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10 CFR 50.90,
10 CFR 50.92,
10 CFR 51

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

South Texas Project
Unit 1
Docket No. STN 50-498
Response to Questions Asked by EMCB and PERB Staff on Steam Generator
Voltage-Based Repair Criteria Submittal (TAC M 94535)

Reference: 1.) Letter from Mr. T. H. Cloninger, South Texas Project, to the U.S. Nuclear Regulatory Commission (ST-HL-AE-5269), "South Texas Project , Unit 1, Docket No. STN 50-498, Unit 1 Technical Specifications 3.4.5 and 3.4.6.2" dated January 22, 1996.

2.) Letter from Mr. W. T. Cottle, South Texas Project, to the U.S. Nuclear Regulatory Commission (ST-HL-AE-5332), "South Texas Project, Unit 1, Docket No. STN 50-498, Revised Proposed Amendment to Incorporate Voltage-Based Repair Criteria In Unit 1 Technical Specifications 3.4.5 and 3.4.6.2", dated April 4, 1996

The South Texas Project (STP) submits Attachments 1, 2, 3,and 4 as responses to questions asked by the Materials and Chemical Engineering Branch (EMCB) and Emergency Preparedness and Radiation Protection Branch (PERB) staffs. Attachment 1 is questions asked by the EMCB staff with the responses to those questions. Attachments 2 is questions asked by the PERB staff with the responses to their questions. Attachment 3 contains the STP dose analysis in response to question 2 of Attachment 2 as requested by the PERB staff for information only to support the PERB staff review. Attachment 4 is Plant General Arrangement Drawings to support control room habitability questions addressed in Attachment 2.

A revised Topical Report, BAW-10204P, proprietary to Framatome Technologies, Inc. (FTI), will be submitted under a different cover letter. The revised Topical Report should not delay approval of the subject amendment change as the areas that have created the need for revision have been addressed in the attachments to this letter.

060006

A001

Drawings located in Central Files

If you should have any questions concerning this matter, please call Mr.H. R. Pate at (512) 972-7787 or myself at (512) 972-7162.

S. E. Thomas
Manager,
Design Engineering

HRP/lf

Attachment:

1. Response to Questions Asked by the EMCB Staff
2. Response to Questions Asked by the PERB Staff
3. STP Dose Analysis
4. Plant General Arrangement Drawings

c: *

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* Above copies distributed without Attachments 3 & 4 except as noted by asterisk

ATTACHMENT 1

RESPONSE TO QUESTIONS ASKED BY THE EMCB STAFF

The ECMB staff requests that the licensee respond to the following comments and/or questions:

1. In the submittal, there are several instances where the guidance in Generic Letter (GL) 95-05 is only partially stated or not stated at all and, as a result, it is not clear whether the GL or the modified guidance which was provided in the submittal will be followed. In addition, it is not readily evident what exceptions are being taken to GL 95-05. As a result, all the differences between the proposal and GL 95-05 should be specified and technically justified. In addition, any alternatives (e.g., use of smaller diameter sized bobbin probes), which are permitted by GL 95-05 subject to NRC approval, that are being requested for approval as a result of this amendment request should be specified and technically justified.

   In several of the following questions/comments, specific areas in which the staff has identified an inconsistency between the submittal and GL 95-05 are cited. In these instances, if the comment/question is addressed in question 1, a further response is not needed.

   Response: The STP submittal was revised and submitted in STP letter from W.T. Cottle to U.S. Nuclear Regulatory Commission (ST-HL-AE-5332) "South Texas Project, Unit 1, Docket No. STN 50-498, Revised Proposed Amendment to Incorporate Voltage-Based Repair Criteria in Unit 1 Technical Specifications 3.4.5 and 3.4.6.2" dated April 4, 1996.

2. Provide the maximum permissible primary-to-secondary leakage under postulated steam line break conditions per 10 CFR 100 and GDC 19 referred to on page 2-2.

   Response: This question is answered in Attachment 2, Response to questions asked by the F `RB staff.

3. The rotating pancake coil (RPC) inspection scope is inconsistent with GL 95-05. In addition, several statements appear to contradict each other. Please provide the technical basis for any exceptions taken to the GL 95-05 RPC inspection scope. This technical basis should address the staff's evaluation of similar public comments received on the draft generic letter. Exceptions to the RPC inspection scope specified in GL 95-05 include, but may not necessarily be limited to the following:

Bobbin indications above 1.0 volt and below the upper voltage repair limit shall be inspected by RPC (page 2-2 and page 3 of 13 of Attachment 2).

Response: All bobbin indications above 1.0 volt will be inspected with RPC. A revision to the Topical Report is in preparation as discussed in our revised submittal.

The RPC inspection scope for dents, artifact signals, and copper deposits discussed in Appendix A and on page 7-2.

Response: Section A.3.8 and page 7-2 of the Topical Report are being revised to be consistent with Section 3.b of GL 95-05. Intersections with flaw signals of 1.0 volt will be inspected with RPC.

Intersections with flaw signals 1.0 volt will be inspected with RPC unless the tube is to be plugged or sleeved (page A-14).

Response: All bobbin indications above 1.0 volt will be inspected with RPC.

Verification of the integrity of TSP intersections exhibiting alloy property or artifact signals is accomplished by RPC testing of a representative sample of such signals (page A-18)

Response: The Topical Report is being revised to state TSP intersections exhibiting alloy property changes or artifact signals shall be inspected with RPC and will not have voltage-based repair criteria applied to them.

Intersections with dent voltages exceeding 5.0 volts for which 1.0 volt flaws may not be detectable, are candidates for RPC inspection of dented TSP intersections (page A-21).

Response: The Topical Report wording is being changed to say such intersections will be inspected with RPC.

The RPC inspection scope of some support plate intersections with bobbin coil indications > 1.0 volts is required in order to verify the applicability of the alternate repair limit (page A-21).

Response: The Topical Report is being changed to say all such intersections will be inspected with RPC.

4. Provide a copy of references 27 and 28 and/or address any differences between the database referenced in these reports compared to the databases presented in BAW-10204P.

Response: The current database is being incorporated into the Topical Report and is consistent with databases used in other current submittals for Byron Unit 1, Beaver Valley Unit 1, Farley Unit 1 and Sequoyah.

5. It was indicated that a growth rate allowance of 30% per effective full power year (EFPY) would be used in the determination of the upper voltage repair limit. Please provide the basis for this given that the growth rates at South Texas Unit 1 could potentially be higher than the 30% per EFPY. Discuss the possibility of using the more conservative of the South Texas Unit 1 specific growth rate or the 30% per EFPY growth rate allowance which is consistent with GL 95-05 (pg 6-3).

Response: The last paragraph on page 6-3 of the Topical Report is being revised to use the more conservative of either the 30% per EFPY growth or the STP-1 plant-specific growth rate.

6. In Section 6.2.2, it was indicated that the upper voltage repair limit had been calculated to be 2.85 volts. Please discuss any plans and criteria for submitting subsequent amendment requests to update this limit due to changes in growth rate and/or the database. Alternatively, discuss the possibility of adopting the methodology specified in GL-95-05 for addressing this issue.

Response: Section 6.2.2 of the Topical Report is being revised to state the upper voltage repair limit will be determined prior to each outage using the most recently approved NRC database and the more conservative of the growth rates as discussed in Question #5. See Section 2.a.2 of GL 95-05.

In several other instances, a specific cycle was indicated with respect to implementation of certain aspects of the voltage-based repair criteria (e.g., 100% bobbin coil inspections will be performed for Unit 1 cycle 6 as indicated on page 7-1). This indicates that other criteria may be implemented in subsequent cycles. Please indicate your long-term plans with respect to adopting deviations from GL 95-05 (this question is similar to question 1).

Response: The Topical Report has been reviewed for references to 'cycle 6' and is being revised to reflect the appropriate requirements will be met for implementation of voltage bases repair criteria during future outages.

7. Discuss how flow distribution baffle indications will be dispositioned.

Response: As discussed in the STP revised submittal, the voltage based repair criteria will not be applied to the flow distribution baffle plate intersections. If at some future outage STP plans to apply voltage-based repair criteria to FDB intersections, the technical bases will be submitted for NRC review and approval.

8. Discuss your plans with respect to training data analysts on the potential for primary water stress corrosion cracking to occur at tube support plate intersections (GL item 3.c.8).

Response: Steam Generator Inspection Training Manual will include references to the requirements of the GL and on the potential for PWSCC at TSPs.

9. Clarify if the tube pull guidance in the GL will be followed (e.g., frequency and number of tube pulls, leak and burst testing, etc.).

Response: As stated in the revised STP submittal, tubes will be pulled as required by Generic Letter 95-05. As an alternative, the tube pull requirement may be met by participating in an industry sponsored tube pull program endorsed by the NRC. Hot leak and burst testing will be performed in accordance with the industry development of guidelines to ensure potential tube pull specimen results from potential break through leak defects are not lost.

10. Clarify the following statement from page 8-3; "The tubes that were pulled had various types of defects confirmed through the laboratory tests. However, only the tubes with axial-oriented ODSCC at TSP intersections are pertinent for the purposes of the ARC implementation." In particular, does this statement imply that other forms of degradation were detected at the tube support plate elevations?

Response: As discussed in the STP revised submittal, tubes were pulled for tubesheet and TSP degradation. Axial ODSCC was the dominant degradation mechanism for all of the TSP locations examined. None of the following were observed: PWSCC at TSP's, axial cracking extending beyond the confines of the TSP's, nor circumferential cracks at TSP's.

11. GL 95-05 specifies that voltage growth rates should be evaluated for TSP intersections where bobbin indications can be identified at two successive outages and if an indication changes from non-detectable to a relatively high voltage (e.g., 2.0 volts). Clarify your position with respect to including indications in the growth rate calculations which change from non-detectable to a relatively high voltage.

Response: High growth voltages will be included in the growth calculations. Additionally, the STP-1 plant specific growth rate will include indications that have appeared in two successive outages, and historical lookups will be performed on small voltage indications that did not appear in the previous inspection. This approach will yield the most accurate plant-specific growth rate for STP-1.

12. On page 9-5, it was indicated that the eddy current testing (ECT) uncertainties from Reference 7 would be followed. Provide a copy of Reference 7 and/or discuss any and all differences between the Reference 7 uncertainty models and those specified in GL 95-05.

Response: The ECT uncertainties models that are presented in GL 95-05 will be used in the STP-1 voltage - based repair criteria calculations.

13. Calculations were performed to determine the beginning-of-cycle voltage distribution, end-of-cycle voltage distribution, probability of burst given a steam line break, and the primary-to-secondary leakage under postulated accident conditions. Please provide the data used in these calculations in graphical and tabular format for the staff to confirm the results of these calculations. In addition, discuss how the tails of the end-of-cycle voltage distribution are determined and treated when performing the burst probability and leakage calculations (refer to page 10-7).

    Response: The requested tabular data is included with this submittal. Additional clarification will be provided in Section 10.2 of the Topical Report as to the treatment of the tails of the EOC voltage distributions. The tails are not integrated to a pre-determined value. The probability of burst simulation takes fractional values of indications through the burst correlation accounting for the tails at each end of the distribution.

14. On page 10-2 it was indicated, in part, that Reference 26 was used in calculating the probability of burst given a steam line break. Please specify what portions of Reference 26 were used in this calculation (e.g., deterministic versus probabilistic Monte Carlo). Discuss if this methodology will be used in future calculations.

    Response: Only the Monte Carlo method of calculating the probability of burst is being used. The deterministic method is not being used. Future calculations will also only use the Monte Carlo.

15. Confirm the adjusted burst pressure values listed in Table 10-3 for specimen AC-1, R26C63, TSP 2 and specimen AC-1, R39C37, TSP 2.

    Response: The adjusted burst pressure values shown in Table 10-3 for specimen AC-1, R26C63, TSP 2 and specimen AC-1, R39C37, TSP 2 are correct.

    Confirm whether model boiler specimen 593-3 listed in Table 10-3 is used in the probability of leakage correlation.

    Response: Model boiler specimen 593-3 data is NOT used in the probability of leakage correlation for 3/4" tubes. This indication was not leak tested and not destructively examined. Therefore, there is no basis to infer as a leaker or a non-leaker.

Confirm whether specimen AA-1, R16C42, TSP 3 listed in Table 10-3 is used in the conditional leak rate calculation.

Response: Since no leakage was detected in the leak test for specimen AA-1 R16C42, TSP3, it is NOT included in the conditional leak rate correlation for 3/4" tubes.

Confirm whether model boiler specimen 598-1 was removed from the conditional leak rate calculation as a result of data exclusion criteria 2a or 2b (see Table 11-4).

Response: Model boiler specimen 598-1 is excluded from the conditional leak rate correlation for 3/4" tubes. This specimen had a bobbin voltage of 64 volts which is more than 40 volts above the next highest voltage data (22 volts); exclusion of this data is consistent with EPRI Criterion 2 for excluding data from correlations.

In many instances, the burst pressures for the model boiler specimens have been changed since previous submittals (e.g., reference 6). Please address the reason for these changes. If the burst pressure values currently reported are correct (i.e., the previous values were incorrect), indicate the process to ensure that the data used are appropriate (i.e., the quality controls on the data).

Response: The discrepancies noted exist only in the adjusted burst data for 3/4" model boiler specimens, and its magnitude is the same for all specimens involved. The affected adjusted burst pressure values were calculated using a flow stress value of 163 ksi instead of the more exact value 163.6 ksi; consequently, the adjusted burst pressure values shown in Table 6-1 of the reference (and in Table 3-1 of the EPRI Draft Report TR-100407, Revision 2A) are overestimated by about 0.4%. This can be readily verified using the measured burst pressure data (shown in Table 5-6 of the Reference) and tensile strength properties for 3/4" model boiler tubes (shown in Table 4-3 of the Reference).

This type of round-off difference is being evaluated as part of an independent QA review of the ARC database. A consistent round-off practice is being applied to the database and very small differences may occur from prior reports. Standard Westinghouse QA procedures were applied to the database preparation effort which require documenting the source of the data and data evaluation procedures in the form of calculation notes and an independent review of the calculation notes.

16. From Section 13.2, clarify if the NRC will be notified if indications attributable to primary water stress corrosion cracking are identified (Section 13.2.b and 13.2.1).

Response: The STP revised submittal includes NRC notification upon detection of PWSCC in any support plate intersection.

17. From Section 13.3, clarify if the operating length and non-destructive examination uncertainty models will be provided to the NRC (Sections 13.3.b.ii, 13.3.b.vi, and 13.3.1).

Response: The Topical Report is being revised to state the operating length and uncertainty models will be provided to the NRC as part of the 90 day report.

18. From Section 14.0, clarify whether or not the voltage-based tube repair criteria will be applied to intersections with interfering signals from copper, to flow distribution baffle plate intersections, to intersections with dent voltage greater than 5 volts, and to intersections with large mixed residuals.

Response: As discussed in the STP submittal, the voltage based repair criteria will not be applied to any of these intersections.

19. On page A-2, it indicates that smaller than nominal diameter probes may be used during the inspection. Clarify whether the GL 95-05 guidance with respect to using smaller and larger diameter probes will be followed.

Response: The Topical Report will be revised to state that any intersection that is inspected with smaller than nominal diameter probes will not have the voltage based repair criteria applied at those intersections without technical justification provided to and approved by the NRC.

20. Address the following differences between the ECT guidelines specified in Reference 5 of GL 95-05 and the proposed ECT guidelines:

Omitting the sections on "spans and rotations", copper, and establishing if a bobbin indication is within the tube support plate.

Response: Appendix A of the Topical Report is being revised to contain the sections on spans and rotations, copper, and establishing if a bobbin indication is within the tube support plate.

Omission of the 0.187" diameter flat bottom hole 40% through from the OD from the calibration standard.

Response: The use of dual probing and the need for using guide tube standards, requires that the minimum number of calibration flaws are provided due to limited space. Since the 40% ASME hole is not utilized for calibration of bobbin coil data, it has been excluded from the calibration standards. The 100%, 60%, and 20% ASME holes are used to establish the phase analysis curve. The ARC is not related to phase analysis, but amplitude only. For amplitude normalization, the 20% ASME holes are used to calibrate/normalize bobbin data. See question 23 for response to use of 40% through wall holes for probe wear.

Using a probe wear standard with 0.052" through-wall holes versus a probe wear standard with 0.067 through-wall holes.

Response: The correct size diameter hole for a 3/4" tubing calibration standard is 0.052". The larger 0.067" holes are for 7/8" size tubing.

21. Clarify if a transfer standard will be used during the steam generator tube inspections.

Response: The current calibration standards have been normalized to the original laboratory standard via a transfer standard. If additional calibration standards are used during future inspections, they also will be normalized via a transfer standard.

22. Provide the basis for the probe wear criteria specified in Section A.2.4 or alternatively adopt a probe wear criteria that has already been approved by the NRC.

    Response: The Topical Report is being revised to reflect the NEI probe wear criteria that has been approved by the NRC. This criteria will be utilized during any inspection where the voltage based repair criteria is to be implemented.

23. Clarify whether new probe variability will be controlled from the 20 to 80% ASME through-wall holes or the 40 to 100% through-wall holes (page A-10).

    Response: The Topical Report is being revised to reflect that the 40 to 100% through-wall holes will be used for new probe variability control. The probes, as purchased from the manufacturer, meet the new probe variability requirements specified in the GL and those proposed by NEI and approved by the NRC.

24. Clarify whether indications not confirmed by RPC and greater than the upper voltage repair limit will be plugged and repaired. Page A-15 indicates that such indications may remain in service contrary to the proposed technical specifications.

    Response: Page A-15 of the Tropic Report will be revised to reflect that all indications greater than the upper voltage repair limit will be repaired, regardless of RPC confirmation.

25. Please clarify the first sentence of the first paragraph on page A-18.

    Response: The Topical Report being revised to state that the voltage - based repair criteria will not be applied to TSP intersections where large mixed residuals are present.

26. On page 10 of 13 of Attachment 2, it was indicated that a logarithmic probability of leakage function would be used. Clarify if a logarithmic or log-logistic probability of leakage function would be used.

    Response: The No Significant Hazards Review provided with the STP submittal was revised to clarify that a log-logistic function is used to represent the POL correlation.

27. It was indicated on page 10 of 13 of Attachment 2 that the EPRI TR-100407 methodology will be used to calculate the end-of-cycle leakage. Clarify whether the EPRI methodology or the methodology specified in BAW-10204P will be used (i.e., Reference 26). Page 3 of 13 of Attachment 2 indicates that approval of both methodologies is requested. With respect to the EPRI methodology, please address the following, if approval is requested:

In Section D.4.2.1, a method for calculating the joint distribution of the regression parameters is presented. It appears to be incorrect. The derived distribution should represent the posterior distribution of the true parameters about their estimates. A derivation of the correct result is given in Section 2.7 of "Bayesian Inference In Statistical Analysis", Box GEP, Tiso GC, Addison Wesley, 1973.

It does not appear that Equation D-19 for generating leak rates correctly accounts for systematic errors caused by parametric uncertainty in the leak rate. The variations at each tube support plate are treated as if they were independent of each other, and they are not.

In Section D.4.2.5, the systematic errors caused by parametric uncertainty are not correctly expressed in Equation D-22. The probability of leakage variations at each tube support plate are treated as if they are independent of each other, and they are not.

The formula for calculating the scatter about the predicted leak rate appears to be wrong (See page D-44 Item 3). According to this, the equation for generating the scatter is Equation D-9. The term under the square root in this equation is unnecessary. This term accounts for parametric uncertainty, but parametric uncertainty has been accounted for by sampling random slopes and intercepts.

Response: The methods for calculating EOC leakage presented in Section D.4 of EPRI TR-100407 are not utilized. The Safety Evaluation of the STP submittal was revised to remove this reference to the EPRI methodology. The methodology in WCAP-14277 is being used for the Monte Carlo simulations which are used to calculate the leak rate.

28. It is indicated on page 9 of 13 of Attachment 2 that the structural limit is 4.0 volts and 4.7 volts. Clarify the current value of the structural limit.

Response: The structural limit is based upon the industry database, and will change with the addition of more pulled tube specimens. STP will assess changes to the database and their effect on the voltage structural limit prior to each inspection when voltage-based repair criteria will be implemented.

29. Discuss any differences between the proposed technical specifications and the technical specifications provided in GL 95-05.

Response: The Tech Spec changes of the revised STP submittal, as addressed in response to Question 1, are consistent with those contained in Attachment 2 of the GL.

Please provide the current end of cycle (EOC) and beginning of cycle (BOC) voltage bin distributions for each steam generator.

Response:

STP-1 A EOC VOLTAGE DISTRIBUTION

BIN	COUNT
0.1	0
0.2	0.688521
0.3	7.500686
0.4	18.96069
0.5	20.08885
0.6	16.6074
0.7	13.71964
0.8	10.30458
0.9	7.716164
1	5.562284
1.1	3.616547
1.2	2.216994
1.3	1.408318
1.4	0.858148
1.5	0.445802
1.6	0.234245
1.7	0.12634
1.8	0.06651
1.9	0.038805
2	0.022597
2.1	0.010483
2.2	0.004273
2.3	0.001511
2.4	0.000475
2.5	0.000148
2.6	5.O6E-05
2.7	1.73E-05
2.8	6.5E-06
2.9	3.3E-06
3	0
3.1	0
3.2	0
3.3	0
3.4	0
3.5	0
3.6	0
3.7	0
3.8	0
3.9	0
4	0
sum	110.2

STP-1 B EOC VOLTAGE DISTRIBUTION

BIN	COUNT
0.1	0.338162
0.2	6.728282
0.3	20.35351
0.4	29.43169
0.5	31.97776
0.6	28.30853
0.7	21.6282
0.8	15.15476
0.9	9.661302
1	5.52924
1.1	2.927745
1.2	1.644578
1.3	1.075655
1.4	0.816066
1.5	0.628126
1.6	0.452366
1.7	0.303243
1.8	0.191818
1.9	0.111625
2	0.061668
2.1	0.032562
2.2	0.017813
2.3	0.010388
2.4	0.006494
2.5	0.003973
2.6	0.002251
2.7	0.001193
2.8	0.000546
2.9	0.000266
3	0.00011
3.1	4.74E-05
3.2	2.28E-05
3.3	9.6E-06
3.4	7.5E-06
3.5	4.7E-06
3.6	0
3.7	2.4E-06
3.8	0
3.9	0
4	0
sum	177.4

STP-1 C EOC VOLTAGE DISTRIBUTION

BIN	**COUNT**
6.1	0.337785
6.2	10.05363
0.3	38.88888
0.4	64.46081
0.5	76.32967
0.6	74.59673
0.7	59.96128
0.8	44.60363
0.9	31.3434
1	20.53237
1.1	12.53861
1.2	7.4496
1.3	4.495129
1.4	2.765537
1.5	1.811811
1.6	1.180066
1.7	0.767741
1.8	0.516929
1.9	0.342554
2	0.215915
2.1	0.130331
2.2	0.07576
2.3	0.043612
2.4	0.024771
2.5	0.01441
2.6	0.008751
2.7	0.005091
2.8	0.002963
2.9	0.001653
3	0.000896
3.1	0.000415
3.2	0.00022
3.3	0.000125
3.4	6.47E-05
3.5	3.65E-05
3.6	1.28E-05
3.7	9.5E-06
3.8	5.1E-06
3.9	3.7E-06
4	3.1E-06
4.1	1E-06
4.2	0
4.3	1E-06
4.4	0
sum	453.5

STP-1 D EOG VOLTAGE DISTRIBUTION

BIN	COUNT
0.1	0
0.2	5.205829
0.3	18.62297
0.4	35.03272
0.5	44.0913
0.6	39.3221
0.7	31.15698
0.8	23.13642
0.9	16.85538
1	11.99593
1.1	8.034215
1.2	25.194564
1..3	3.376537
1.4	2.256983
1.5	1.403947
1.6	0.808593
1.7	0.449873
I.8	0.250057
1.9	0.142066
2	0.07989
2-1	0.041736
2.2	0.021144
2.3	0.010608
2. 4	0.00541
2.5	0.002618
2.6	0.001242
2.7	0.000502
2.8	0.00
2.9	8.3E-05
3	4.319-05
3.1	1.67E-05
3.2	7.5E-06
3.3	6.1E-06
3.4	2.1 E-06
3.5	7E-07
3.6	0
3.7	0
3.8	0
3.9	1E-06
4	0
sum	247.6

STP1 A BOC VOLTAGE DISTRIBUTION

BIN	COUNT
0	0
0.1	0
0.2	3.3
0.3	28.3
0.4	35
0.5	9.7
0.6	13.3
0.7	9
0.8	3.3
0.9	5
1	3.3
SUM	110.2

Note: BOC implies that the 0.6 POD has been applied and the plugged indications have been subtracted.

STP-1 B BOC VOLTAGE DISTRIBUTION

BIN	COUNT
0	0
0.1	1.7
0.2	29
0.3	40.3
0-4	40
0.5	30.7
0.6	1.9
0.7	8.3
0-8	6.7
0.9	0
1	0
1.1	0
1.2	0
1.3	0
1.4	1.7
sum	177.4

Note: BOC implies that the 0.6 POD has been applied and the plugged indications have been subtracted.

STP-1 C BOC VOLTAGE DISTRIBUTION

BIN	COUNT
0	0
0.1	1.7
0.2	45
0.3	96.7
0.4	88.3
0.5	95
0.6	56.7
0.7	28.3
0.8	21.7
0.9	11.7
1	5
1.1	0
1.2	1.7
1.3	0
1.4	0
1.5	0
1.6	1.7
sum	435.5

Note: BOC implies that the 0.6 POD has been applied and the plugged indications have been subtracted.

STP-1 D BOC VOLTAGE DISTRIBUTION

BIN	COUNT
0	0
0.1	0
0.2	25
0.3	40.7
0.4	67.7
0.5	44
0.6	25
0.7	16.7
0.8	10
0.9	8.3
1	6.7
1.1	1.7
1.2	0
1.3	1.7
sum	247.5

Note: BOC implies that the 0.6 POD has been applied and the plugged indications have been subtracted.

STP1 GROWTH FILE

BIN	PER CENT
0	37.8
0.1	28.86
0.2	19.7
0.3	7.68
0.4	3.56
0.5	1.74
0.6	0
0.7	0
0.8	0.76
sum	100

Additional Questions on Distribution.

Q-1 What are the ranges of each bin data?

Response: The total in each bin represents the upper limit of each bin (i.e., a0.1 volt bin value would include everything from 0 up to and including 0.1 volts).

Q-2 Is interpolating of the BOC distribution and growth bin values used?

Response: We do not interpolate or sample the bin range. The discrete upper bin values are used.

Q-3 How is wear treated?

Response: If a sampled value of the wear distribution gives a value outside ± 15%, then the value is set to 15%.

Q-4 In what manner do you account for NDE uncertainty? Is equation 3.5 or 3.6 of WCAP 14277 used?

Response: Equation 3.6 is used.

ATTACHMENT 2

RESPONSE TO QUESTIONS ASKED BY THE PERB STAFF

Response to PERB Staff Questions

1. The licensee should determine the limiting maximum primary-to-secondary leak rate in the steam generator in the faulted loop for a main steamline break accident.

   Response: The limiting maximum primary-to-secondary post-Main Steam Line Break (MSLB) leak rate in the steam generator in the faulted loop for a main steamline break accident is 5.0 gpm.

2. A radiological dose analysis should be provided that demonstrates that STP-1 is within the acceptance criteria of GDC 19 for the control room and 10 CFR 100 for the EAB and LPZ in the event of a main steamline break accident.

   Note that previous STP-1 analyses evaluated three cases of reactor coolant iodine concentrations: (1) a pre-accident spike of 60 microcuries per gram dose equivalent I-131: (2) an accident initiated spike and (3) additional coolant iodine activity as a result of potential fuel failures (5%) from a main steamline break. The licensee should include all three cases of reactor coolant iodine concentrations in their calculations.

   Response: STP has performed a radiological dose analysis to establish the limiting maximum primary-to-secondary post-MSLB leak rate in the steam generator in the faulted loop. This value was reported in the response to Question 1, above. Consistent with the current licensing basis (see UFSAR Section 15.1.5.3) three cases were evaluated: (1) a pre-accident spike of 60 microcuries per gram dose equivalent I-131; (2) an accident initiated spike; and (3) additional coolant iodine activity as a result of potential fuel failures (5%) from a main steamline break.

   A description of the MSLB analysis may be found in UFSAR Section 15.1.5.3. A description of the control room may be found in UFSAR Section 6.4.4.1. The following additional assumptions were made to determine the limiting maximum primary-to-secondary post-MSLB leak rate in the steam generator in the faulted loop:

a) The pre-break primary-to-secondary leak rate was assumed to be at the current Technical Specification limit of 1 gpm. This yields a conservatively high isotopic concentration in the secondary system.

b) During the accident, the primary-to-secondary leak rate was assumed to be at the proposed voltage-based repair criteria Technical Specification limit of 600 gpd (0.42 gpm) total leakage. This was divided, using the current MSLB methodology, into the affected and unaffected steam generators. The 600 gpd leakage was assumed to split 65% to the unaffected steam generators (390 gpd/ 0.273 gpm) and 35% to the affected steam generator (210 gpd/ 0.147 gpm). Note that this results in an conservative leak rate of 210 gpd in the affected steam generator, which is in excess of the proposed 150 gpd leakage in any one steam generator.

c) All releases were assumed to end after 8 hours, when the plant is placed on the Residual Heat Removal system.

d) Doses were calculated at the site boundary, and the control room. Although the Technical Support Center (TSC) is non-safety related, doses for personnel in the TSC were also determined. The TSC and the control room share HVAC intake structures, therefore, the values for atmospheric dispersion (χ/Q) are the same. The assumed free volume of the TSC is 48170 cubic feet. The intake flow is 1210 cfm and the filtered recirculation flow is 4750 cfm. The intake flow and a portion of the recirculation flow are filtered by a 4" charcoal bed. Unfiltered inleakage is assumed to consist to 10 cfm from door movement and 6.2 cfm due to fan shaft leakage. Filter efficiencies are from Regulatory Guide 1.52.

e) In addition to the cases above, a second set of analyses were made at 10 gpm above the proposed voltage-based repair criteria Technical Specification limits. These "Tech Spec + 10 gpm" results were used to bound the dose consequences and allow determination of a limiting flow, as described in (f), below.

f) The limiting maximum primary-to-secondary post-MSLB leak rate in the steam generator in the faulted loop was determined by a linear interpolation on the thyroid doses to the TSC personnel. A point slightly below the GDC 19 limit of 30 rem was chosen on this "flow vs. dose" curve to determine the limiting maximum primary-to-secondary post-MSLB leak rate.

g) The following additional information was supplied to the reviewer as a result of a teleconference with STP Staff members:

Assumptions

1. For a pre-existing iodine spike, the activity in the reactor coolant is based upon an iodine spike which has raised the reactor coolant concentration to 60 micro Ci/gm of dose equivalent I-131. The secondary coolant activity is based on 0.1 micro Ci/gm of dose equivalent I-131. Noble gas activity is based on 1% failed fuel.

2 The total steam generator tube leak rate prior to the accident and until 8 hours after the start of the accident is 0.42 gpm (approx. 600 gpd). This is conservatively divided into 0.147 gpm (35%) to the affected loop and 0.273 gpm (65%) to the unaffected loops.

3. For a concurrent iodine spike, the accident initiates an iodine spike in the Reactor Coolant System (RCS) which increases the iodine release rate from the fuel to a value 500 times greater than the release rate corresponding to a RCS concentration of 1 micro Ci/gm dose equivalent I-131. The iodine activity released to the RCS in the duration of the accident is conservatively assumed to mix instantaneously and uniformly in the RCS. Noble gas activity is based on 1% failed fuel.

4. No iodine spiking is assumed to occur with accident initiated fuel failures. For this case the RCS concentration is based on 5% of failed fuel for both iodines and gases. At the start of the accident the secondary activity is based upon 1% failed fuel. The activity due to failed fuel is assumed to mix instantaneously and uniformly in the RCS.

5. Following the rupture, auxiliary feedwater to the faulted loop is isolated and the steam generator is allowed to steam dry. Thus, the iodine partition factor for the affected steam generator is 1. The iodine partition factor for the unaffected steam generators is 0.01.

6. Offsite Power is lost.

7. The condensers are unavailable for steam dump.

8. All activity is released to the environment with no consideration given to radioactive decay or to cloud depletion by ground deposition during transport to the exclusion zone boundary and low population zone.

9. Eight hours after the accident, cold shutdown is reached and no further steam or activity is released.

10. The equilibrium secondary activity before the Steam Generator rupture is based upon a preexisting primary to secondary leakage of 1 gpm. This conservative since Technical Specification Change 182 will limit the preexisting leakage to 150 gpd per Steam Generator or 600 gpd (0.42 gpm) total to the environment.

11. The source term is based upon a power level of 4100 MW thermal, 5 w/o enrichment, and a 3 region core with equilibrium cycle core at end of life. The three regions have operated at a specific power of 39.3 MW/MTU for 509, 1018, and 1527 EFPD, respectively.

12. The X/Q for the Reactor Containment Building (RCB) to Control Room (CR)/TSC intake is assumed to apply for MSLB site to the CR/TSC intake.

13. The primary to secondary leakage in the unaffected steam generator is assumed to instantaneously flash to steam.

14. The offsite, CR and TSC doses change linearly as a function of the primary to secondary break flow.

15. The Source Term data for the reactor coolant iodine activity based on 60 micro Ci/g Dose Equivalent Iodine 131 (DEI) and the Secondary Iodine Activity based upon 0.1 micro Ci/g DEI are valid for the burnups assumed in Assumption 11.

Primary Coolant Activities

A. Reactor coolant iodine activity based on 60 micro Ci/g Dose Equivalent Iodine 131 (DEI)

Isotope	Concentration (micro Ci/g)
I-131	45
I-132	53
I-133	71
I-134	11
I-135	40

B. Secondary Iodine Activity based upon 0.1 micro Ci/g DEI.

Isotope	Concentration (micro Ci/g)
I-131	7.5e-2
I-132	8.8e-2
I-133	1.2e-1
I-134	1.8e-2
I-135	6.6e-2

C. Gap activity based on 4100 MW.

Isotope	Gap Activity (Ci)
I-131	1.1e+7
I-132	1.6e+7
I-133	2.3e+7
I-134	2.5e+7
I-135	2.1e+7
Xe-131m	7.7e+4
Xe-133m	3.3e+6
Xe-133	2.3e+7
Xe-135m	4.6e+6

Xe-135	6.5e+6
Xe-137	2.0e+7
Xe-138	1.9e+7
Kr-83m	1.4e+6
Kr-85m	3.0e+6
Kr-85	3.7e+5
Kr-87	5.5e+6
Kr-88	7.9e+6
Kr-89	9.7e+6

D. Reactor coolant activity based on 1% failed fuel.

Isotope	Gap Activity (micro Ci/g)
I-131	2.4
I-132	2.7
I-133	3.7
I-134	0.55
I-135	2.1
Xe-131m	1.9
Xe-133m	16.0
Xe-133	240.0
Xe-135m	0.45
Xe-135	8.5
Xe-137	0.17
Xe-138	0.59
Kr-83m	0.38
Kr-85m	1.6
Kr-85	7.7
Kr-87	1.0
Kr-88	2.9
Kr-89	0.084

Atmospheric Dispersion Factors (sec/m^3)

Time	**EAB**	**LPZ**
0-2	1.3e-4	3.8e-5
2-8		1.6e-5
8-16		1.1e-5
16-72		4.3e-6
72-720		1.2e-6

Atmospheric Dispersion Factors for the Control Room and TSC (sec/m^3)

Containment LOCA leakage to CR/TSC intake

Time (hr)	Chi/Q
0-8	1.06e-3
8-24	7.01e-4
24-96	4.44e-4
96-720	1.90e-4

TSC HVAC Flowrates and Filtration and Volume

Filtered Intake Flow	1210 cfm
Unfiltered Flow	16.2 cfm
Exhaust Flow	1226.2 cfm
Filtered Recirc. Flow	4750 cfm

Intake and Recirculation Filtration Efficiencies (%)
Particulate/Organic/Elemental .990 for all

Volume 48170 ft^3

Control Room HVAC Flowrates and Filtration and Volume

Filtered Intake Flow	2200 cfm[1]
Unfiltered Flow	10 cfm
Exhaust Flow	2210 cfm
Filtered Recirc. Flow	9500 cfm

Intake Filtration Efficiencies (%)
Particulate/Organic/Elemental 98.86, 94.32, 99.0

Recirculation Filtration Efficiencies (%)
Particulate/Organic/Elemental 95.00, 95.00, 99.00

Volume 274080 ft^3

Technical Specification Dose Equivalent Iodine Limit

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[1] 235 cfm of this flow does not pass through the Control Room recirculation filter units.

Technical Specification 3.4.8 limits the specific activity of the reactor coolant to:

a. Less than or equal to 1 microCurie per gram DOSE EQUIVALENT I-131, and

b. Less than or equal to 100/E microCuries per gram of gross radioactivity.

Volume of the RCS

13,103 ft^3

The iodine spike is accounted for by increasing the release rate from the fuel by a factor of 500. These factors are given below:

Isotope	**Release Rate (Ci/sec)**
I-131	1.9
I-132	2.8
I-133	4.0
I-134	4.4
I-135	3.7

Results

The results of the analyses are given below. Two calculations were performed. These calculations are identical except for the assumptions regarding the preexisting primary-to-secondary steam generator tube leak rates.

For the first calculation the steam generator tube leak rate prior to the accident and until 8 hours after the start of the accident is 0.1 gpm (approximately 150 gpd total primary-to-secondary leakage).[2] This is conservatively divided into 0.035 gpm to the affected loop and 0.065 gpm to the unaffected loops. These values were assumed to be the values that were to be used in the Technical Specifications to restrict primary-to-secondary leakage during operations.

Doses were calculated at the site boundary, and the control room. Although the TSC is non-safety related, doses for personnel in the TSC were also determined.

[2] This total flow does not include Steam Generator Break flow caused by MSLB.

In addition to the "Tech Spec" cases above, a second set of analyses were made at 10 gpm above the proposed voltage-based repair criteria Technical Specification limits. These "Tech Spec + 10 gpm" results were used to bound the dose consequences and allow determination of a limiting flow. The limiting maximum primary-to-secondary post-MSLB leak rate in the steam generator in the faulted loop was determined by a linear interpolation on the thyroid doses to the TSC personnel. A point at approximately 90% of the GDC 19 limit of 30 rem was chosen on this "flow versus dose" curve to determine the limiting maximum primary-to-secondary post-MSLB leak rate.

For the first calculation, this the limiting maximum primary-to-secondary post-MSLB leak rate was calculated to be 5.1 gpm.

For the first calculation, the primary-to-secondary break flow was used to calculate the doses for three cases. The three cases considered are:

A) Case A: A preexisting iodine spike raises the concentration in the RCS to 60 micro Ci/g DEI 131.

B) Case B: The main steamline break causes an iodine spike that increases the release rate to the RCS to a value 500 times greater than the release rate corresponding to an RCS iodine concentration of 1 micro Ci/g DEI 131.

C) Case C: No iodine spiking is assumed to occur with accident initiated fuel failures. For this case the RCS concentration is based on 5% of failed fuel for both iodine and gases. At the start of the accident the secondary activity is based upon 1% failed fuel. The activity due to failed fuel is assumed to mix instantaneously and uniformly in the RCS.

The results utilizing the 5.1 gpm break flow are given in Table 1.

Table 1 Onsite and Offsite Doses for a Primary-to-Secondary Break Flow of 5.1 gpm

	EAB (rem)			LPZ (rem)			Control Room (rem)			TSC (rem)	
	Thyroid	Whole Body	Beta Skin	Thyroid	Whole Body	Beta Skin	Thyroid	Whole Body	Beta Skin	Thyroid	Whole Body	Beta Skin
Case A: Pre-Accident Iodine Spike	4.92E+0	9.44E-3	3.21E-3	3.20E+0	4.67E-3	1.75E-3	5.40E-1	7.58E-4	1.46E-2	7.49E-1	4.43E-4	1.49E-2
Case B: Accident Initiated Iodine Spike	1.37E+1	4.69E-2	1.33E-2	1.11E+1	2.41E-2	7.56E-3	1.99E+0	9.20E-4	1.54E-2	2.77E+0	5.73E-4	1.62E-2
Case C: 5% Failed Fuel	1.33E+2	5.62E-1	1.88E-1	1.08E+2	2.80E-1	9.84E-2	1.95E+1	8.08E-2	8.00E-1	2.70E+1	5.18E-2	9.01E-1

EAB doses are 0-2 hour doses. All others are 0-30 day doses.

Subsequent to performing the first calculation, described above, it was determined that the allowed primary-to-secondary leak rate should have been 150 gpd for any one steam generator, for an allowed total of 600 gpd. This change in assumptions will slightly decrease the allowable post-MSLB primary-to-secondary leakage.

Therefore, for the second calculation, the total steam generator tube leak rate prior to the accident and until 8 hours after the start of the accident is 0.42 gpm (approximately 600 gpd total primary-to-secondary leakage).[3] This is conservatively divided into 0.147 gpm (35%) to the affected loop and 0.273 gpm (65%) to the unaffected loops. Note that this results in a conservative leak rate of approximately 211 gpd in the affected steam generator, which is in excess of the proposed 150 gpd leakage in any one steam generator.

For the second calculation, the limiting maximum primary-to-secondary post-MSLB leak rate is calculated to be 5.0 gpm. Table 2 gives the onsite and offsite doses at 5.0 gpm.

Note for the second calculation, all three Cases were not recalculated for the break flow of 5.0 gpm. Only the doses from the limiting case (Case C) were calculated since the difference in the limiting break flow is small (5.1 versus 5.0 gpm). Therefore, Case C will continue to yield the limiting doses.

Inspection of Case C results in Tables 1 and 2 show the slight effect of the change in initial conditions. The relatively large differences between Cases A, B, and C doses in Table 1, and the negligible differences in Case C results between Tables 1 and 2 provide justification for assuming Case C is the limiting case, thereby limiting the reanalysis to Case C alone.

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[3] This total flow does not include Steam Generator Break flow caused by MSLB.

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Table 2 Case C Onsite and Offsite Doses for a Primary-to-Secondary Break Flow of 5.0 gpm

	EAB (rem)			LPZ (rem)			Control Room (rem)			TSC (rem)		
	Thyroid	Whole Body	Beta Skin	Thyroid	Whole Body	Beta Skin	Thyroid	Whole Body	Beta Skin	Thyroid	Whole Body	Beta Skin
Case C: 5% Failed Fuel	1.33E+2	5.68E-1	1.92E-1	1.08E+2	2.85E-1	1.01E-1	1.95E+1	9.35E-2	9.31E-1	2.70E+1	5.96E-2	1.04E+0

EAB doses are 0-2 hour doses. All others are 0-30 day doses.

3. A previous license amendment (Nos. 28 and 19, issued on 09/26/91) revised certain UFSAR sections based on a single failure of the electric heater in the control room HVAC system. That amendment addressed radiological consequences from a LOCA, fuel handling accident, and gaseous waste processing system failure accident, but not a main steamline break accident.

The licensee's analyses of control room operator doses from a main steamline break accident should specify the assigned filter efficiencies for the control room HVAC system for the duration of the accident. If changes have been made to the control room HVAC system since 1991, the licensee should describe those changes and account for them in their analysis.

The licensee should also describe how the main control room HVAC makeup and cleanup filtration system is actuated for a main steamline break accident, including operator actions and timing, if applicable.

Response: a) The operation of the control room HVAC has not changed since the cited submittals (Nos. 28 and 19, issued on 09/26/91). The operation of the HVAC, for radiological protection purposes, is described in UFSAR Section 6.4.4.1.

Table 6.4-2 presents the HVAC parameters for the doses to control room operators due to a postulated LOCA. The voltage-based repair criteria/MSLB analysis used the data from this table. The containment leakage x/Q's were used, since they were qualitatively judged to be similar in value to ones which would be calculated from the isolation valve cubicle (the release point for a MSLB) to the control room HVAC intake structure. The filter efficiencies for the makeup air filters were modified to reflect an assumed single failure of a filter heater - in addition to an assumed single failure of a Standby Diesel Generator and its associated train. Also, the efficiencies were calculated assuming a flow of 2200 cfm.

	UFSAR Table 6.4-2	APC[4]/MSLB Analysis

[4] APC - Alternate Plugging Criteria

Inorganic iodine	98.5%	98.86%
Organic iodine	98.5%	94.32%
Particulates	99%	99%

b) The control room HVAC is placed in emergency mode upon the receipt of a safety injection signal or high radioactivity, as described in UFSAR section 6.4.2.2. No credit for operator action is taken in the analysis.

4. Is the STP-1 average primary coolant temperature assumed to be 590°F for DBA calculations?

Response: After discussions with the reviewer, it was determined that what was needed was a value to be used to determine equilibrium isotopic concentrations in the primary and secondary systems. For this purpose, a temperature of 592°F may be used (UFSAR Table 11.1-1).

5. Is the STP-1 steam temperature and feedwater temperature in the steam generator assumed to be 556°F and 440°F, respectively, for DBA calculations?

Response: The best estimate values for the steam temperature and feedwater temperature in the steam generator are 556°F and 440°F.

6. What is the STP-1 water volume and steam volume in both the steam generator and secondary coolant for DBA calculations?

Response: After discussions with the reviewer, it was determined that what was needed was data to be used to determine equilibrium isotopic concentrations in the primary and secondary systems. The MSLB/voltage-based repair criteria analysis assumed the following:

Mass in Unaffected S/Gs: 4.14×10^5 lbm
Mass in Affected S/G: 1.38×10^5 lbm
Primary side (RCS) mass: 5.73×10^5 lbm

The volume of the Steam Generator secondary side used in the calculation of the blowdown masses after a Main Steam Line Break accident are as follows:

Volume of the water: 2742 ft^3 per steam generator
Volume of the steam: 5245 ft^3 per steam generator

The condenser hotwell provides approximately 108,000 gallons of condensate storage, equivalent to the storage required for approximately 5 minutes of operation at maximum load.

Questions Relating to the Atmospheric Dispersion Factors

1. From where is the effluent assumed to leak and at what height(s)? Is the leak assumed to be from a single point or from multiple points or a diffuse source? What is/are the assumed location(s) and height(s) of the leak(s) with respect to the intake(s)? Figures might be helpful in describing these relationships.

Response: The STP analysis used the X/Q from the containment building to the control room HVAC intake. Therefore, the effluent is essentially assumed to leak from the containment building skin. A MSLB is postulated to occur in the isolation valve cubicle (IVC) between the containment building and the main steam line isolation valves (MSIVs). However, the containment is closer to the control room HVAC intake than the IVC and it is assumed that the X/Qs would be similar. It is assumed that the proximity of the release to the containment building would draw the release into the building's wake, yielding a source equivalent to leakage directly from the containment building surface.

The X/Q is calculated using the diffuse source/ point receptor methodology in Murphy & Campe[5].

The distance between the containment and the control room intake in the STP analysis is assumed to be 61.87 m (203 ft). It is assumed that the source and the receptor are at the same elevation. Actually, the straight-line distance between the intake and the IVC is about 277 ft (assuming the release point and the intake are at the same elevation). Also, the main steam lines are at 55'-6" and the intake is at about 80 ft. Therefore, the plume would have to go up and over the Electrical Auxiliary Building (EAB) and the Mechanical Auxiliary Building (MAB) to reach the control room HVAC intake. More detail is given in response to Question #3.

Section 1.2 of the UFSAR contains plant general arrangement drawings which may be used to determine distances and directions.

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[5] Murphy, K.G., and Campe, K.M., "Nuclear Power Plant Control Room Ventilation System Design for Meeting General Design Criteria 19," *13th AEC Air Cleaning Conference*, USAEC, CONF-740807.

2. What are the distance and direction between the assumed leak(s) from the containment surface or other structure(s) and the control room intake(s)? Is the intake a volume receptor such as an isolated control room with infiltration occurring at many locations? If there are two or more control room fresh air inlets, does each meet the single failure criterion for active components, the seismic criteria, as well as any applicable missile criteria. The design details must assure that the most contaminated inlet is isolated and the least contaminated inlet remains in operation to provide control room pressurization.

Response: The distance between the containment and the control room intake in the STP analysis is assumed to be 61.87 m (203 ft). It is assumed that the source and the receptor are at the same elevation. Actually, the straight-line distance between the intake and the IVC is about 277 ft (assuming the release point and the intake are at the same elevation). Also, the main steam lines are at 55'-6" and the intake is at about 80 ft. The control room intake is almost due East from the containment building. It is at approximately 95° from North from the center of the containment building. The control room intake is 117.6° from North from a realistic release point in the IVC (at grid location N.5/21).

The control room is assumed to be a point receptor. The majority of the air intake is via the HVAC intake louvers on the east face of the MAB. Only a small fraction (10 cfm) of air into the control room is considered to be unfiltered inleakage from the EAB (from door movement).

A design description of the control room HVAC system and how it functions to meet its design basis may be found in UFSAR Section 6.4.

3. What is the diameter, height and projected cross-sectional area of the containment or other building(s) from which the leak is assumed to occur? What buildings or other structures (including dimensions and orientations) are located near to and/or between the release point(s) and intake(s)? Figures might be helpful in describing these relationships.

Response: The height of the containment from the grade elevation to the springline is 125 ft. The radius of the containment is 79 ft. The radius of the containment dome is 78 ft. This presents an area profile of 29,307 ft^2, or 2723 m^2.

The Isolation Valve Cubicle (IVC) is the structure immediately to the north of the containment building. This structure houses the PORVs, safety relief valves and MSIVs for each main steam line. The MSLB outside containment is assumed to occur in this structure. The top of the building is at an elevation of 86'. The main steam line in this building is located at an elevation of 55'-6".

The HVAC intake for the control room HVAC system is located on the east face of the mechanical building - nearly due east of the containment building. The roofs of the intervening buildings are generally at 80' to 96'. Any release from the main steam lines in the IVC to the control room HVAC intake would travel upwards from 55'-6", through the open roof of the IVC at 86', very near the containment shell. The release would then travel over the electrical auxiliary building (EAB) roof at 86', down to the roof of the mechanical auxiliary building (MAB) at 80', and over or around one 16' structure housing the intake to the intake louvers at about 80'. The straight-line distance (through structures, not a string-line distance) is approximately 277'.

4. What are the basis and assumptions for the X/Q provided by the licensee in its control room habitability assessment?

Response: The STP analysis used the X/Q from the containment building to the control room HVAC intake. Therefore, the effluent is essentially assumed to leak from the containment building skin. A MSLB is postulated to occur in the isolation valve cubicle (IVC) between the containment building and the main steam line isolation valves (MSIVs). However, the containment is closer to the control room HVAC intake than the IVC and it is assumed that the X/Qs would be similar. It is assumed that the proximity of the release to the containment building would draw the release into the building's wake, yielding a source equivalent to leakage directly from the containment building surface.

The X/Q is calculated using the diffuse source/ point receptor methodology in Murphy & Campe.

The distance between the containment wall and the control room intake is assumed to be 61.87 m (203 ft). It is assumed that the source and the receptor are at the same elevation.

The height of the containment from the grade elevation to the springline is 125 feet. The radius of the containment is 79 feet.

The radius of the containment dome is 78 feet. This presents an area profile of 29,307 ft^2, or 2723 m^2.

Pasquill stability class F is used, with a 5 percentile wind speed of 1.4 meters per second. The following plume dispersion standard deviations were used:

$\sigma_Y = 2.6$ m $\sigma_Z = 1.7$ m

ATTACHMENT 3

MSLB DOSES FOR APC