GL 95-05, the licensee will complete a probabilistic analysis to quantify the potential for steam generator tube ruptures, given an MSLB. The results of the probabilistic analysis will be compared to a threshold value of 1×10^{-2} per cycle in accordance with GL 95-05. This threshold value will provide assurance that the probability of burst is acceptable considering the assumptions of the calculation and the results of the NRC staff's generic risk assessment for steam generators contained in NUREG-0844, "NRC Integrated Program for the Resolution of Unresolved Safety Issues A-3, A-4, and A-5 Regarding Steam Generator Tube Integrity." Failure to meet the threshold value indicates that ODSCC confined to within the thickness of the tube support plate could contribute a significant fraction to the overall conditional probability of tube rupture from all forms of degradation that was assumed and evaluated as acceptable in NUREG-0844.

The licensee referenced WCAP-14277, "SLB Leak Rate and Tube Burst Probability Analysis Methods for ODSCC at TSP Intersections," dated January 1995, as the document containing the details of the methodology for calculating the conditional probability of burst given an MSLB. The NRC staff has previously approved the use of the Monte Carlo methodology in WCAP-14277 for one-cycle applications of voltage-based repair criteria [Reference 4]. For the application of the voltage-based repair criteria at BVPS-1, the NRC staff

notes that these methods are consistent with the criteria specified in GL 95-05. Section 4.7 of WCAP-14277 states that additional data "may be incorporated into the reference database utilizing the approved outlier criteria." Section 2.a.1 within Attachment 1 to GL 95-05 states that "the supporting datasets...should contain all applicable data." The NRC staff notes that the conditional burst probability and accident leak rate calculations should incorporate all available pulled tube data. The licensee submitted the supporting databases to the NRC on March 7, 1996. The datasets contained all applicable data supporting the empirical models for a voltage-based repair criteria. The NRC staff concludes that the licensee's proposed methodology for calculating the conditional burst probability is consistent with the guidance in GL 95-05 and is acceptable.

3.3.2 Accident Leakage

The licensee has proposed to follow the methodology described in WCAP-14277 for calculating the steam generator tube leakage from the faulted steam generator during a postulated MSLB. The model consists of two major components: (1) a model predicting the probability that a given indication will leak as a function of voltage (i.e., the probability of leakage model); and (2) a model predicting leak rate as a function of voltage, given that leakage occurs (i.e., the conditional leak rate model).

The NRC staff has reviewed the Monte Carlo methodology being proposed by the licensee for BVPS-1 for determining the amount of primary-to-secondary leakage under postulated accident conditions. The NRC staff finds this methodology acceptable for implementation of the voltage-based repair criteria since it is in accordance with the guidance of GL 95-05.

3.3.3 Primary-to-Secondary Leakage During Normal Operation

An important implication of a voltage-based steam generator tube repair criteria is that the criteria may permit tubes to have, or to develop, through-wall or near through-wall cracks during an operational cycle, thus creating the potential for primary-to-secondary leakage during normal operation, transients, or postulated accidents. Postulated accident leak rates are assessed in the accident leakage calculations described previously in Section 3.3.2.

The NRC staff finds that adequate leakage integrity during normal operation is reasonably assured by the TS limits on allowable primary-to-secondary leakage. GL 95-05 specifies that the operational leakage limits of the plant TSs should be reduced to 150 gallons per day. BVPS-1 TS 3.4.6.2 currently limits the primary-to-secondary leakage through one steam generator to 150 gallons-per-day (gpd). This requirement is consistent with the guidance in GL 95-05 and is therefore acceptable.

Additionally, GL 95-05 states that licensees should review their leakage monitoring measures to ensure that should a significant leak occur in service, the leak will be detected and the plant will be shut down in a timely manner to reduce the likelihood of a potential tube rupture. As stated in its December 7, 1995, submittal, the licensee will provide an effective leakage monitoring program by following the guidance of EPRI TR-104788, "PWR Primary-to-Secondary Leak Guidelines," Research Project S 550, Final Report, May 1995. The NRC staff finds the licensee's leakage monitoring program acceptable.

3.4 Degradation Monitoring

To confirm the nature of the degradation occurring at the TSP elevations, tubes are periodically removed from the steam generators for destructive analysis. Tube pulls can confirm that the nature of the degradation being observed at these locations is predominantly axially oriented ODSCC, provide data for assessing the reliability of the inspection methods, and supplement the existing databases (e.g., burst pressure, probability of leakage, and leak rate). GL 95-05 contains guidance that states licensees should remove at least two pulled tube specimens with the objective of retrieving as many intersections as practical (a minimum of four intersections) during the plant steam generator inspection outage preceding initial application of the voltage-based repair criteria. On an ongoing basis, additional tube specimen removals (minimum of two intersections) should be obtained at the first refueling outage following 34 effective full power months of operation or at the maximum interval of three refueling outages after the previous tube pull. Alternatively, the licensee may participate in an industry-sponsored tube pull program endorsed by the NRC as described in GL 95-05.

Upon initial implementation of an interim voltage-based alternate repair criteria in 1995, the licensee removed three tubes for burst and leak rate testing and metallographic examination from the BVPS-1 steam generators. A metallurgical examination performed on the tubes concluded that the dominant degradation mechanism for the indications at the support plate elevations in the pulled tubes was axially oriented ODSCC. The NRC staff concludes that the tubes removed from the BVPS-1 steam generators during the 1995 outage satisfy the initial tube pull criteria in GL 95-05. As stated in the licensee's December 7, 1995, submittal, future tube pulls at BVPS-1 will be scheduled in accordance with GL 95-05 from the 1995 outage.

3.5 Assessment of Radiological Consequences

The licensee performed an assessment of the radiological dose consequences of an MSLB accident in support of its amendment request to apply a voltage-based repair limit for the BVPS-1 steam generator tube support plate intersections experiencing ODSCC. That assessment was based upon a 4.5 gpm primary to secondary leak in the faulted steam generator initiated by the accident and the TS allowable value of primary to secondary leakage from both intact steam generators. The licensee found the radiological dose consequences acceptable, assuming an allowable activity level of dose equivalent ^{131}I of 1.0 μCi/g in the primary coolant and 0.1 μCi/g in the secondary coolant

The NRC staff has independently calculated the doses resulting from an MSLB accident using the methodology in SRP 15.1.5, Appendix A. The NRC staff performed two separate assessments. The first assessment was based upon a pre-existing iodine spike activity level of 60 μCi/g of dose equivalent ^{131}I in the primary coolant. The second assessment was based upon an accident-initiated iodine spike. Both assessments utilized dose conversion factors listed in Regulatory Guide 1.109 (1977) for the calculation of dose equivalent ^{131}I in the primary and secondary coolants, as required by the BVPS-1 TSs.

For the accident initiated spike assessment, the NRC staff assumed that the accident initiated an increase in the release rate of iodine from the fuel by a factor of 500 over the release rate to maintain an activity level of 1 μCi/g of dose equivalent ^{131}I in the primary coolant. For each assessment, the NRC staff calculated doses for individuals located at the Exclusion Area Boundary (EAB) and at the Low-Population Zone (LPZ). The control room operator's thyroid dose was also calculated. The parameters which were utilized in the staff's assessment are presented in Table 1. The radiological doses for each of the assessments are presented in Table 2.

The NRC staff's calculations showed that the thyroid doses for the EAB and LPZ are within the acceptance criteria presented in SRP 15.1.5, Appendix A of NUREG-0800. The control room operator thyroid doses are within the acceptance criteria presented in SRP 6.4 of NUREG-0800. Since the calculated doses meet those acceptance criteria, the NRC staff concluded that a leak rate of 4.5 gpm is an acceptable limit for the maximum primary to secondary leakage initiated by the MSLB accident.

4.0 SUMMARY

The licensee submitted an application for an amendment to the BVPS-1 TSs which would permit the use of a voltage-based steam generator tube repair criteria. The licensee's submittal follows the guidelines provided in GL 95-05. The NRC staff reviewed the proposed amendment to the BVPS-1 TSs and concluded that the methods proposed by the licensee are also consistent with the guidance in GL 95-05, except as noted above. The NRC staff concludes that adequate structural and leakage integrity can be ensured, consistent with applicable regulatory requirements, for indications to which the voltage-based repair criteria will be applied. The NRC staff's approval of the proposed voltage-based repair criteria is based, in part, on the licensee being able to successfully demonstrate (which the licensee committed to do in the December 7, 1995, letter) after each inspection outage that the conditional probability of burst and the primary-to-secondary leakage during a postulated MSLB will be acceptable per the guidance in GL 95-05.

5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Pennsylvania State official was notified of the proposed issuance of the amendment. The State official had no comments.

6.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (61 FR 178). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

7.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

References:

1. "Issuance of Amendment No. 184 to Facility Operating License No. DPR-66 in Response to Change Request No. 207 Regarding Interim Steam Generator Tube Plugging Criteria (TAC No. M89991)," February 3, 1995.

2. Letter from B. Sheron, NRC, to A. Marion, NEI, dated March 18, 1996.

3. Letter from A. Marion, NEI, to B. Sheron, NRC, "New Probe Variability For Use In The ODSCC Alternate Repair Criteria," January 23, 1996.

4. Safety Evaluation by the Office of Nuclear Reactor Regulation Related to License Amendment No. 106 to Facility Operating License NPF-8, Southern Nuclear Operating Company, Inc., Joseph M. Farley Nuclear Plant, Unit 2, No. STN 50-364, dated April 7, 1995.

Attachments: Tables 1 and 2

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Date: April 1, 1996

TABLE 1

INPUT PARAMETERS FOR BEAVER VALLEY POWER STATION, UNIT NO. 1
EVALUATION OF A MAIN STEAMLINE BREAK ACCIDENT

1. Primary coolant concentration of 60 μCi/g of dose equivalent ^{131}I.

Pre-existing Spike Value (μCi/g)	
^{131}I =	45.26
^{132}I =	15.80
^{133}I =	72.78
^{134}I =	9.76
^{135}I =	37.81

2. Volume of primary coolant and secondary coolant.

Primary Coolant Volume (ft^3)	9387
Primary Coolant Temperature (°F)	577.0
Secondary Coolant Steam Volume (ft^3)	3788
Secondary Coolant Liquid Volume (ft^3)	2080
Secondary Coolant Steam Temperature (°F)	516.8
Secondary Coolant Feedwater Temperature (°F)	436.9

3. TS limits for DE ^{131}I in the primary and secondary coolant.

Primary Coolant DE ^{131}I concentration (μCi/g)	1.0
Secondary Coolant DE ^{131}I concentration (μCi/g)	0.1

4. TS value for the primary to secondary leak rate.

Primary to secondary leak rate, maximum any SG (gpd)	150
Primary to secondary leak rate, total all SGs (gpd)	450

5. Maximum primary to secondary leak rate to the faulted and intact SGs.

Faulted SG (gpm)	4.5
Intact SGs (gpm/SG)	0.1

6. Iodine Partition Factor

Faulted SG	1.0
Intact SG	0.01
Primary to Secondary Leakage	1.0

INPUT PARAMETERS FOR BEAVER VALLEY POWER STATION, UNIT NO. 1
EVALUATION OF A MAIN STEAMLINE BREAK ACCIDENT

7. Steam Released to the Environment

Faulted SG (0 - 2 hours)	4.5 gpm primary to secondary leakage
Faulted SG (2 - 4 hours)	4.5 gpm primary to secondary leakage
Intact SGs (0 - 2 hours)	375,000 lbs plus primary to secondary leakage
Intact SGs (2 - 8 hours)	705,393 lbs plus primary to secondary leakage

8. Letdown Flow Rate (gpm) 60

9. Release Rate for 1.0 μCi/g of Dose Equivalent ^{131}I

	Ci/hr
^{131}I =	7.8
^{132}I =	17.4
^{133}I =	19.3
^{134}I =	25.6
^{135}I =	18.5

10. Atmospheric Dispersion Factors

	sec/m^3
EAB (0-2 hrs)	1.30×10^{-3}
LPZ (0-8 hrs)	1.30×10^{-4}
Control Room (0-8 hrs)	2.42×10^{-3}

11. Control Room Parameters

Filter Efficiency (%)	95
Volume (ft^3)	173,000
Makeup flow (cfm)	690
Recirculation Flow (cfm)	0
Unfiltered Inleakage (cfm)	10
Occupancy Factor (0-8 hrs)	1

TABLE 2

CALCULATED THYROID DOSES FOR BEAVER VALLEY POWER STATION, UNIT NO. 1
MAIN STEAMLINE BREAK ACCIDENT

	DOSE (rem)	
LOCATION	Pre-Existing Spike	Accident-Initiated Spike
EAB	43*	24**
LPZ	16*	25**
Control Room**	30	30

* NUREG-0800 Acceptance Criterion = 300 rem thyroid

** NUREG-0800 Acceptance Criterion = 30 rem thyroid