TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

March 20, 1984

Director of Nuclear Reactor Regulation
Attention: Ms. E. Adensam, Chief
Licensing Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Ms. Adensam:

In the Matter of the Application of	)	Docket Nos.	50-390
Tennessee Valley Authority	)		50-391

Watts Bar Nuclear Plant (WBN) Safety Evaluation Report (SER) NUREG-0847 issued June 1982) Section 3.11 "Environmental Qualification of Mechanical and Electrical Equipment" states that an audit of the WBN qualification files will be required as part of the NRC staff's review of the WBN equipment qualification program. This subject audit was conducted on February 14-16, 1984 and consisted of a review of the qualification files for eleven electrical components and subsequent field walkdown to ensure that a parallel existed between the installed component and the component qualified.

The audit concluded with several findings (generic and component specific) being identified and requiring resolution. Enclosed are TVA's responses to a select number of the audit findings as identified by NRC's audit summary provided at the audit exit meeting. Additional time will be required in responding to several of the findings due to their scope and/or nature. A schedule for responding to these findings is provided for each item.

During the audit, NRC representatives noted that a specific SER on the WBN equipment qualification program is tentatively scheduled to be issued by mid-April 1984 and that audit findings which remain unresolved would be incorporated into the SER as open items. NRC representatives additionally noted that TVA's responses to the audit findings must be submitted by mid-March 1984 in order for the findings to be considered for exclusion from the SER.

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Advanced To: PM T. Kenyon

Director of Nuclear Reactor Regulation March 20, 1984

If you have any questions concerning this matter, please get in touch with D. B. Ellis at FTS 858-2681.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills

L. M. Mills, Manager
Nuclear Licensing

Sworn to and subscribed before me
this 20th day of March 1984

Paulette H. White

Notary Public
My Commission Expires 9-5-84

Enclosure
cc: U.S. Nuclear Regulatory Commission (Enclosure)
Region II
Attn: Mr. James P. O'Reilly Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30303

50-390
Responses to NRC 840214016 audit findings re util equipment qualification program, per NUREG-0874

w/ltr 84/03/20

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ENCLOSURE A

WATTS BAR NUCLEAR PLANT

GENERIC COMMENTS ON ENVIRONMENTAL QUALIFICATION PROGRAM

NRC Question

1A. The temperature and pressure profiles for outside containment were marked preliminary. TVA should submit the final profiles to the Staff.

TVA Response

Final issued environmental profiles are provided in Appendix A.

NRC Question

1B. TVA should also provide justification/explanation for the equipment which now sees a temperature higher than that previously considered in the environmental qualification review. Also, TVA has informed the Staff that some areas were classified as mild but, based on the new evaluation, they are now classified as harsh. TVA should include the equipment located in these areas in the qualification program.

TVA Response

The group of equipment affected by an auxiliary boiler steam line break is the only equipment which now sees a temperature higher than previously considered. The explanation for the sequence of events that led to the curves in the Watts Bar Nuclear Plant (WBN) Electrical Equipment Environmental Qualification Report (EEEQR) being stamped as 'preliminary' for areas affected by an auxiliary boiler steam line break is given below. Additionally, justification for the qualification of the equipment in these areas to the final higher temperature curves is also given.

TVA discovered by an environmental qualification test that the temperature switches used to detect an auxiliary boiler steam line break did not respond as fast as assumed by the environmental profile calculation. During the course of redesigning this break detection and mitigation system, it became necessary to incorporate environmental profiles in the EEEQR before all design work was complete. The curves could not be considered final until the outstanding design work on the break detection and mitigation system was complete. Therefore, they were marked 'preliminary.'

As part of the investigation into the various options concerning the redesign of the system, a study was performed to determine the impact that the present design would have on the qualification status of the affected equipment. The study was performed by having the engineers responsible for the qualification of the affected equipment evaluate the impact of the slightly higher temperatures. This study showed that although the present design resulted in temperature profiles slightly higher than the preliminary profiles, the higher temperatures did not adversely impact the qualification of the affected equipment. Therefore, TVA elected not to redesign the break detection and mitigation system so as to keep the temperature profiles below the preliminary profiles which were used in the EEEQR. The final temperature profiles have been documented and issued and have been factored into our Environmental Qualification (EQ) program.

Additionally, TVA has evaluated the qualification of the equipment in those areas whose classification has changed from a mild to harsh environment and has factored this equipment into the qualification program. All required components in these areas are of the same type, manufacturer, and model number as other components which have already been included in TVA's environmental qualification program.

NRC Question

2. Recently, TVA has provided a 10 CFR 50.55(e) report on the containment temperature profile and informed the NRC that equipment inside containment will see a much higher temperature than what was previously determined. Provide justification and the effect of these higher temperatures on the equipment qualification.

TVA Response

TVA is still investigating possible corrective actions to reduce the temperature to a level that will not significantly impact equipment qualification. The results of our investigation will be detailed in the final 10 CFR 50.55(e) report. Equipment will be qualified per the requirements outlined in our final report on this item.

NRC Question

3. TVA has used the spray and steam environment test as a basis for submergence qualification of the NSSS equipment. This method of qualification for submergence is not acceptable. TVA should either relocate the equipment subjected to submergence above the flood level or provide additional testing based on the actual submergence test.

TVA Response

The TVA method of using the spray and steam environment testing for RTDs (NEB 68-24) and transmitters (NEB 3-29) used inside containment provides adequate assurance that the components are qualified for submergence. The testing subjected the components to spray impingement and saturated steam under the following pressure conditions.

RTDs - 66 psig for 6 days
Transmitters - 75 psig for 15 days

No inleakage of moisture occurred. TVA evaluated these results and concluded that, since there was no inleakage of moisture in a vapor/spray state under such high-pressure conditions, that inleakage of moisture in a liquid state under the relatively low-pressure conditions (14.5 psig maximum) of the postulated design basis loss-of-coolant accident at Watts Bar would not occur either.

NRC Question

4. In accordance with 10 CFR 50.49, all equipment which is designated category 1 and 2 in accordance with Regulatory Guide (RG) 1.97 should be qualified for the environment to which they will be subjected. In accordance with this requirement, TVA should either provide justification for interim operation or qualify all equipment which is either installed or will be installed prior to fuel load.

TVA Response

TVA will not implement RG 1.97 before fuel load. The WBN SER (NUREG-0847) documents the NRC evaluation of TVA's postaccident monitoring (PAM) provisions. The NRC evaluation concludes that TVA's PAM provisions as described in the final safety analysis report (FSAR) provide substantial conformance to RG 1.97 and that those provisions are acceptable in the near term. Further, NRC stated that compliance with RG 1.97 will be required in the context of emergency preparedness. After issuance of NUREG-0847, NRC issued generic letter 82-33 (Supplement 1 of NUREG-0737) which delineated requirements for emergency preparedness, including compliance with RG 1.97. TVA's response to generic letter 82-33 described how TVA will integrate implementation of RG 1.97 requirements with other emergency response features. When RG 1.97 is implemented, TVA will comply with applicable requirements related to environmental qualification including the addition of any required components to TVA's environmental qualification program. However, until such time, only those PAM items listed in FSAR Section 7.5 that are located in a harsh environment will be considered in TVA's environmental qualification program. These components were previously specified by letter from L. M. Mills to E. Adensam dated January 11, 1984.

NRC Question

5. A radiation sample calculation with bases and assumptions for 1-LT-3-39 should be provided to show how the radiation dose was determined.

TVA Response

Enclosed in Appendix B is the calculation used to determine the integrated accident dose in the area where instrument 1-LT-3-39 is located. This instrument is located on elevation 716 in the lower containment outside the crane wall. The integrated accident dose used was that for the lower containment inside the crane wall. This corresponds to detector 6 in the model shown on page 6.12 of TI-RPS-48 R1. Note that this is conservative since the dose inside the crane wall is greater than the dose outside the crane wall (see pages 7.7, 7.8, 11.6, and 11.7). The integrated accident dose for this area is determined on page 7.8 and shown graphically on page 11.7.

Also enclosed in Appendix B is a microfilm copy of the supporting computer runs and a copy of the TVA drawings referenced in the calculation.

NRC Question

6. TVA should provide a writeup to discuss how the determination was made that the instrument accuracy demonstrated is adequate for the Watts Bar application. During the audit, the Staff was able to agree with TVA's approach for determining accuracy for balance-of-plant equipment. However, for NSSS equipment, TVA informed NRC that this is done only by exception. Westinghouse informs TVA only in cases were the generic accuracy may not be suitable for the Watts Bar application. TVA should request Westinghouse to document that demonstrated accuracy is acceptable for the applicable instrument for the Watts Bar design.

TVA Response

For BOP trip or postaccident monitoring equipment, the inaccuracies caused by accident environmental effects were combined with the normal loop inaccuracies (which included the inaccuracies of the output devices and any interposing instruments), using a square root of the sum of the squares method. The result is the total loop inaccuracy of the trip switch output or indicator. This total inaccuracy was applied to the normal set points for each safety system in the most conservative manner in order to evaluate the effect on the system safety function.

For control applications, it was assumed that instrument function occurred at the extreme limit of the error band on the side that would tax system performance the most. The loop accuracy was considered acceptable if the system could still perform its safety function. If the system could not perform its intended safety function, the required accuracy was then specified by the system engineer.

For indicators, the instrument error was evaluated in the adverse direction to determine if the conveyed information would prevent appropriate operator action. If the inaccuracies did not prevent prompt operator action or cause ambiguities, then the loop accuracy was considered acceptable. If the inaccuracies had the potential to prompt inappropriate operator action or cause ambiguities, the required accuracy was then specified by the system engineer.

Both the calculation of the total loop inaccuracy and the effect on the ability of the system to perform its safety function are documented in TVA's QA calculations.

For NSSS equipment, Westinghouse is currently performing a statistical set point study that will include the plant-specific accuracies for the instrumentation installed at WBN. This study is scheduled to be completed in April 1984.

NRC Question

7. During the period of the last three years, the NRC has issued many information notices (e.g., IE IN81-29, 82-03, 82-52, and 83-72) which affect the equipment qualification status. TVA should confirm that it has reviewed all applicable information notices for their equipment and proper action has been taken to resolve the concern addressed in the information notices.

TVA Response

TVA confirms that all information notices which transmitted equipment environmental qualification notices have been reviewed for applicability to TVA equipment. In most cases, the components described in the qualification notices are not used by TVA in safety-related applications in harsh environment areas at Watts Bar. However, the following NCRs have been written on TVA equipment that is similar to those components specified in the information notices.

NCR	EQPT	IN
WBN MEB 8115	LIMITORQUE SMB-00	81-29 & 82-52
WBN EEB 8147	ASCO NP-1	81-29 & 82-52
WBN NEB 8401	BARTON 763, 764	83-72

TVA is still investigating the applicability of equipment environmental qualification notice No. 24 (IN 83-72) as described in our response to NRC comments on EQS MEB-67-134 and MEB-1-107 (see enclosure B). As in the past, any future information notices will be reviewed in accordance with TVA Division of Engineering Design Procedure 2.10 entitled 'NRC-OIE Bulletins, Circulars, and Information Notices - Distribution and Preparation of Responses' and action will be taken to resolve the concern as appropriate.

NRC Question

8. During the audit, six items which are categorized as 'C' were selected by the Staff. Out of six items, four will be reclassified as category 'A' based on RG 1.97. Proper justification was provided for the other two items. Based on this, TVA should reevaluate the list of category 'C' items and submit the updated list to the Staff for review.

TVA Response

An updated category 'C' list is included as Appendix C.

NRC Question

9. For many components, a summary report or material analysis was used as the basis for equipment qualification. A summary report by itself is not an acceptable way to demonstrate qualification. In cases where a summary report is used, TVA should also evaluate the complete test report and document the findings in the file. Also, it is TVA's responsibility to keep the test report for the life of the equipment. For those files where only material analysis is used, TVA should either get the applicable existing test report for the equipment from the vendor or requalify the equipment by testing. Material analysis is acceptable only for the aging of the equipment.

TVA Response

The response to this question is divided into three parts relating to the three subject areas of this comment.

a. Use of summary reports - TVA has used complete test reports for its equipment qualification except for three cases where summary reports were used. For one case (EQS EEB-XS-1), TVA has now obtained the complete test report. TVA is currently reviewing the report and will document the results of this review in the EEEQR. For the second case, TVA has used a summary report only as supplemental information with a complete Wyle test report as the primary documentation of qualification (see response to Question 5 on EQS EEB-TB-1). For the third case (EQS MEB-72-0155), TVA is now in the process of obtaining the complete test report which will be reviewed and the results will be documented in the EEEQR.

b. Maintenance of test reports - TVA maintains the test report for the life of the equipment since the test report is considered to be the QA procurement documentation, and as such, falls within TVA's QA program described in Topical Report TVA-TR75-1A. The test reports are maintained in the Management Engineering Data Systems (MEDS) file which is the system used by TVA's design divisions for the retention and storage of QA records as described in TVA-TR-75-1A.

c. (1) Material analysis used alone for qualification - TVA does not use material analysis alone, but always with some partial type test data for qualification.

(2) Material analysis used for aging only - 10 CFR 50.49, Section f.4 and NUREG-0588, Section 2.1.4 state that material analysis in combination with partial type test that supports any analytical assumptions or conclusions made is acceptable for qualification. Neither 10 CFR 50.49 nor NUREG-0588

limits the material analysis to aging only; therefore, it is TVA's position that material analysis with supporting partial type data is acceptable for qualification.

NRC Question

10. For any component which has an outstanding nonconformance report (NCR), the equipment should be considered unqualified and justification for interim operation should be provided if the NCR is not closed prior to fuel load.

TVA Response

A justification for interim operation was included in the EEEQR for all NCRs that will not be closed before fuel load.

NRC Question

11. During the plant walkdown, the Staff and its consultant made the following observation:

a. Flexible conduits are used for class 1E cable termination. These conduits are not qualified for the environmental effect. There is a probability that these conduits may fail and provide a leakage path for water/steam to enter the class 1E equipment. These conduits should be qualified for the environment in which they are located to avoid this problem. (Reference item 7 above, IE IN-83-72, No. 13.)

b. Terminal blocks are used inside the containment while they are listed as only for outside containment application. Justify this discrepancy.

c. Some terminal block enclosures did not have any weephole. This will require the enclosure to be qualified for the pressure they will be exposed to confirm that these boxes are qualified to withstand the pressure conditions caused by the design bases accident.

TVA Response

TVA will provide a response to this item by March 30, 1984.

ENCLOSURE B

WATTS BAR NUCLEAR PLANT

COMPONENT-SPECIFIC COMMENTS ON ENVIRONMENTAL QUALIFICATION PROGRAM

NRC Question

1. The terminal blocks qualification is based only on the material analysis. However, it should be noted that NUREG-0588 category II requirements which are applicable to Watts Bar, allows the material analysis only for aging consideration. In order to demonstrate the qualification of the terminal blocks either a new test should be performed or some old test on the similar equipment should be referenced.

2. Explain how the composition and/or manufacturing process was taken into account, when the reference material was used for the material analysis.

3. Explain the differences between the TVA type D enclosure and the NEMA enclosure. Demonstrate similarity between TVA type D and tested enclosure.

4. Are terminal blocks subjected to submergence? If yes, how was the qualification for submergence determined.

5. Qualification report is a summary document based on the test report. Has TVA reviewed this test report? If yes, where is the TVA evaluation documented? How will the test report be maintained for the life of equipment?

TVA Response

1. NUREG-0588 Category II requirements allow qualification by analysis, provided some partial type tests on vital components of the equipment are used to support the analytical methods (see TVA response to Generic Question 9). Our qualification of the terminal blocks was based on both material analyses and test data (references 1, 2, and 3 on Appendix 1 of EQS EEB-TB-1).

   In addition, Wyle Laboratories has demonstrated a 10-year qualified life for the CR151 terminal blocks (Test Report 17503-1) for a high energy line break (HELB) accident with the following environmental parameters:

   Temperature: 315°F (approximate)
   Pressure: 25.4 psia

   A copy of the HELB test profile is attached. Although the documented test data on the terminal blocks do not envelope the worst-case environmental profile of their installation, the data used in conjunction with the material analyses allows us to conclude that the blocks are qualified for the more severe environmental conditions.

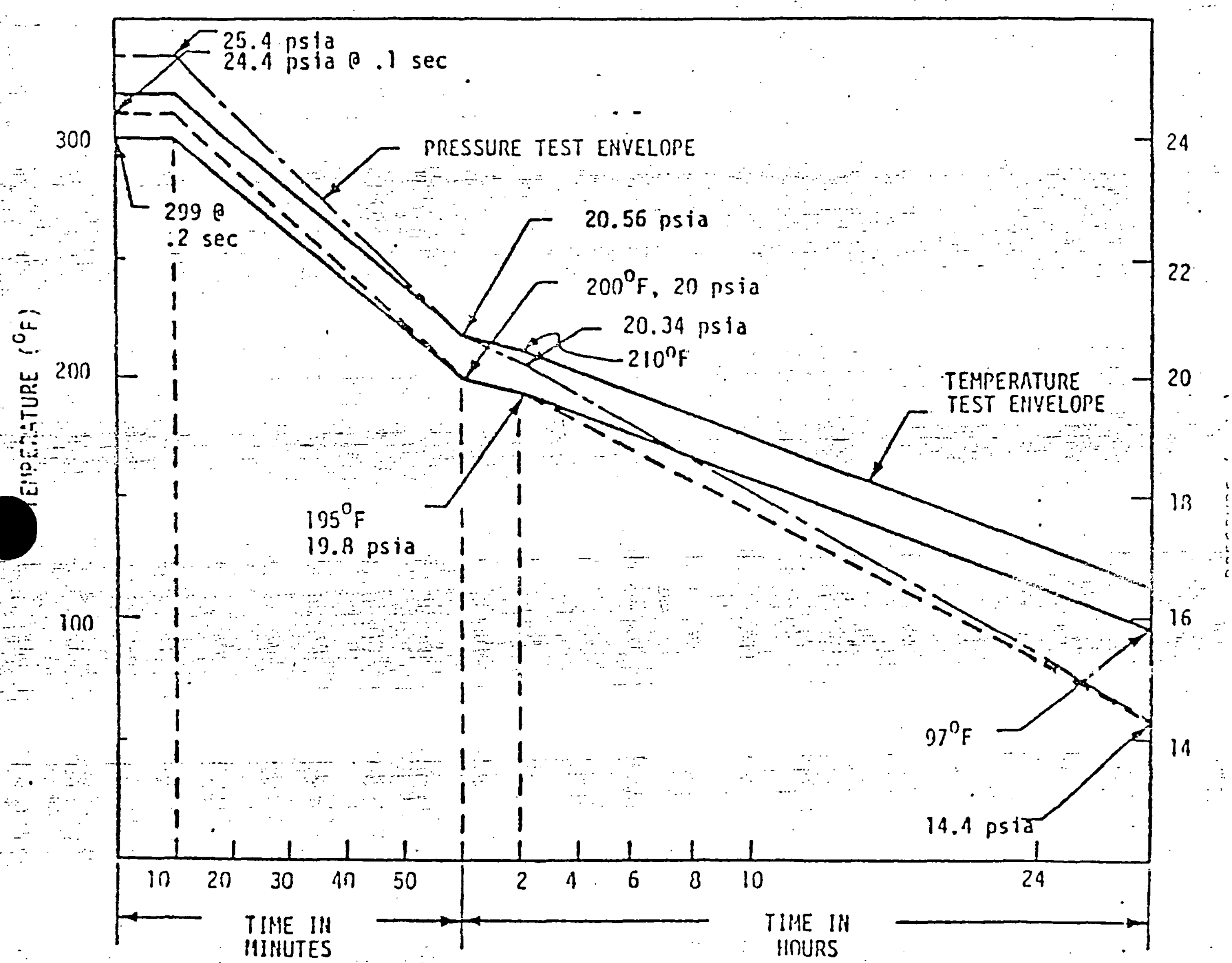
2. The terminal blocks indicated in reference 3 are General Electric type EB-25, which are installed at Watts Bar. Docket No. 50-213 (referenced

in QSR 010-A-01) indicates that the terminal blocks are composed of a wood flour-filled phenolic material. The GE EB-5 is composed of a like material and Wyle Laboratories has identified the material composition of the CR151 blocks to be flour-filled phenolic. Our material analysis was based on this material.

3. Terminal blocks in harsh environments for safety-related applications are installed only in NEMA enclosures, which are sheet steel gasketed boxes. TVA type D enclosures are used in mild environments or for non-safety related applications.

4. The possibility of terminal blocks being submerged is under evaluation, and a response will be provided by April 30, 1984.

5. TVA has not reviewed the test report indicated in reference 3 of the EQS. Wyle Laboratories reviewed the test report under contract with TVA, and TVA has accepted their summary of the test data. However, TVA had Wyle perform a qualification test on the terminal blocks and has reviewed and approved the Wyle test report (Wyle Report 17503-1) and will use the report as the main document of qualification. The summary report is used only as supplemental information. Maintenance of these reports for the life of the equipment in addressed in generic item 9.B.



FIXURE X-1: PHASE I HELB PROFILE

<u>NRC Question</u>

1. The test report referenced in EEB-PEN-1 is a summary document which uses data from many referenced reports. TVA did have these reports in their possession but there was no evidence that the referenced reports have been reviewed and approved for their applicability to Watts Bar. There are some test anamolies reported in the test report; how are they resolved for Watts Bar?

<u>TVA Response</u>

The test reports are currently being reviewed again and the evaluation (including the resolution of the test anomalies) will be documented on an EQS and placed in the EEEQR. The test reports will be maintained as described in the response to generic item 9.B.

<u>NRC Question</u>

2. Similarity between the tested equipment and installed equipment has not been demonstrated.

<u>TVA Response</u>

Similarity between the tested equipment and the installed equipment will be as described in TVA's response to item (1) above.

NRC Question

1. Qualification report is a summary document based on a test report. Has TVA reviewed the test report? If yes, where is the TVA evaluation documented? How will the test report be maintained for the life of the equipment?

TVA Response

The test report is currently being reviewed and the evaluation will be documented on the EQS and placed in the EEEQR. The test report will be maintained as described in the response to generic item 9.B.

NRC Question

2. Qualified life and replacement intervals have not been determined for the equipment.

TVA Response

TVA has determined that this equipment is located in an essentially mild environment (see Question 3) and is therefore not required to meet the aging requirements of 10 CFR 50.49. However, the equipment should perform adequately for 40 years according to the vendor information.

NRC Question

3. Equipment was subjected to only aging tests (thermal, radiation, humidity) and seismic test and was not subjected to an environmental condition after the HELB. If aging data is used to demonstrate the qualification for HELB, then the corresponding time should be taken out from the qualified life consideration.

TVA Response

Aging data has not been used to demonstrate equipment qualification for HELB. TVA has reviewed HELB environmental conditions for the area in which the electro-switch is located and has determined that the HELB conditions are not significantly greater than the normal/abnormal conditions; therefore, per 10 CFR 50.49 the switch can be considered to be in a mild environment. This conclusion is discussed in detail below.

Temperature - The switch is designed to operate continuously at 55°C (131°F). The abnormal temperature is 110°F (8 hours per excursion, 1% of plant life) and the HELB temperature increases to 123°F in 10 seconds and drops to 117°F in 2.6 minutes then drops linearly to normal within 24 hours. The normal design temperature of the switch exceeds the abnormal and HELB temperatures. In addition, a test of the switch at 80°C (176°F) for 120 hours provides further confidence of the operability of the switch during abnormal/HELB temperature excursions. In conclusion, the capabilities of the switch exceed the short time temperature excursions of abnormal and HELB temperatures such that operation of the switch is assured.

The humidity, pressure, and radiation abnormal and HELB are

Humidity: 10-90% (abnormal)
100% (HELB)

Pressure: Atmospheric (14.4 psia - Abnormal)
Atmospheric (14.4 psia - HELB)
-3 psi from atmospheric during tornados

Radiation: 10^4 RADS (Normal, abnormal, and HELB)

Humidity - The switch was tested at 90-95% humidity for 96 hours at 40°C and passed all functional requirements. The switch is housed in NEMA 4 enclosures. This is more than adequate for operation at 100% humidity for 24 hours at normal temperature of 80°F after the 24 hours.

Pressure - The switch is modular in design and consists of several subassemblies or decks of contracts within a phenolic molding. There are no glass components which can crack. Also, all operating parts are exposed to the same atmospheric pressure so no differential pressure can result, causing misoperation. Therefore, TVA concludes that switch operation would not be effected by abnormal, HELB, or tornado pressure.

Radiation - The switch was tested after exposure to 10^4 RADS and passed all functional requirements.

Conclusion: As seen from the design characteristics of the switch and the tests performed on the switch versus the short time durations of the relatively insignificant abnormal and HELB environmental conditions, this switch, at this location can be considered to be located in a mild environment.

NRC Question

4. WBN-EEB-1009 lists equipment located in all general spaces outside containment; however, the equipment qualification parameter does not envelop the required parameter for all locations outside containment. If the equipment is located only in particular areas, which is the case, then the environmental condition for that location should be specified on the sheet WBN-EEB-1009, or Table 3.11-6.

TVA Response

The switches have been determined to be located in a mild environment, and therefore will be removed from Table 3.11-6 in the EEEQR.

NRC Question

1. Insufficient test data was provided in the EQS package for the Parsons/Peebles electric motor.

TVA Response

Per 10 CFR 50.49, 'A mild environment is an environment that would at no time be significantly more severe than the environment that would occur during normal plant operation, including anticipated operational occurrences.' The accident environment of the areas in which these motors are located is not significantly more severe than its normal/abnormal operating environment. The motors are therefore considered to be in a 'mild' environment. The analysis documented in the attached Environmental Qualification Sheet (EQS) WBN-MEB-3-0201, R2 shows that the environment in which these motors operate will not degrade or otherwise cause the motors to fail.

Unit No. 1 and 2
EQS No. WBN-MEB-3-02
TVA ID No.
Aux. FW Pump 1A-A
1B-B
2A-A, 2B-B Motors

Revision		1	2		
Preparer/Date	F.F. Carr/6-6-83	1-3-84	3-13-84		
Reviewer/Date	J.D. Hubble/6-7-83	1-3-84	3-13-84		

WBN EQUIPMENT QUALIFICATION SHEET (R3)

Manufacturer and Model No. Parsons-Peebles-Frame T-4007J
Verification of Table Information (Table 3.11-7, 3.11-8)

NA Equipment Type - The equipment has been identified as per TVA ID number designations (such as, MOV, SOV).

X Location - The location has been identified (such as, inside primary containment, annulus, individually cooled rooms, general spaces, or area affected by HELB outside primary containment).

X Component - A unique TVA ID number has been assigned (such as, 1-FSV-68-308).

X Function - A functional description of the component has been given (such as, steam generator blowdown).

X Contract No., Manufacturer, and Model No. - The contract number, manufacturer, and model number have been given.

X Abnormal or Accident Environment - All abnormal or accident environmental conditions applicable to this equipment have been identified either in tables by references to figures from tables.

X Environment to Which Qualified - The environment to which the equipment has be qualified is addressed in either the tables or the environmental analysis attached.

X Category - A category of a, b, c, or d has been defined for the equipment.

X Operation and Accuracy Required and Demonstrated - The operation and accuracy required and demonstrated have been defined.

Qualification Status (check if applicable, NA if not)

Qualified Life (If equipment is qualified, indicate the qualified life with a numerical entry): NA

NA Qualification Report and Method - A qualification report and the method of qualification has been identified on the Table Input Data Sheet (TIDS).

X Environmental Analysis - An environmental analysis has been done, attached to the EQS, and independently reviewed by the responsible organization.

NA Qualification by Similarity (If applicable) - A justification for qualificatic by similarity is attached to the EQS considering all the above factors and referenced to the appropriate tables.

NA Qualification of Several Exact Components (If applicable) - When an EQS is use for more than one item, a list of all exact components is given as an append with all references to appropriate tables with justification for qualificatior considering all the above factors.

NA Interim Qualification (If applicable) - (Open item) - Component has been determined to be qualified only for a limited interim operation, an NCR has been written, and plan of action has been determined to yield a qualified component.
Term of Interim Qualification __________
NCR No. __________

NA Unqualified Component - (Open item) - (If applicable) - Component has been determined to be unqualified; the following is attached to EQS: NCR number, reason for non-qualification, and justification of continued operation.
NCR No. __________

Per 10CFR50.49, "A mild environment is an environment that would at no time be significantly more severe than the environment that would occur during normal plant operation, including anticipated operational occurrences." The accident environment of the areas in which these motors are located is not significantly more severe than its normal/abnormal operating environment. The motors are therefore considered to be in a "mild" environment. The analysis summary of Appendix 2 shows that the environment in which these motors operate will not degrade or otherwise cause the motors to fail.

Prepared by: Frank P. Carr

Reviewed by: Jerry D. Hubble

1. The motors listed in Table 3.11-7 and 3.11-8 are Parsons-Peebles 600 HP, 6600V, 3-phase 60 Hz motors, Frame T-4007J. They are located in the auxiliary building room No. A1, elevation 713', column: (A3-A4) - (S-T) unit 1, (A3-A13) - (S-T) unit 2. The motors are supplied in redundant trains for each unit. One pump/motor can fail under single failure criteria and the systems satisfy its safety requirements. T remaining motor must operate intermittently for a maximum period of up to 30 days to meet TMI postaccident cooling requirements.

2. The motors are subject to a HELB outside primary containment conditions (Volumes 9 and 19). They are required to operate and not fail in the following environments:

	Normal (Abnormal)	Accident
Temperature	104°F (110°F)	128°F
Pressure	ATM (ATM)	14.42 PSIA
Relative Humidity	80% (90%)	100%
Radiation	5 X 10^2 rads (NA) (40-year TID)	1 X 10^4
Flooding	NA	NA

See WBN Environmental Data Drawings 47E235-52, -54, and -55.

3. A summary of analysis of the effects of temperature, pressure, relative humidity, and radiation during normal/abnormal and HELB environment is noted below.

<u>Temperature</u> - The motors are equipped with a class F insulation system and vendor supplied data indicates the insulation can operate at temperatures up to 140°C for 25 years of continuous operation without exceeding the insulation's useful life (see insulation thermal endurance graph attached). Motor test summary data sheet shows a maximum rise of 57.4°C plus a maximum ambient of 53.3°C (128°F) for an overall winding temperature of 110.7°F. This is well below the continuous operation temperature of 140°C the motor insulation was designed to withstand; moreover, the motors are projected to be required to operate only 315 hours in their 40-year plantlife based on data taken over the first 3 years from motors used in a similar application at Sequoyah. No degradation to the insulation is expected in such nonsevere conditions.

<u>Pressure</u> - The pressure transient existing during a HELB is postulated to induce an approximate 0.02 psia positive pressure rise from a normal atmospheric pressure of 14.4 psia. Since the motor is not sealed but has air inlet and outlets that allow the free exchange of external air, the pressure transient will be substantially equalized across the motor enclosure. The heavy gauge materials which make up the motor enclosure should be more than adequate to withstand this minor pressure change. All oil coupling to the bearings are flanged fittings and do not offer an orifice through which the oil could be forced out due to the pressure difference. Therefore, the pressure transient experienced during a HELB will not adversely affect the motor's operation.

Relative Humidity - These motors normally operate in an environment of 80 percent humidity or less and under abnormal conditions up to 90 percent humidity. Years of motor operating experience and information from motor manufacturers attest to the fact humidity at these low levels will not cause the motors to be functionally inoperable nor degrade motor performance. The temperature of the motor windings or other motor parts must be at least 3 to 4°F below the environment temperature in order for condensation to collect on them for humidities up to 90 percent. The motor parts should remain at the environment temperature for normal and abnormal conditions and therefore no moisture can condense. During a HELB humidity can reach the 100 percent level. However, during this condition the motors will be operating so no moisture can condense on the windings. Consequently, the humidity levels encountered by these motors will not be detrimental to motor operation of motor life.

Radiation - The maximum integrated dose is 1 X 10^4 RADS. This is considered negligible. All materials found in motors to date exhibit radiation damage thresholds above this level. This level of radiation would not degrade or otherwise cause the motor to fail.

Conclusions

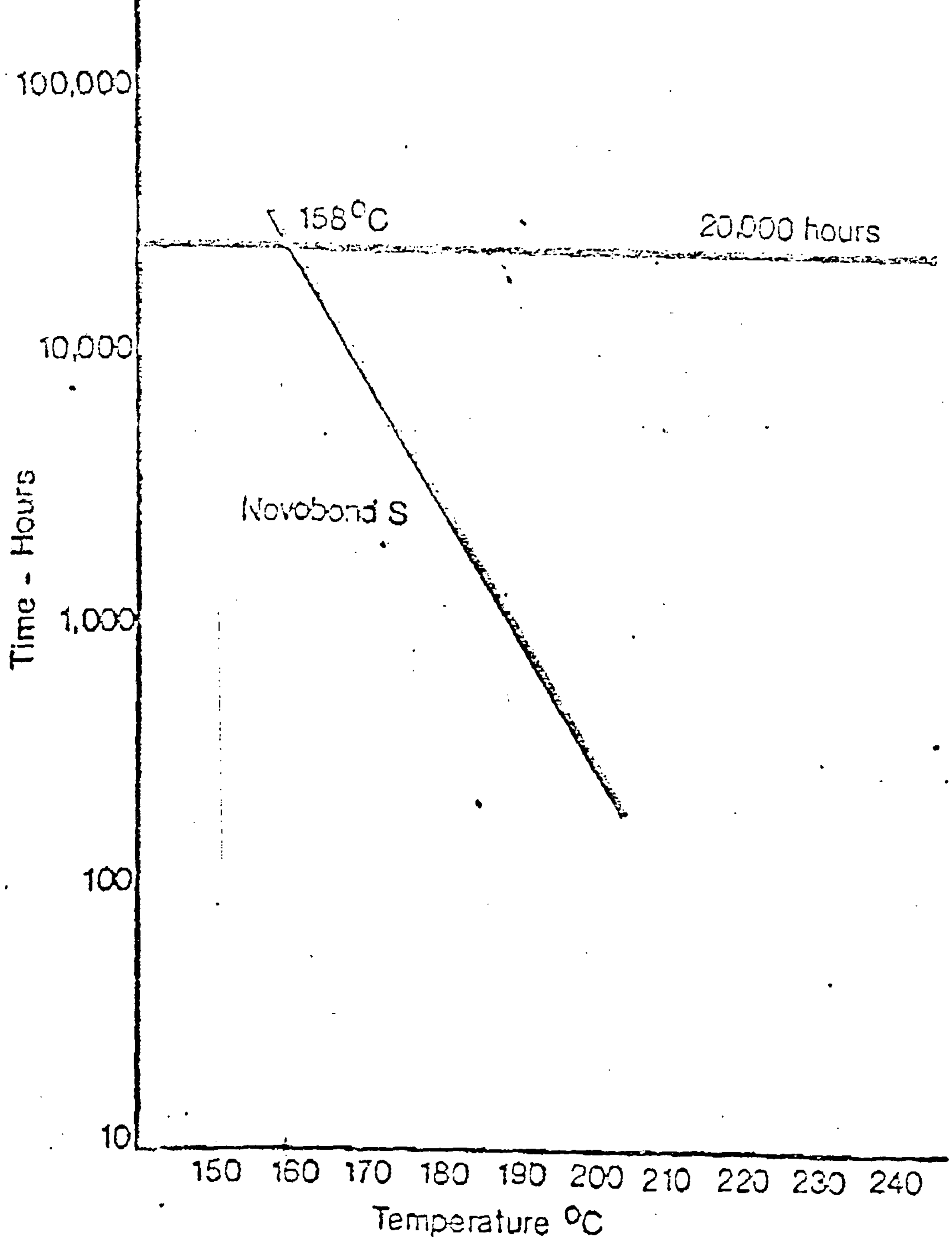
Therefore, based on the fact that the motor materials are not subject to degradation in the accident environment and on the fact that the accident extremes are far less severe conditions than those allowed by the manufacturers specification, these motors are considered qualified for their accident environment.

The analysis discussed above demonstrates that this equipment is located in a mild environment and is, therefore, not subject to the requirements of 10CFR50.49.

G64072.04

Jones Stroud Insulations
Graph 2

THERMAL ENDURANCE PROFILE TO IEC 216-1
MICAPAPER SYSTEMS



NRC Question

1. What is the qualified life of the valve actuator, complete with solenoids and limit switches?

2. The following additional information is needed:

   a. Analysis to show qualified life.

   b. Analysis to extrapolate the 10-day test profile to envelope the 100-day postaccident requirement.

   c. Actual test data and not 'required' profile.

   d. Analysis to determine if the actuator could be flooded in environmental condition No. 21 (Table 6.1(R1)).

   e. Address pressure as it pertains to environmental qualifications.

   f. The installed limit switches were different from the tested limit switches. Address this anomality in the file.

   g. The file does not state the manufactured model of the solenoid valve. Is the installed solenoid valve the same as the test solenoid valves? Document the results in the file.

   h. Documentation that the test actuator is the same model or equivalent as the installed actuator.

TVA Response

(1) and (2a) - TVA will provide responses to these items by March 30, 1984.

(2b) Extrapolation of 10-day profile to 100-day requirement.

These actuators have been determined to be category A/B, 5 min/100 days. It is not necessary to extrapolate the test profile to envelope the 100-day requirement based on the following:

1. The operating requirement is only for five minutes (category A). After this, the requirement is only to fail as is and remain in the failed position for the 100-day requirement.

2. These operators fail closed, and the closure is maintained by mechanical springs which are not electrical equipment.

3. The solenoid exhaust valves are fail open valves and the air cylinder supply valves are fail closed. Therefore, failure of

these valves will not adversely affect the performance of this actuator.

(2c) Use of required profile.

The American Environments Company qualification test report states that the test profile shown in Figure 5 of their test report STR-060578-2 is the profile to which the actuator was subjected, not the 'required' profile. It is TVA's position that point-by-point test data is not required if this data is plotted into a curve for our use.

(2d) This actuator is located above flood level so an analysis is not needed to determine whether or not the actuator can be flooded.

(2e) Atmospheric pressure must rise above 30 psig to have any effect on air cylinder exhaust during a dump situation. Since maximum atmospheric pressure at Watts Bar is 25.18 psia pressure will have no effect on environmental qualification.

(2f) Limit switches are permitted to be different from the tested limit switches because the limit switches are not required to operate the MSIV. They perform an indication function only.

(2g) The solenoid valves are part of the Chicago Fluid Power subplate mounted air control system as documented in the A&M test report on page 1.

(2h) TVA is obtaining documentation from the manufacturer which attests to the similarity between the tested and installed actuator.

NRC Question

1. Provide documentation on submergence qualification.

2. Provide nonconformance report on calibration errors.

3. Provide analysis of anomalies discussed in test report to verify that they do not affect WBN qualification.

4. Provide documentation in file to verify that the WBN-specific accuracies are enveloped by the test report generic accuracies.

5. Address IE bulletins and notices thay may be applicable to Bartons.

6. Document in the file the verbal analysis given for selection of most age-susceptable material.

7. What is the required operating time:

TVA Response

1. The TVA method of using the spray and steam environment testing provides adequate assurance that the components are qualified for submergence. The testing subjected the components to spray impingement and saturated steam under 75 psig for 15 days. No inleakage of moisture occurred. TVA evaluated these results and concluded that, since there was no inleakage of moisture in a vapor/spray state under such high-pressure conditions, that inleakage of moisture in a liquid state under relatively low-pressure conditions (14.5 psig maximum) would not occur either.

2. Attached is a copy of nonconformance report WBN NEB 8401. This NCR covers the calibration errors for Barton 763 and 764 pressure transmitters located inside containment.

3. The following addresses the anomalies discussed within WCAP-9885:

   (a) The disappearance of the output from test unit BD-3 was determined to be caused by handling abuse to the lead wire insulation to the transmitter. The TVA QA program requires inspection of the transmitter before they are shipped and before they are installed at the plant. This concern will be identified in our qualification maintenance program to check for damage to the insulation on the wiring.

   (b) The exhibiting of large zero shift during calibration runs caused oxidation to form on the coil. This problem can be eliminated by wiping the zero pot. This will be identified in our qualification maintenance program so that the zero pots will be wiped during the next calibration check on all lot 1 and 2 transmitters.

(c) The problem of the transmitters exhibiting large errors and erratic behavior has been corrected by a change in the manufacturing procedure requiring the soldering of the connector between the strain gauge and the circuit board. This modification has been made in transmitters after and including lot 4. Westinghouse tests show this modification is required within 5 years for lot 1 and 2 transmitters. This will be addressed by our qualification maintenance program.

4. Westinghouse is currently performing a statistical setpoint study that will include the plant specific errors and allowances for the instrumentation installed at Watts Bar. This study is scheduled to be finished in April 1984. If any instrumentation accuracies are not enveloped by the test report generic accuracies, they will be documented and reported.

5. We have reviewed the IE bulletins and notices that may be applicable to Barton transmitters. When action has been required to resolve any concerns from these bulletins and notices, we coordinated the resolution with Westinghouse. If required, a nonconformance report is then issued.

6. We will update EQS-NEB-3-29 to include the most age-susceptable material in these transmitters. We will also include documentation in our files showing the thermal aging analyses for these materials. The following is a list of the nonmetallic materials for these transmitters:

   Ethylene Propylene Terpolymer (EPT)
   Nylon (Vydyne 20M)
   Tefzel
   Sylgard No. 170
   Plyolefin
   Epoxy Laminated NEMA Graded FR5
   Silicone Oil 550
   Epoxylete 6203
   RTV 102
   Silastic
   Loctite

7. The required operating time for Postaccident Monitoring is 100 days as stated in Table 3.11-4/N3 of the EEEQR. The 100 days is based on an engineering evaluation of the time required to mitigate an 0588 event and bring the plant to hot standby. The evaluation consisted of the following:

   a. A detailed study of the accident analysis defined in Chapter 15 of the FSAR.

   b. A detailed knowledge of the safety systems required to mitigate the events.

c. A thorough review of the plant specific emergency operating procedures.

Based on the above information the long-term operability time for equipment qualification was defined as 100 days.

DIVISION OF ENGINEERING DESIGN
NONCONFORMANCE REPORT

MEDS Accession No. NEB '840215 85

1 REPORT NO. WBNNEB8401

2 PLANT Watts Bar	3 UNIT 1 and 2
4 PREPARER/ORGANIZATION/DATE D. L. Hill/EN DES-NEB/February 10, 1984	

5a DESCRIPTION OF CONDITION

Per notification from Westinghouse, Barton 763 and 764 pressure transmitters located inside containment are subject to new, additional errors which have not been previously accounted for in trip and actuation setpoints and emergency operating instructions. These errors result from improper temperature compensation, current leakage, and pressure effects. The magnitude and impact of these errors has not yet been quantified, but Westinghouse believes that wide range reactor coolant pressure transmitter errors could lead to inappropriate operator action during post-accident recovery. The new errors could also delay or prevent automatic actuations. For further details, refer to Westinghouse letter No. WAT-D-5904 (NEB 840208 625).

A list of potentially affected transmitters is attached.

5b SYSTEM 1,3,63, and 68 5c VENDOR NAME Westinghouse 5d CONTRACT NO. 71C62-54114-1

6 DATE OF OCCURRENCE EST (X), ACT. ( ) November 1982	9 SIGNIFICANT CONDITION ADVERSE TO QUALITY YES [X] NO [ ]
7 METHOD OF DISCOVERY W letter WAT-D-5904	10 *BRANCH CHIEF/DATE
8 UNID CODE (EN DES-EP 8.01) N/A	2-14-84

11a CORRECTIVE ACTION:

11b SCHEDULED DATE OF COMPLETION: ____________

12 CORRECTIVE ACTION DEVIATES FROM A DESIGN CRITERIA REQUIREMENT YES [ ] NO [ ]

13 DESIGN CRITERIA DOCUMENT NO. EXCEPTION REQUEST NO.

14 ECN REQUIRED [ ] YES [ ] NO ECN NO. 15 SCHEDULE IMPACT [ ] P [ ] A [ ] N

NONCONFORMANCE REPORT

1 REPORT NO. ______

16 ASSIGNABLE CAUSE: (REQUIRED IF SIGNIFICANT)
17 POTENTIAL GENERIC CONDITION REVIEW REQUIRED (EN DES-EP 1.52) YES [ ] NO [ ]
18a ACTION REQUIRED TO PREVENT RECURRENCE: (REQUIRED IF SIGNIFICANT) 18b SCHEDULED DATE OF COMPLETION: ______
19 *INDEPENDENT REVIEW:

20 LABOR EST. ( ), ACT. ( ) MH	21 SCHEDULE EST. ( ), ACT. ( ) DAYS

22 ACTIVITY NO.	23 TASK DESCRIPTION	24 DATE INITIATED

25 REMARKS

27 DISTRIBUTION: 28 CONST PROJECT MANAGER EN DES PROJECT MANAGER CHIEF, ESB OFFICE OF QA MEDS CIS EN DES MANAGER (for significant NCRs) NEB (for Significant NCRs)** NSRS (for Significant NCRs)	26 ALL EN DES ACTION COMPLETE: ______ *BRANCH CHIEF/ORG. ______ DATE
*DISTRIBUTE AFTER THIS SIGNATURE ** HANDCARRY COPY TO NEB-NLS	______ MEDS ACCESSION NO.

APPENDIX A

WATTS BAR NUCLEAR PLANT

NUREG-0588: FINAL ENVIRONMENTAL DRAWINGS

APPENDIX B

WATTS BAR NUCLEAR PLANT

NUREG-0588: SAMPLE RADIATION CALCULATION FOR COMPONENT NUMBER 1LT-3-39

LIMITORQUE OPEN ITEMS

EQS MEB-67-134 and MEB-1-107

NRC Question

A. SMB-000, FCV-67-87A

1. Analysis and justification needs to be provided for lack of time margin to support the thermal lag analysis.

2. Provide documentation listing if any operators contain Buchanan 0824 terminal blocks (reference IE IN 83-72).

3. Per IE IN 83-72, class B insulation motors rated for 40°C is not qualified. This was noted during walkdown.

B. SMB-00, FCV-1-15

1. Same as above.

2. Same as above.

3. During the walkdown, it was noted that the flex conduit was broken at the connector and pulled away exposing the cables.

TVA Response

A. New operators for FCV-67-87A, qualified for inside containment, have been purchased and delivered to Watts Bar. These will be installed by May 14, 1984.

B. 1. The data provided with our EQS MEB-1-107 on these valves was sufficient to address question 1 on margin.

2. TVA is conducting a walkdown verification to determine if Buchanan 0824 terminal blocks are used. We anticipate completion of this effort by April 20, 1984.

3. TVA will provide a response to this item by March 30, 1984.

ROSEMOUNT RTD OPEN ITEMS

EQS NEB-68-24

NRC Question

1. Actual elevation of the equipment is unknown.

2. The temperature tested is 320°F, on the EQS it shows 340°F, the required parameter is 327°F.

3. No aging was performed on the equipment. Also need analysis to determine correct temperature for the head of the switch during normal operation.

4. Radiation does not provide proper margin.

5. Required and demonstrated accuracy needs to be provided.

6. The qualified life was calculated by the 10°C rule using 120°F. This may be the wrong temperature to use for qualified life. See No. 3 above.

7. During the walkdown it was noted that a potting compound is used in the head of the RTD. This was not addressed in the test report.

TVA Response

1. The RTDs are at elevation 718'. The narrow range RTDs perform their trip function in the first 30 seconds of the event. Major flooding will not occur until the RTDs' trip function has occurred. These RTDs actuate the short-term reactor trip and the ECCS due to a small break LOCA. This actuation will result in major flooding within the containment. This was not addressed in the EQS because the major flooding which would cause these RTDs to be submerged does not occur until after the trip function. Once the trip has occurred the RTDs' safety function has been performed.

2. The actual temperature test profile is shown in Figure 6.3 of WCAP-9157. This profile shows that the RTDs were tested at a peak temperature of approximately 345°F. The data shows that the test temperature remained above 340°F for 20 minutes. This value was listed on the EQS as the temperature to which the equipment was qualified. This provides a 13°F margin over the required temperature of 327°F.

3.a. TVA stated that thermal aging was not performed in the test sequence in paragraph 3 of sheet 1 on EQS-NEB-68-24. We do, however, have a thermal aging analysis for the materials used in the Rosemount RTD. The age susceptible materials have been identified and this analysis will be part of the qualification file for this equipment. 10 CFR 50.49, Section f.4, and NUREG-0588, Section 2.1.4, states that material analysis in combination with partial type test is acceptable for qualification.

3.b. Westinghouse has performed an analysis that demonstrates that the RTD head will not increase to the primary coolant temperature of 650°F to which the probe is exposed. This analysis shows that the air velocity and the ambient temperature of the area are sufficient to limit the temperature rise of the RTD head to approximately 90°F. This was determined by using a forced convection heat transfer equation. This analysis is Westinghouse Cal-note SEC-OSA-1242-CO.

4. Although it was not listed in EQS NEB-68-24, TVA calculation on radiation was used to determine how much radiation this piece of equipment would be exposed to. This calculation (TI-RPS-48) will be added as a reference to the EQS. These RTDs are located next to sensor 6 as shown on sheet 6.12. The one-hour radiation dose at this location is 1.4356×10^{0} rads. The normal, integrated five-year radiation dose at the center of pipe (worst case) is 4×10^{7} rads (qualified life is five years).

   Total dose rads $= 4 \times 10^{7} + 1.4356 \times 10^{6}$
   $= 4.14356 \times 10^{7}$ rads

   Since this equipment is qualified to 1×10^{8} rads:

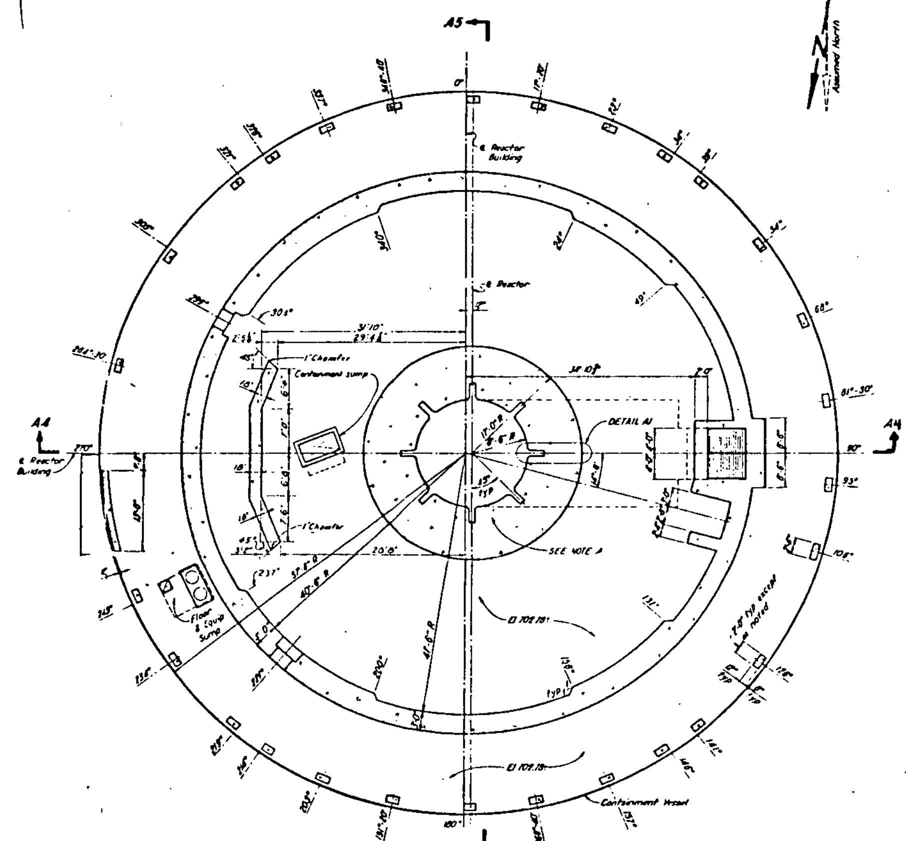
   This gives a margin of $1 \times 10^{8} - 4.14356 \times 10^{7} = 5.85 \times 10^{7}$ rads for 5 years
   = 58 percent

   The EQS will be upgraded to show this.

5. The accuracy for the narrow range RTDs are given in WCAP-9746. We will update EQS NEB-68-24 to reference this report. In Table 1 of WCAP-9746 the required accuracy is shown to be $\pm$ 0.2%, and the demonstrated accuracy as $\pm$ 0.2%.

6. 120°F is the correct temperature to use for the qualified life for these RTD. Please see our reply to part (b) of question 3 which references the Westinghouse analysis of RTD head temperature.

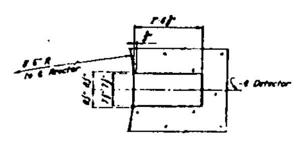
7. The potting compound used in the head of the RTD is an epoxy-polymer resin and is, in fact, addressed in the test report. The potting compound was addressed in the material analysis section of that report.



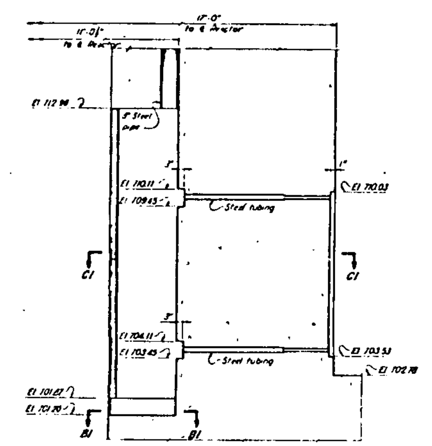
PLAN El 702.78

UNIT 1 AS SHOWN
UNIT 2 OPP HAND EXCEPT AS NOTED

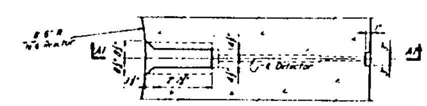
NOTE A:
THE REACTOR SUPPORTS FOR UNIT 2 ARE NOT OPPOSITE HAND BUT HAVE AN IDENTICAL ORIENTATION TO THOSE OF UNIT 1.



B1-B1



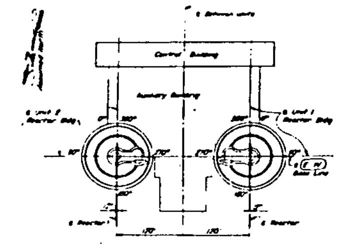
A1-A1



SECTIONAL PLAN C1-C1

DETAIL A1

NEUTRON DETECTOR WINDOWS
Scale 1" = 1'-0"



KEY PLAN

Scale 1" = 400'

NOTES:

1. THE REACTOR BUILDING IS A CLASS I STRUCTURE, AND QUALITY ASSURANCE IS REQUIRED.
2. THESE DRAWINGS SHOW AN ASSEMBLAGE OF THE INTERIOR CONCRETE STRUCTURE. FOR DETAILED OUTLINE DIMENSIONS, CLASS OF CONCRETE, AND CONSTRUCTION JOINTS SEE DETAILED COMPANION DRAWINGS.
3. CONSTRUCTION SPECIFICATION G-2 APPLIES UNLESS OTHERWISE NOTED.
4. FLOORS SHALL BE FINISHED BY STEEL TROWELING (BUT NOT "HARD TROWELED" TO A SATIN FINISH) IN ACCORDANCE WITH CONSTRUCTION SPECIFICATION G-22, UNLESS OTHERWISE NOTED.
5. FOR AREAS OF PROTECTIVE COATINGS FOR SLABS AND WALLS, SEE ARCHITECTURAL DRAWINGS, 46W466 SERIES.
6. FOR EMBEDDED PARTS, PIPES, AND CONDUITS, SEE STRUCTURAL STEEL, MECHANICAL, AND ELECTRICAL DRAWINGS.
7. CHAMFER ALL EXPOSED CORNERS 3/4", UNLESS OTHERWISE NOTED.
8. FOR DETAILS OF ELECTRICAL CONDUIT ENCASEMENTS, SEE DETAIL C1, 41N710-1. ENCASEMENTS TO BE PROVIDED ONLY ON THOSE FLOORS SPECIFIED BY ELECTRICAL CONDUIT AND GROUNDING DRAWINGS.

THIS DRAWING IS A DUPLICATE OF SEQUOYAH NUCLEAR PLANT DRAWING 41N716-1 R2 EXCEPT AS NOTED BY ENCIRCLEMENTS ON R0 ISSUE. ELEVATIONS NOT ENCIRCLED ON R0 ISSUE ARE SEQUOYAH BUILDING ELEVATIONS RAISED BY 23'-3". ENCIRCLED ELEVATIONS ON R0 ISSUE HAVE BEEN CHANGED OTHERWISE TO SATISFY DESIGN REQUIREMENTS.

Scale 1" = 1'-0"
Except as noted

COMPANION DRAWINGS:

41N716-2 THROUGH 41N716-5
41N721-1 .... CRANE WALL
41N726-1 .... REACTOR SHIELD WALL & REFUELING CANAL
41N719-1 .... STEAM GENERATOR & PRESSURIZER ENCLOSURE
41N711-1 .... FLOOR SLAB - EL 716
41N712-1 .... MISCELLANEOUS WALLS
41N713-1 .... ICE CONDENSER FLOOR SLAB - EL 744
41N715-1 .... FLOOR SLAB - EL 707
41N741-1 .... PRECAST COVERS & BULKHEADS
41N710-1 .... FLOOR SLAB - EL 702.78

FSAR

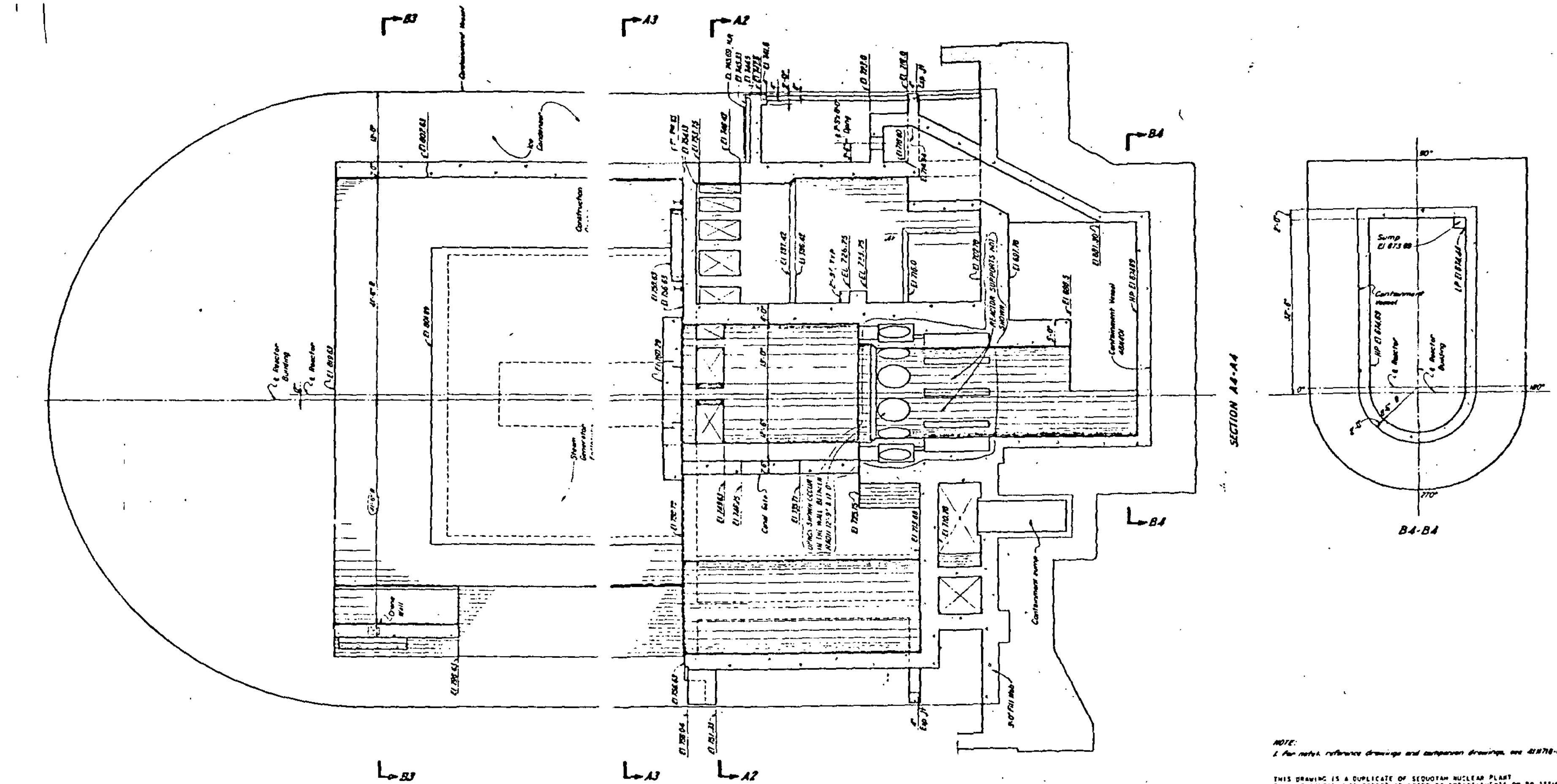
REACTOR BUILDING
UNITS 1 & 2

CONCRETE
INTERIOR STRUCTURE
OUTLINE

WATTS BAR NUCLEAR PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED	RECOMMENDED	APPROVED

KNOXVILLE | 65 | C | 4 | 41N716-1 R6



NOTE:
1. For notes, reference drawings and comparison drawings, see 41N716-1.

THIS DRAWING IS A DUPLICATE OF SEQUOYAH NUCLEAR PLANT DRAWING 41N716-4 R1 EXCEPT AS NOTED BY ENCIRCLEMENTS ON R0 ISSUE. ELEVATIONS NOT ENCIRCLED ON R0 ISSUE ARE SEQUOYAH BUILDING ELEVATIONS RAISED BY 33'-0". ENCIRCLED ELEVATIONS ON R0 ISSUE HAVE BEEN CHANGED OTHERWISE TO SATISFY DESIGN REQUIREMENTS.

Scale 1/8"=1'-0"

REACTOR BUILDING
UNITS 1 & 2

CONCRETE
INTERIOR STRUCTURE
OUTLINE

WATTS BAR NUCLEAR PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED | RECOMMENDED | APPROVED

KNOXVILLE | 85 | C | 4 | 41N716-4

EN DES CALCULATIONS TI-RPS-48 R1

TITLE	UNID SYSTEM(S)	PLANT/UNIT
...EGRATED ACCIDENT DOSE INSIDE PRIMARY CONTAINMENT		SQN
		SAR SECTION(S)

...RING ORGANIZATION		REV	(FOR MEDS USE)	MEDS ACCESSION NUMBER
EN DES/NEB-NAL		R0		
APPLICABLE DESIGN DOCUMENTS	BRANCH/PROJECT IDENTIFIERS TI-RPS-48	R1	830420D0101	NEB '83 0414 235
	RPS 3027	R2		

KEY NOUNS Integrated Accident Dose, Equipment Qualification: NUREG-0588 ~~TID-14844 Source~~

REV	R0	R1	R2	R3
DATE		4-14-83		
PREPARED SANass		[signature] 4/13/83		
CHECKED LEStanford for HVHagins		S. A. Keener		
SUBMITTED LEStanford		L E Stanford		
APPROVED GEGerman		G. E. German		
ATTACHMENTS MICROFILMED:				
LIST ALL PAGES* ADDED BY THIS REV:		1.1-2, 1-4, 3.1, 6.1-22, 7.1-9, 11.2-8, 12.1-11		
...ALL PAGES* ...ED BY THIS REV:		Appendix I		
LIST ALL PAGES* CHANGED BY THIS REV:		1-10, 12		

STATEMENT OF PROBLEM

Calculate the integrated maximum hypothetical accident (MHA) gamma and beta doses inside the primary containment.

ABSTRACT

An analysis was performed to determine the integrated accident dose inside the primary containment. This was done to satsify the requirements of NUREG-0578 and NUREG-0588 for the equipment qualification. Some safety-related electrical equipment located inside the containment is only required to function for a few minutes after an accident (see the attached letter from P. G. Ioannides to L. E. Stanford). Rev. 0 of this analysis was done only for relatively long-time periods (i.e., 1 day, 30 days, 1 year, and 2 years) after an accident. Therefore, rev. 1 was performed to investigate the radiaiton environment for shorter time periods (i.e., 0.01 hr, 0.02 hr, etc.) after an accienet. In rev. 1 the source activities were recalculated based on TID-14844 and SQN FSAR Table 15.1-4, instead of using the source terms from TI-709 as in rev. 0.

The STP computer program was used to calculate the photon spectrum from the activities, and the QAD-P5Z computer program was used to calculate the dose rates. The dose rates and integrated doses were calculated at six different locations over a 1-year period, and these are tabulated in the results section of this analysis. The maximum 1-year gamma dose is $2x10^7$ rads. The computer outputs are stored in RAD-70.

E73103.03

TVA 10697 (ENDES-7-78) *Use revision log (form TVA 10534) if more room is required

TVA

Title: INTEGRATED ACCIDENT DOSE INSIDE PRIMARY CONTAINMENT

REVISION LOG

Revision No.	DESCRIPTION OF REVISION	Date Approved
1	In this revision, the radiation environment in the primary containment was investigated for shorter time periods than those investigated in revision 0. New source terms were calculated based on TID-14844 and SQN FSAR Table 15.1-4, including 30 additional short lived isotopes. Initially, 100 percent of the noble gas and 50 percent of the iodine core inventory was assumed to be airborne, and 50 percent of the iodine, 50 percent of the cesium, and 1 percent of the other fission product core inventory was assumed to go into the sump. In the previous analysis 100 percent of the noble gas, 25 percent of the iodine, and 1 percent of the other fission product core inventory was assumed to be airborne at time zero. The revised source distribution was based on Regulatory Guide 1.89 (draft), TID-14844, and NUREG-0588. In revision 0, integrated doses were calculated from integrated source activities. However, in revision 1, photon spectrums were calculated from source activities at each time step, and resulting dose rates were then integrated. The upper containment dome was remodeled from a hemisphere to an equivalent volume cylinder in the QAD input. Even though there is twice as much airborne iodine in revision 1, the assumption that the other fission products will be in the sump rather than in the air decreased the maximum 1-year dose from 7.2×10^7 rads to 2×10^7 rads. E73103.06	

TVA 10534 (EN DES-4-78)

TABLE OF CONTENTS

TVA 489H (EN DES-2-78) TENNESSEE VALLEY AUTHORITY SHEET 1 OF 12

SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT SQN

TI-RPS-48

COMPUTED BY SAN DATE 3/23/81 CHECKED BY [illegible] DATE 7-20-81

I Purpose

This analysis was performed to determine the integrated accident dose inside the primary containment. This was done to satisfy requirements of NUREGs 0578 and 0588 for equipment qualification and servivability after an accident. The analysis was done using the STP results from TI-709 "Dose inside the primary containment following a MHA". A sampling proceedure was used in TI-709 which gives the integrated concentration in the containment. The source terms printed out in STP are then total photons released, per cc, during the sampling time. These source terms were put into a general geometry model of QAD and integrated doses were calculated at several locations in containment for several integration times.

SUPERSEDED BY pp 1.1

SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT SQN

TI-RPS-48

COMPUTED BY YHI DATE 3/9/82 CHECKED BY SAK DATE 5/7/82

I. PURPOSE (continue)

Some safety-related electrical equipment located inside the containment are only required to function for a few minutes after an accident. Since TI-RPS-48 (Rev.0) calculation was done only for relatively long time periods (ie, 1 day, 30 day, 1 year, 2 year) after the accident, in this revision the calculation was done with the shorter time periods (ie, 0.01 Hr, 0.02 Hr, 0.05 Hr, 0.1 Hr, etc.)

Also, instead of using the STP results from TI-709, a new STP run was done using the new source terms which were calculated based on TID-14844. Newly generated STP results (ie, photon spectrums) were then put into a general geometry model of QAD and the integrated doses were calculated at six different locations in the primary containment.

1. See Appendix II, a memo from P.G. Ioannides to L.E. Stanford.

TVA 489H (EN DES-2-78) TENNESSEE VALLEY AUTHORITY SHEET 2 OF 12

SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT SQN

TI-RPS-48 / 1

COMPUTED BY SAN DATE 3/24/81 CHECKED BY KLH DATE 7-29-81

II Assumptions

1) The releases are based on Reg Guide 1.4 assumptions of 100 % noble gas and 25% iodine airborne in the containment at time T = 0

2) Finite cloud dose calculations

3) Other assumptions used in this analysis are those used in the chapter 15 design basis MHA

SUPERSEDED BY pp 2.1 & pp 2.2

III References

1) TI-709 "Dose inside the primary containment following a MHA" on RAD-20

2) Drawings 47N 716 -1 & 2

SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT SQN

TI-RPS-43

COMPUTED BY YHI DATE 3/11/82 CHECKED BY SAK DATE 5/7/82

II. ASSUMPTIONS

1. The core activity is assumed to be instantaneously released (at t=0) within the primary containment in the following fractions of the core inventory:†

100%	noble gases
50%	iodines
50%	cesium
1%	other fission products.

2. All of above noble gases are assumed to be airborne within the primary containment, and the cesium and other fission products are assumed to be in the sump. All released iodines were assumed to be simultaneously contained in the sump water and the containment atmosphere as a conservative measure.

3. All airborne activities are assumed to be uniformly distributed within the primary containment.

† This is based on conservative measure per discussion with Steve A. Nass. Bases of assumption were TID-14844 and Reg. Guide 1.89 (in draft form at the time when this revision was done) and the TMI experience.

SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT SQN

TI-RPS-48

COMPUTED BY YHI DATE 3/11/82 CHECKED BY SAK DATE 5/7/82

4. The iodines removed by the ice in the ice condenser are assumed to be just removed instead of routing it to the sump, because the maximum amount of released iodines were assumed to be contained in the sump water (see the assumption # 2).

5. Eventhough the sump volume varys with respect to the time after an accident, the sump volume is assumed to be fixed value at the final sump volume.††

6. No iodine plate-out was assumed.

7. All radioactive material in the sump water was assumed to be homogenously distributed.

8. The volume of sump water was assumed to be sum of the reactor coolant volume, refueling water storage tank (RWST) volume, and ice water volume. Other factors which affect the volume of sump water i.e., SIS accumulators, UHI

†† See page 3.1 of this calculation.

TVA 489H (EN DES-2-78) TENNESSEE VALLEY AUTHORITY SHEET 2.3 OF 12

SUBJECT Integrated Accident Dose inside Primary Containment PROJECT SQN

TI-RPS-48

COMPUTED BY YHI DATE 7/21/82 CHECKED BY SAK DATE 5/7/82

8. (continue)

accumulator, and the sump water circulated outside containment) was assumed to be negligible.

TVA 489H (EN DES-2-78) TENNESSEE VALLEY AUTHORITY

SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT SQN TI-RPS-48

COMPUTED BY YHI DATE 3/10/82 CHECKED BY SAK DATE 5/7/82

III. REFERENCES

1. TID-14844, "Calculation of Distance Factors for Power and Test Reactor Sites", March, 1962.

2. Drawings: 41N716-1, (R4), "Concrete Interior Structure Outline," SQN.
   41N716-4, (R2), " " " " " ; SQN.
   47W812-1, (R11), "Flow Diagram: Containment Spray System", SQN.

3. NUREG-0588, "Interim Staff Position on Environment Qualification of Safety-Related Electrical Equipment," pp 7-10.

4. SQN FSAR, Vol. 11, Section 15.5

5. TI-RPS-14, "Containment Activity as A Function of Time for Various Combinations of Primary System Leak Rate and Fuel Damage," pp 14.

6. Computer runs for this analysis; stored in RAD-70.

	Job name	Date	Time
GTP run	KXSQNYHI	3/22/82	09.00.21
QAD run	KXSQNAIR	4/1/82	19.39.07
	KXSQNSUM	4/1/82	21.54.43
Integration run	KXSQNINT	4/13/82	14.50.32
	KXTESTRN	4/14/82	12.45.43

7. TI-679, R0, "Offsite Dose due to ECCS Leakage into the Auxiliary Building."

TVA 489H (EN DES-2-78) TENNESSEE VALLEY AUTHORITY SHEET 3 OF 12

SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT SQN

TI-RPS-48

COMPUTED BY SAN DATE 3/24/81 CHECKED BY [signature] DATE 7-20-81

IV Data

The QAD boundarys and zones are shown in Figure 1. Dimensions were taken from drawings 41N716-1 & 2.

Copies of the STP output from TI-709 is attached which show the integrated source terms in component 3 "PC Sample".

SUPERSEDED BY PP 3.1

SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT SQN

TI-RPS-48

COMPUTED BY YHI DATE 3/10/82 CHECKED BY SAK DATE 5/7/82

IV. DATA

primary containment free volume $= 1.241 \times 10^6$ ft^3 (ref. 4: Table 15.5-4

primary containment deck fan flow rate $= 40,000$ cfm (ref. 4: Table 15.5-4)

Ice condenser iodine removal efficiency .... (ref 4: Table 15.5-5) (see page 6.10 of this calculation)

Reactor coolant volume $= 12,600$ ft^3 $= 94,249$ Gal (Ref #5

†Refueling Water Storage Tank Volume $= 340,000$ Gal (Ref #7, page 5)

††Ice volume $= 357,314$ Gal $= 4.777 \times 10^4$ ft^3 (Ref #7, page 5)

Total sump volume = Reactor Coolant Volume
+ RWST Volume
+ Ice Volume
$= 7.916 \times 10^5$ Gal

Dimensions used for QAD model in page 6.12 .... (Ref #2)

---

† The capacity of RWST tank is 375,000 gals (Ref: 47W812-1, R11, SQN Drawing), but only 340,000 gals is available for the injection into the primary coolant system in case of LOCA (ref: SQN FSAR, page 15.5-19a).

†† This volume refers to the ice water volume:

$$2.98 \times 10^6 \text{ lb (Max.) of ice} \times \frac{1 \text{ gal}}{8.34 \text{ lb}} = 357,314 \text{ gal (Ref \#7, page 5)}$$

where 8.34 lb/gal $= 0.9992$ g/cc = density of water

TVA 489H (EN DES-2-78) TENNESSEE VALLEY AUTHORITY SHEET 4 OF 12

SUBJECT ______ PROJECT TI-RPS-48

COMPUTED BY JCO DATE 3/22/80 CHECKED BY [illegible] DATE 3/22/80

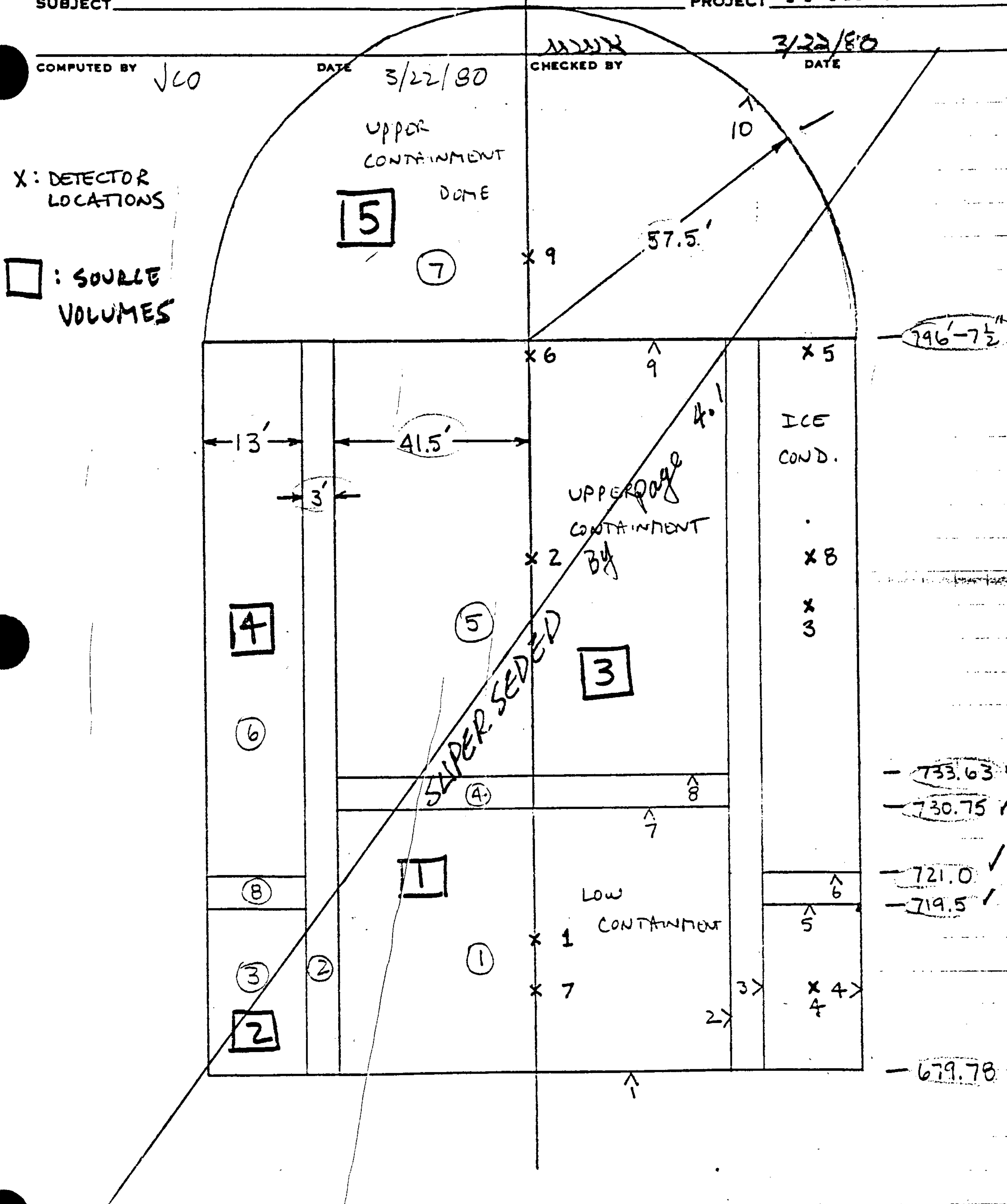


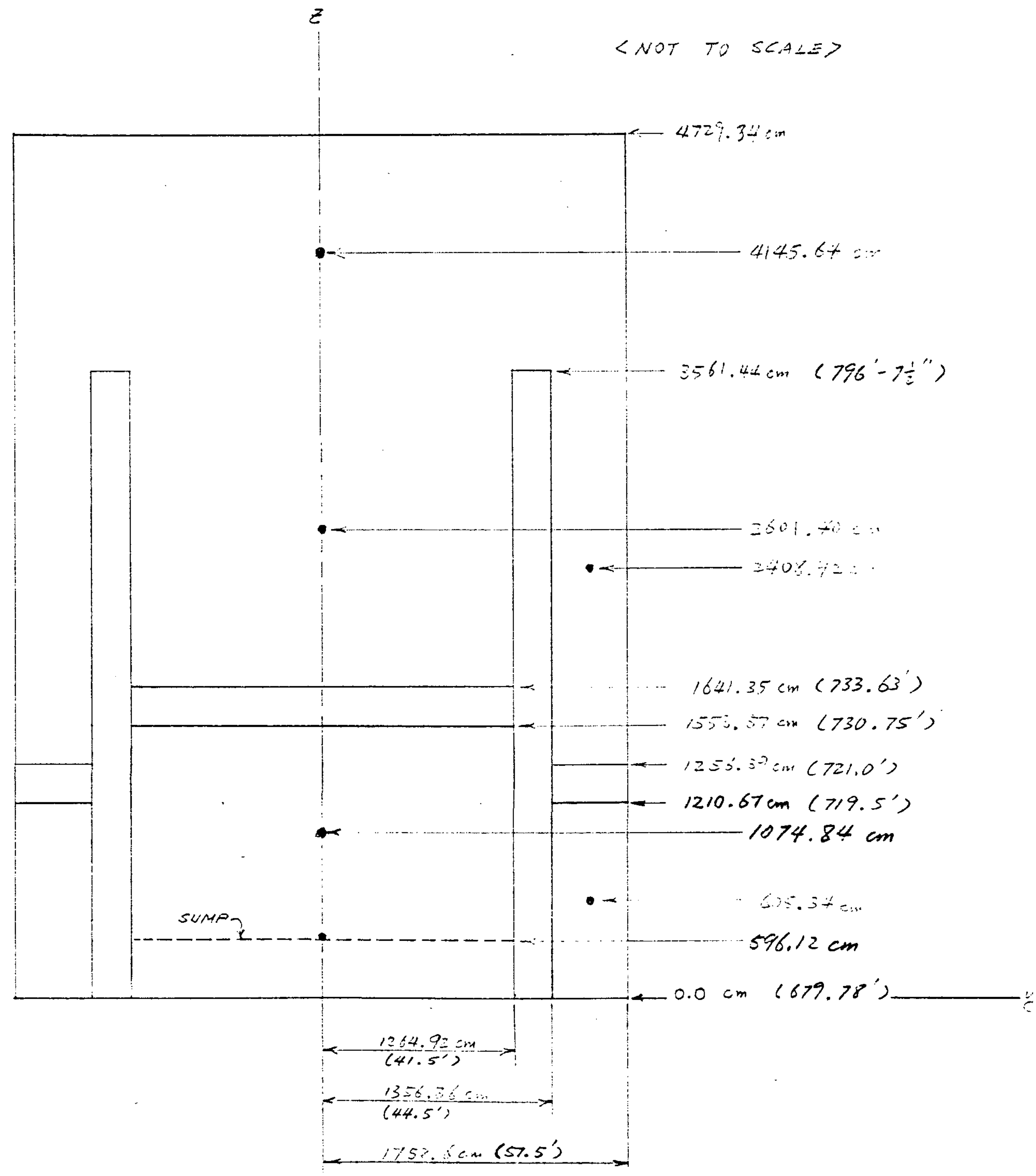
Figure 1 QAD Model

SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT SQN

TI-RPS-48

COMPUTED BY YHI DATE 10/16/81 CHECKED BY SAK DATE 5/7/82

DIMENSION DATA



REFERENCE: Ref #2, Drawings 41N716-1 & 4.

TVA 489H (EN DES-2-78) TENNESSEE VALLEY AUTHORITY SHEET 5 OF 12

SUBJECT ______ PROJECT TI-RPS-48

COMPUTED BY JCO DATE 3/22/80 CHECKED BY [illegible] DATE 3/22/80

SURFACE 1 : REFERENCE 0.0 CM ✓

SURFACE 2 : CRANE WALL 1264.92 cm ✓ SQN DWG 41N716-1

SURFACE 3 : OUTSIDE CRANE WALL 1264.92 + 91.44 = 1356.36 cm ✓ (41N716-4)

SURFACE 4 : ICE CONDENSER : 1356.36 + 396.24 = 1752.6 cm ✓ (41N716-4)

6.13

SURFACE 5 : CEILING OF LOW CONTAINMENT ANNULUS pool : 1210.67 cm ✓ (41N716-4)

SURFACE 6 : FLOOR OF ICE CONDENSER : 3256.39 cm ✓ (41N716-4)

SURFACE 7 : CEILING OF LOWER CONTAINMENT : 1553.57 cm ✓ (41N716-4)

SURFACE 8 : FLOOR OF UPPER CONTAINMENT : 1641.35 cm ✓ (41N716-4)

SURFACE 9 : TOP OF UPPER CONTAINMENT : 3561.44 cm ✓ (41N716-4)

SURFACE 10 : RADIUS OF UPPER CONTAINMENT DOME : 1752.6 cm ✓

SUPERSEDED

SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT SQN

TI-RPS-48

COMPUTED BY SMN DATE 3/24/81 CHECKED BY [illegible] DATE 7-28-81

I Calculations

The STP source terms are total photons per cc released during the time period. QAD expects photons/sec/cc and calculates a dose rate in mr/hr. Therefore a conversion factor of 1 hr/3600 sec = 2.78×10^{-4} must be input for UNITSC. The QAD results will then be total integrated mrads over the time period.

SUPERCEDED BY page 6.1

TVA 488 (EN DES-3-77)

SHEET 6.1 OF 12

INTEGRATED ACCIDENT DOSE
INSIDE PRIMARY CONTAINMENT

TI-RPS-48

SQN

COMPUTED YHI DATE 4/23/82

CHECKED SAK DATE 5/7/82

V. CALCULATION

A new set of the source terms was generated for STP input. The calculations of the source terms were based on TID-14844 and SQN FSAR Table 15.1-4 (see APPENDIX II, page 12.3 of 12) The example calculations are shown in page 6.2-6.4, and the source terms are tabulated in page 6.5-6.8.

Newly tabulated source terms were then used in the STP computer program to calculate the photon spectrum. The model used for STP is shown in page 6.9, and the input for STP is shown in page 6.10.

The photon spectrums were then used to calculate the dose rate using the general geometry QAD computer program. QAD model and related calculations are shown in page 6.12 thru 6.17.

Dose rates due to the beta radiations were calculated analytically (see page 6.18).

Finally, a computer program was set-up to calculate the integrated dose from the dose rates due to the gamma and beta radiation. The integration method which was used in this analysis is shown in pages 6.19-22. Also, the dose rates at $t=0$ were linearly interpolated as shown in page 6.21, and the integrated doses for the first time intervals were approximated by using the trapezoid rule as shown in page 6.22.

(continue →)

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SUBJECT Integrated Accident Dose inside Primary Containment PROJECT SQN

TI-RPS-48

COMPUTED BY YHI DATE 7/23/82 CHECKED BY SMK DATE 5/7/82

To calculate the dose rate using general geometry QAD-P5Z computer program, two separate runs were done. In first run, the dose rate due to the airborne source (noble gas and iodine) was calculated. The airborne source was superimposed on the whole region modeled for this analysis, including the sump water and concrete walls.† In second run, the dose rate due to the shine from the sump water (iodine and other fission products) was calculated. This sump water source was put into the region 9 on page 6.12. The shielding effect due to the concrete walls, sump water, and the air was incorporated into the calculation accordingly in both runs. The dose rate at six different locations was calculated for both runs (see page 6.12 for the locations of the detectors). The dose rates from each runs were then added for the corresponding detector points in the integration program, described on pages 6.19 - 6.22., before being integrated.

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† A test run was done to investigate the validity of this configuration. The result from this test run confirmed that above configuration is acceptable for this analysis.

SUBJECT Integrated Accident Dose inside Primary Containment PROJECT SQN

TI-RPS-48

COMPUTED BY YHI DATE 7/21/82 CHECKED BY SAK DATE 5/7/92

Reactor Inventory for Each Isotope

To determine the source activity for each isotope, the following equation from TID-14844, page 20, was used.

$$q_t = P_o \times (3.2 \times 10^{16}) \times \gamma_i (1 - e^{-\lambda T_o}) / 3.7 \times 10^{10}$$

$$= 0.865 \times 10^6 \, P_o \gamma_i \, (1 - e^{-\lambda T_o}) \quad [Ci]$$

where q_t = amount of isotope type i contained by the reactor at shutdown [Ci]

P_o = reactor power level [MW_t]

γ_i = fission yield [atoms/fission]

λ = decay constant [sec^{-1}]

T_o = time interval during which the reactor has operated [sec]

3.2×10^{16} = number of fissions per sec. per megawatt.

3.7×10^{10} = number of disintegrations per sec. per curie.

In this equation, the neutron capture was assumed to be negligible. The formation of the isotope i due to the decay of its precursor was incorporated into the accumulative fission yield (γ_i) used in this analysis, see pages 12.8 - 12.11 of this analysis.

The decay constant (λ) was calculated using the following equation:

$$\lambda = \frac{\ln 2}{T_{\frac{1}{2}}}$$

where $T_{\frac{1}{2}}$ = half-life, given on pages 12.9 - 12.11 of this analysis.

SUBJECT INTEGRATED ACCIDENT DOSE INSIDE PRIMARY CONTAINMENT PROJECT SQN

TI-RPS-48

COMPUTED BY YHI DATE 3/15/82 CHECKED BY SAK DATE 5/7/82

If $T_0 \gg T_{\frac{1}{2}}$, $e^{-\lambda T_0}$ becomes insignificant, and we get the "saturation inventory"

q_s = saturation inventory

$$= 0.865 \times 10^6 \; P_0 \, \gamma_i \qquad [Ci]$$

EXAMPLE. 1/ Core inventory of Cs-137 based on full power of 3565 MWt for 650 days.

$$q_t = 0.865 \times 10^6 \; P_0 \, \gamma_i \, (1 - e^{-\lambda T_0}) \qquad [Ci]$$

$P_0 = 3565$ MWt

$T_0 = 650$ days $= 5.616 \times 10^7$ sec

$T_{\frac{1}{2}} = 9.4671 \times 10^8$ sec $\Rightarrow \lambda = \frac{\ln 2}{T_{\frac{1}{2}}} = 7.3216 \times 10^{-10}$ sec^{-1}

$\gamma_i = 6.2626 \times 10^{-2}$ atom/fission

$$q_t = 0.865 \times 10^6 (3565)(6.2626 \times 10^{-2})\left(1 - e^{-(7.3216 \times 10^{-10})(5.616 \times 10^7)}\right)$$

$$= 7.78 \times 10^6 \; Ci$$

EXAMPLE. 2/ Core inventory of Kr-90 based on full power of 3565 MWt for 650 days.

$T_{\frac{1}{2}} = 3.2320 \times 10^1$ sec $\ll T_0 = 5.616 \times 10^7$ sec

hence $q_s = 0.865 \times 10^6 \; P_0 \, \gamma_i \qquad [Ci]$

where $P_0 = 3565$ MWt

SUBJECT INTEGRATED ACCIDENT DOSE INSIDE PRIMARY CONTAINMENT PROJECT SQN

TI-RPS-48

COMPUTED BY YHI DATE 3/16/82 CHECKED BY SAK DATE 5/7/82

$\gamma_i = 4.6891 \times 10^{-2}$ atm/fissions

$q_s = (0.865 \times 10^{6})(3565)(4.6891 \times 10^{-2})$ [Ci]

$= 1.45 \times 10^{8}$ Ci

INTEGRATED ACCIDENT DOSE
INSIDE PRIMARY CONTAINMENT

TI-RPS-48
SQN

COMPUTED YHI DATE 3/15/82
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CORE INVENTORY
Based on full power operation for 650 days
(full power : 3565 Mwt)
Reference : TID - 14844 , SQN FSAR TABLE 15.1-4

	ISOTOPE	Activity (Ci)	
1	Kr 83m	1.64 (+7)	SQN FSAR TABLE 15.1-4
2	Kr 85m	3.95 (+7)	" "
3	Kr 85	9.99 (+5)	" "
4	Kr 87	7.59 (+7)	" "
5	Kr 88	1.08 (+8)	" "
6	Kr 89	1.40 (+8)	" "
7	Kr 90	1.45 (+8)	
8	Xe 131m	6.68 (+5)	SQN FSAR TABLE 15.1-4
9	Xe 133m	5.16 (+6)	" "
10	Xe 133	2.03 (+8)	" "
11	Xe 135m	5.46 (+7)	" "
12	Xe 135	5.55 (+7)	" "
13	Xe 137	1.89 (+8)	
14	Xe 138	1.79 (+8)	SQN FSAR TABLE 15.1-4
15	Xe 139	1.59 (+8)	
16	Xe 140	1.15 (+8)	

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INTEGRATED ACCIDENT DOSE
INSIDE PRIMARY CONTAINMENT

TI-RPS-48
SQN

COMPUTED YHI DATE 3/16/82
CHECKED [illegible] DATE 5/?/82

	ISOTOPE		ACTIVITY (Ci)	
17	I	130	7.43 (+3)	
18	I	131	8.80 (+7)	SQN FSAR TABLE 15.1-4
19	I	132	1.34 (+8)	" "
20	I	133	1.97 (+8)	" "
21	I	134	2.31 (+8)	" "
22	I	135	1.79 (+8)	" "
23	I	136m	6.51 (+7)	
24	Br	83	1.64 (+7)	
25	Br	84m	5.93 (+5)	
26	Br	84	2.98 (+7)	
27	Br	85	3.99 (+7)	
28	Br	87	6.79 (+7)	
29	Cs	134	6.25 (+2)	
30	Cs	135	0.0 ~~1.10 (+2)~~ OK	
31	Cs	136	1.63 (+5)	
32	Cs	137	7.78 (+6)	
33	Cs	138	2.07 (+8)	
34	Cs	139	1.98 (+8)	
35	Cs	140	1.82 (+8)	
36	Cs	141	1.36 (+8)	
37	Rb	88	1.12 (+8)	S.E. w/ Kr-88 (NOTE 1)
38	Rb	89	1.49 (+8)	
39	Rb	90m	3.09 (+7)	
40	Rb	90	1.52 (+8)	
41	Rb	91	1.77 (+8)	
42	Se	84	2.91 (+7)	
43	Sr	89	1.50 (+8)	
44	Sr	90	7.73 (+6)	
45	Sr	91	1.82 (+8)	
46	Sr	92	1.83 (+8)	
47	Sr	93	1.93 (+8)	

TVA 489 (EN DES-11-76)

SHEET 6.7 OF 12

INTEGRATED ACCIDENT DOSE

INSIDE PRIMARY CONTAINMENT

TI-RPS-48

SQN

COMPUTED YHI DATE 3/16/82

CHECKED [illegible] DATE [illegible]

	ISOTOPE		ACTIVITY (Ci)	
48	Sr	94	1.85 (+8)	
49	Y	90	1.82 (+8)	S.E. W/ Sr-90 (t=2.9%) (NOTE 1)
50	Y	91m	1.13 (+8)	S.E. W/ Sr-91 ( ) (NOTE 1)
51	Y	91	1.82 (+8)	
52	Y	92	1.84 (+8)	
53	Y	93	1.96 (+8)	
54	Y	94	1.98 (+8)	
55	Y	95	1.98 (+8)	
56	Y	96	1.84 (+8)	
57	Zr	95	1.99 (+8)	
58	Zr	97	1.83 (+8)	
59	Nb	95	1.99 (+8)	
60	Nb	97m	1.73 (+8)	S.E. W/ Zr-97 (t ≅ 10m) (94.5%)
61	Nb	97	1.84 (+8)	
62	Mo	99	1.89 (+8)	
63	Tc	99m	1.66 (+8)	S.E. W/ Mo-99 (t ≅ 21H) (87.7%)
64	Tc	99	1.20 (+3)	
65	Tc	101	1.56 (+8)	
66	Ru	103	9.67 (+7)	
67	Ru	105	3.04 (+7)	
68	Ru	106	8.52 (+6)	
69	Ru	107	5.35 (+6)	
70	Rh	103m	9.67 (+7)	S.E. W/ Ru-103 (t ≅ 9.5H) (100%)
71	Rh	105m	8.22 (+6)	S.E. W/ Ru-105 (t ≅ 6.4m) (26%) (NOTE 1)
72	Rh	105	3.04 (+7)	
73	Rh	106	1.21 (+7)	S.E. W/ Ru-106 ( ) (100%) (NOTE 1)
74	Rh	107	5.35 (+6)	
75	Sn	130	2.78 (+7)	
76	Sb	127	3.96 (+6)	
77	Sb	129	1.96 (+7)	
78	Sb	130m	3.44 (+7)	
79	Sb	130	9.21 (+6)	
80	Sb	133	6.89 (+7)	
81	Te	125m	2.08 (+5)	

TVA 489 (EN DES-11-76)

INTEGRATED ACCIDENT DOSE
INSIDE PRIMARY CONTAINMENT

TI-RPS-48
SQN

COMPUTED YHI DATE 3/16/82
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	ISOTOPE		ACTIVITY (Ci)	
82	Te	127m	6.80 (+5)	
83	Te	127	3.95 (+6)	{ S.E. W/ Te-127m (T≅[illegible]H) (97.6%)
84	Te	129m	5.88 (+6)	" Sb-127 (T≅30H) (83.4%)
85	Te	129	1.92 (+7)	{ S.E. W/ Te-129m (T≅2.2H) (77.8%) } (NOTE 1)
86	Te	131m	1.09 (+7)	" Sb-129m (T≅11 H) (63.6%)
87	Te	131	7.83 (+7)	
88	Te	132	1.29 (+8)	
89	Te	133m	1.21 (+8)	
90	Te	133	9.34 (+7)	
91	Te	134	2.09 (+8)	7.32-6
92	Ba	137m	1.83 (+8)	S.E W/ Cs-137 (T≅58m) (94.1%) (NOTE 1)
93	Ba	139	2.00 (+8)	
94	Ba	140	1.95 (+8)	
95	Ba	141	1.81 (+8)	
96	Ba	142	1.80 (+8)	
97	La	140	1.95 (+8)	S.E. W/ Ba-140 (T≅5D) (100%)
98	La	141	1.82 (+8)	
99	La	142	1.83 (+8)	
100	La	143	1.83 (+8)	
101	Ce	141	1.82 (+8)	
102	Ce	143	1.84 (+8)	
103	Ce	144	1.34 (+8)	
104	Ce	145	1.21 (+8)	
105	Pr	143	1.84 (+8)	
106	Pr	144	1.34 (+8)	S.E W/ Ce-144 (T≅4.2H) (100%)
107	Pr	145	1.22 (+8)	
108	Np	239	0.0	

NOTE 1: Eventhough these isotopes are in the secular equilibrium with the corresponding isotopes, these isotopes have higher activities due to the direct production of isotopes from the fission processes.

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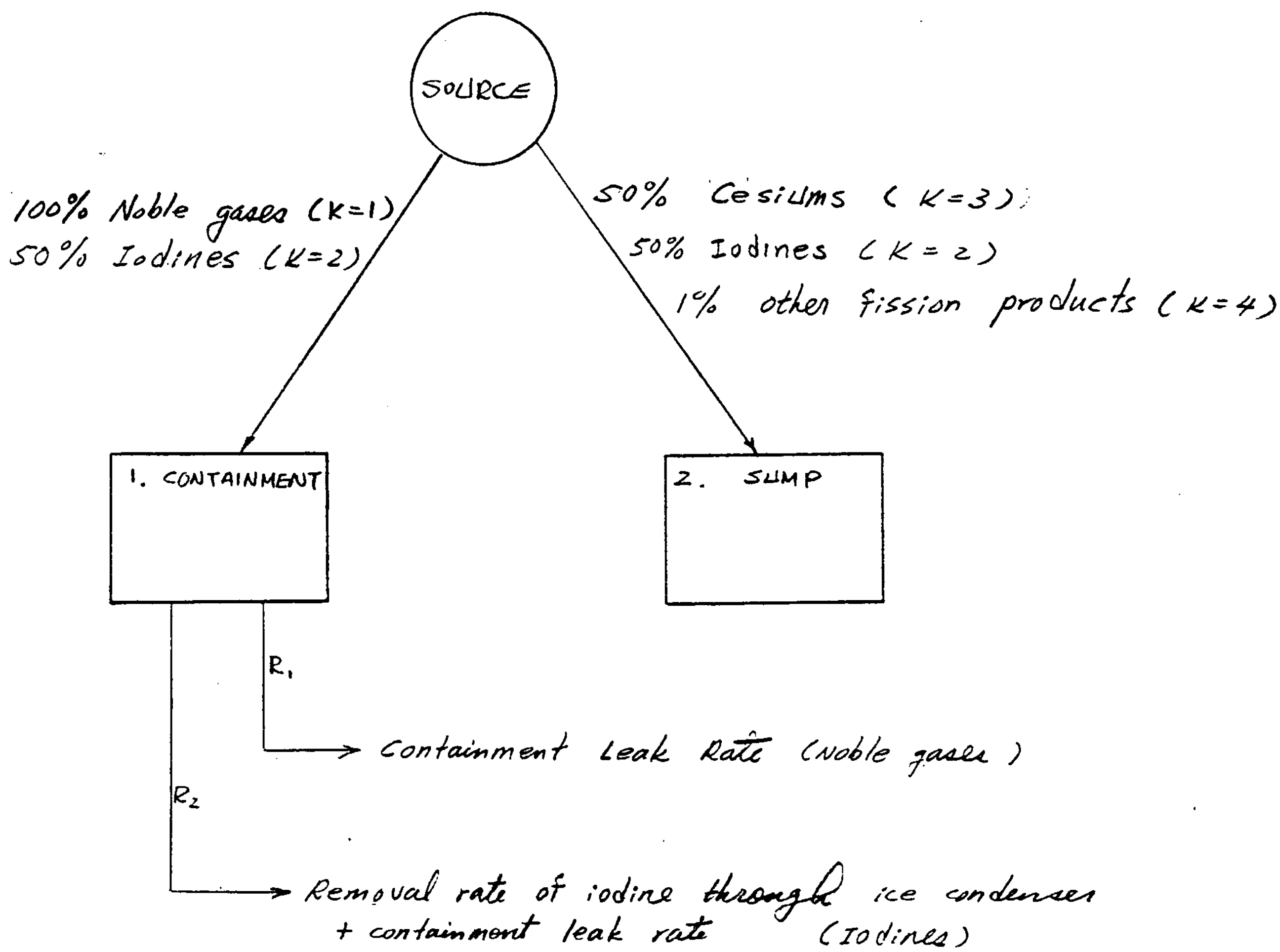
SUBJECT Integrated Accident Dose Inside Primary Containment. PROJECT SQN

TI-RPS-48

COMPUTED BY YHZ DATE 3/9/1982 CHECKED BY SAK DATE 5/7/82

STP MODEL



SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT SQN

TI-RPS-48

COMPUTED BY YHI DATE 3/9/82 CHECKED BY SAK DATE 5/7/82

STP INPUT

1. Source : Core inventory at 3565 MWt power level, SQN. Units are in Curies. (see page 6.6 - 6.9)

2. Volume : component 1 = 1 cont

   component 2 = 1 sump

3. Removal Rate :

   R_1 = (primary containment leak rate) --- for noble gases.

   For $0 \le t < 24$ hr ; $R_1 = 0.25\%$ /day $= 1.042 \times 10^{-4}$ /hr
   For $24\text{hr} \le t \le 30\text{d}$; $R_1 = 0.125\%$ /day $= 5.208 \times 10^{-5}$ /hr

   R_2 = see next page. .... for iodines.

4. Source conversion factor (G) = 1.0×10^{-6} Ci/μCi

   NOTE : Source terms used for the STP run are in Ci, and these must be converted to μCi by dividing by above soure conversion factor.

SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT SQN

TI-RPS-48

COMPUTED BY YHI DATE 3/10/82 CHECKED BY SAK DATE 5/7/82

Iodine Removal Rate from Primary Containment

$$R_2 = \frac{\begin{pmatrix}\text{primary containment deck}\\ \text{fan flow rate}\end{pmatrix}}{\begin{pmatrix}\text{primary containment}\\ \text{free volume}\end{pmatrix}} \times \begin{pmatrix}\text{Ice condenser iodine}\\ \text{removal efficiency}\end{pmatrix} + R_1$$

$$= \frac{40{,}000 \text{ cfm}}{1.241 \times 10^6 \text{ ft}^3} \times \begin{pmatrix}\text{Ice condenser iodine}\\ \text{removal efficiency}\end{pmatrix} \times \left(\frac{60 \text{ min}}{1 \text{ hr}}\right) + R_1$$

where $R_1 = 1.042 \times 10^{-4}$ /hr for $0 \le t < 24$ h

$= 5.208 \times 10^{-5}$ /hr for $24\text{h} \le t < 30$ days

TIME (hr)	IODINE REMOVAL EFFICIENCY †	R_2 (/hr)
0.0 - 0.106	0.96	1.8567
0.106 - 0.133	0.84	1.6246
0.133 - 0.244	0.71	1.3732
0.244 - 0.383	0.67	1.2958
0.383 - 0.522	0.64	1.2378
0.522 - 0.578	0.62	1.1991
0.578 - 0.606	0.30	0.5803
0.606 - 24	0.0	1.042×10^{-4}
24 - 720	0.0	5.208×10^{-5}

† REFERENCE #4 : SQN FSAR TABLE 15.5-5

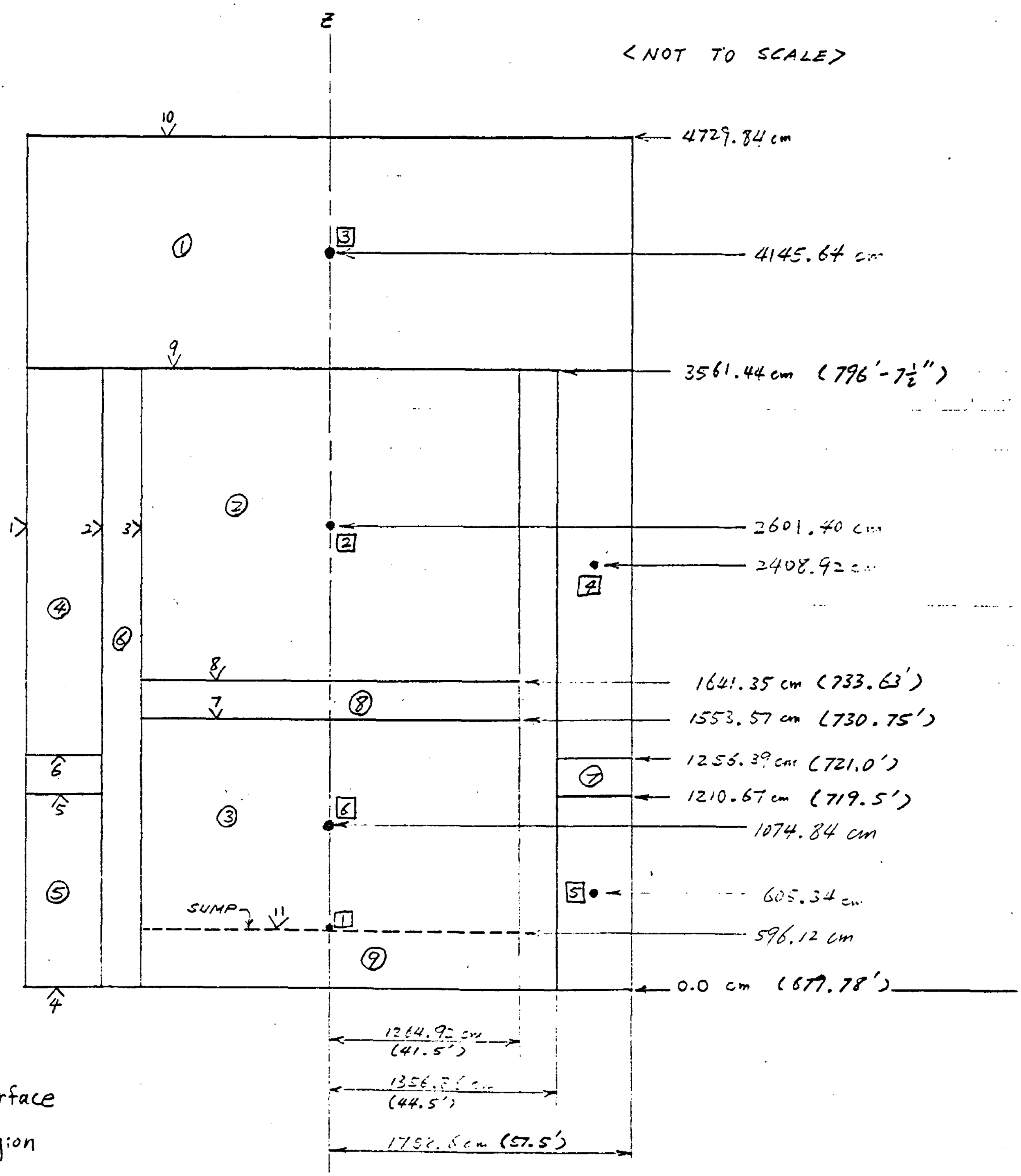
SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT SQN

TI-RPS-48

COMPUTED BY YHI DATE 10/16/81 CHECKED BY SAG DATE 5/7/82

QAD MODEL

(surfaces, regions, and detectors)



<# surface

(#) region

[#] Detector

INTEGRATED ACCIDENT DOSE
INSIDE PRIMARY CONTAINMENT

QAD MODEL

		Reference
surface 1 :	Outer wall of ice condenser	41 N 716-1, R4*
surface 2 :	Crane wall (outside)	"
surface 3 :	Crane wall (inside)	"
surface 4 :	Reference surface	41 N 716-4, R2*
surface 5 :	Ceiling of lower containment annulus	"
surface 6 :	Floor of ice condenser	"
surface 7 :	Ceiling of lower containment	"
surface 8 :	Floor of upper containment	"
surface 9 :	Top of crane wall	"
surface 10 :	Ceiling of upper containment dome	see page 6.14
surface 11 :	Top of sump water	see page 6.15

* The drawings are SQN drawings.
Reference # 2.

TVA 11030 (WM-7-75)

SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT SQN
TI-RPS-48

COMPUTED BY YHI DATE 3/10/82 CHECKED BY SAK DATE 5/4/82

QAD MODEL

Modification on Upper Containment Dome

The previous calculation modeled the upper containment dome as a hemisphere, however, the upper containment dome is modeled as a cylinder in this revision.
Same volume was assumed between the hemisphere and the cylinder to calculated the height of the cylinder modeled as the upper containment dome.

Volume of hemisphere = Volume of cylinder

$$\left(\tfrac{1}{2}\right)\left(\tfrac{4}{3}\right)\pi R^3 = \pi R^2 z$$

$$\tfrac{4}{6} R = z$$

$$z = \tfrac{4}{6} R$$

$$= \tfrac{4}{6}(57.5')$$

$$= 38.33'$$

$$z = 1168.4 \text{ cm}$$

$$\therefore Z_r = 1168.4 \text{ cm} + 3561.44 \text{ cm} = 4729.84 \text{ cm}$$

SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT SQN

TI-RPS-48

COMPUTED BY YHI DATE 10-29-81 CHECKED BY SAK DATE 5/7/82

QAD MODEL

Volume of Sump Water

The sump water is modeled as a cylinder in this revision.

$V_s = 7.916 \times 10^5$ Gal ††

$= 1.0582 \times 10^5\ ft^3$ $1\ ft^3 = 7.4805$ Gal

$= 2.997 \times 10^9\ cm^3$

$r_s = 41.5'$

$= 1264.92$ cm

$$Z_s = \frac{V_s}{\pi r_s^2}$$

$$= \frac{1.0582 \times 10^5\ ft^3}{\pi \times (41.5\ ft)^2}$$

$= 19.56$ ft

$= 596.12$ cm

†† Reference # 5 ; page 14

$V_{sump} = (V_{RWST}) + (V_{ICE}) + (V_{RCV}) = 340{,}000\ GAL + 357{,}314\ GAL + 94{,}249\ GAL$

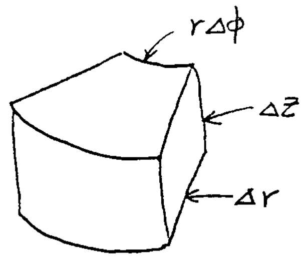
$= 791{,}563$ GAL

SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT TI-RPS-48

COMPUTED BY YHI DATE 10-29-81 CHECKED BY SAK DATE 5/7/82

QAD MODEL

Source Volume Elements for airborne (noble gases & iodines)



$z = 4729.84$ cm

$r = 1752.6$ cm

$\phi = \pi$

$\Delta z = 181.917$ cm

$\Delta r = 194.733$ cm

$r\Delta\phi = 196.641$ cm

$\Delta\phi = 0.1122$

number of Δz elements = 26

number of Δr elements = 9

number of $r\Delta\phi$ elements = 28

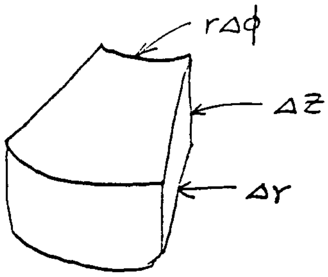
Total number of source elements = 13,104

SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT TI-RPS-48

COMPUTED BY YHI DATE 10-29-81 CHECKED BY SAK DATE 5/7/82

QAD MODEL

Source Volume Elements for the activities in the Sump.



$z = 596.12$ cm

$r = 1264.92$ cm

$\phi = \pi$

$\Delta z = 49.6767$ cm

$\Delta r = 50.59680$ cm

$r\Delta\phi = 49.67329$ cm

$\Delta\phi = 0.0392699$

number of Δz elements = 12

number of Δr elements = 25

number of $r\Delta\phi$ elements = 80

Total number of source elements = 24,000

SUBJECT INTEGRATED ACCIDENT DOSE INSIDE PRIMARY CONTAINMENT PROJECT WBN

TI-RPS-48

COMPUTED BY YHI DATE Apr. 12, 1982 CHECKED BY SAK DATE 4/14/82

Beta Dose Rate Calculations

Assuming that all the energy released by the beta-rays is absorbed in the containment air, the beta dose rates can be calculated from the beta source strengths, which are retrieved from the output of STP run.

Let beta source strength = S (MeV/sec)
beta dose rate = D (rad/hr)

, then

$$D\ (\text{rad/hr}) = \frac{S(\text{MeV/sec})(1.6\times10^{-6}\ \text{ergs/MeV})(3600\ \text{sec/hr})}{(0.00129\ \text{g/cc})(100\ \frac{\text{erg/g}}{\text{rad}})(3.514\times10^{10}\ \text{cc})}$$

where 1.6×10^{-6} ergs/MeV and $100\ \frac{\text{erg/g}}{\text{rad}}$ } conversion factors,

and density of air = 0.00129 g/cc
primary containment free volume = 3.514×10^{10} cc

Example/ At time = 0.01 hr, $S = 4.745\times10^{19}$ MeV/sec,

Hence
$$D = \frac{(4.745\times10^{19}\ \text{MeV/sec})(1.6\times10^{-6}\ \text{ergs/MeV})(3600\ \text{sec/hr})}{(0.00129\ \text{g/cc})(100\ \frac{\text{erg/g}}{\text{rad}})(3.514\times10^{10}\ \text{cc})}$$
$$= 6.029\times10^{7}\ \text{rad/hr}$$

SUBJECT Integrated Accident Dose inside Primary Containment PROJECT SQN

TI-RPS-48

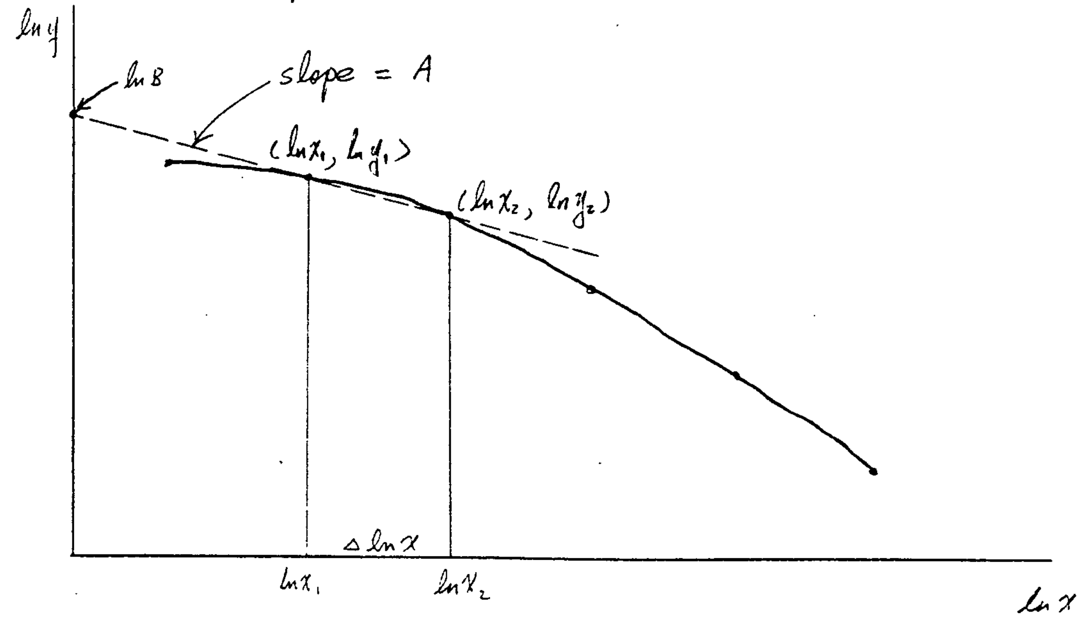
COMPUTED BY YHI DATE 7/21/82 CHECKED BY SAK DATE 5/7/83

Integration Method Used for This analysis

To find a simple integration method for the dose rates, which were calculated using the QAD-P5Z, the following method was used.

Let y = dose rate
x = time

x and y were plotted on a log-log graph paper to determine a simple equation, which describes the relationship between x and y.



Each time interval ($\Delta \ln x$) was estimated by a straight line on the log-log scale.

The equation of this straight line is

$$\ln y = A \ln x + \ln B \quad ; \quad x > 0$$

SUBJECT Integrated Accident Dose inside Primary Containment PROJECT SQN TI-RPS-48

COMPUTED BY YHI DATE 7/21/82 CHECKED BY SAR DATE 5.TTP

where A = slope of the straight line

$\ln B$ = intercept on the ordinate

$$\ln y = A \ln x + \ln B$$

$$\ln y = \ln x^A + \ln B$$

$$\ln y = \ln (B x^A)$$

$$\boxed{y = B x^A}$$

$$A = \frac{\ln y_2 - \ln y_1}{\ln x_2 - \ln x_1}$$

$$A = \frac{\ln (y_2/y_1)}{\ln (x_2/x_1)}$$

or

$$\boxed{A = \frac{\ln (y_1/y_2)}{\ln (x_1/x_2)}}$$

At $x = x_1$

$$y_1 = B x_1^A$$

or $$\boxed{B = y_1 x_1^{-A}}$$

SUBJECT Integrated Accident Dose inside Primary Containment PROJECT SQN

TI-RPS-48

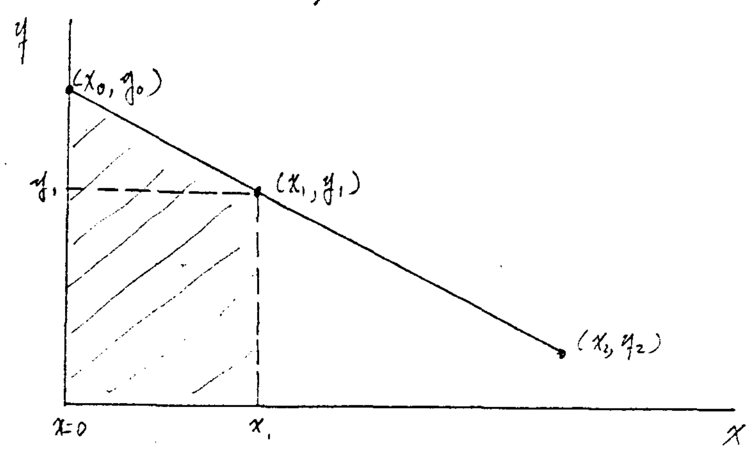
COMPUTED BY YHI DATE 7/21/82 CHECKED BY SAK DATE 5/7/82

$$\text{Integrated Dose} = \int_{y_1}^{y_2} y\,dy = B\int_{x_1}^{x_2} x^A\,dx$$

$$\boxed{\text{Integrated Dose} = \frac{B}{A+1}\left(x_2^{A+1} - x_1^{A+1}\right)} \quad \cdots\text{ equ. (1)}$$

The equ. (1) is not valid at $x=0$, since A is undefined at $x=0$. For first time interval, which includes $x=0$, a different integration method was used.

The dose rate (y_0) at $x=0$ had to be estimated before determining the integration method for this time interval. y_0 was estimated by the linear interpolation.



$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{y_1 - y_0}{x_1 - \cancel{x_0}}$$

0

$$\boxed{y_0 = -\left(\frac{y_2 - y_1}{x_2 - x_1}\right)(x_1) + y_1}$$

SUBJECT Integrated Accident Dose inside Primary Containment PROJECT SQN

TI-RPS-48

COMPUTED BY YHI DATE 7/21/82 CHECKED BY SAK DATE 5/7/82

The integrated dose between x_0 and x_1 was estimated by the trapezoid rule. Hence, the area under the (x_0, y_0) and (x_1, y_1) is the integrated dose for the first time interval.

That is,

Integrated dose for 1st time interval

$$\boxed{= \frac{1}{2}(y_0 - y_1)(x_1 - x_0) + (x_1 - x_0)\,y_1}$$

These integration equations were incorporated in the integration program, which is stored in the RAD-70.

SUBJECT ____ PROJECT TI-RPS-48

COMPUTED BY JCO DATE 3/22/80 CHECKED BY [illegible] DATE 7-20-81

VI Results

INTEGRATED DOSE : 1 DAY POST LOCA

Source in Region	Upper Containment	Ice Condenser	Lower Containment	Lower Containment Annulus
Upper Contain. Dome	5.727×10^{6} R	2.722×10^{6} R	—	—
Upper Containment	9.476×10^{6} R	3.913×10^{2} R	5.497×10^{2} R	2.894×10^{-4} R
Ice Condenser	6.807×10^{2} R	2.624×10^{6} R	8.303×10^{1} R	—
Lower Containment	4.473×10^{2} R	2.866×10^{-4} R	8.742×10^{6} R	3.586×10^{2} R
Lower Contain. Annulus	—	—	5.348×10^{2} R	1.984×10^{6} R
TOTAL	1.52×10^{7} R	5.346×10^{6} R	8.742×10^{6} R	1.984×10^{6} R

page 7.1 thru 7.9

SUPERCEDED

SUBJECT

PROJECT TI-RPS-48

COMPUTED BY JCO DATE 3/22/80 CHECKED BY [illegible] DATE 7-28-81

TIME AFTER LOCA: 30 DAYS

	Source in Region:	Upper Containment	Ice Condenser	Lower Containment	Lower Contain. Annulus
#5	Upper Contain. Dome	2.033×10^{7} R	9.692×10^{6} R	—	—
#3	Upper Containment	3.320×10^{7} R	5.373×10^{2} R	7.675×10^{2} R	3.087×10^{-4} R
#4	Ice Condenser	9.5×10^{2} R	9.154×10^{6} R	1.137×10^{2} R	—
#1	Lower Containment	6.247×10^{2} R	3.056×10^{-4} R	3.056×10^{7} R	4.931×10^{2} R
#2	Lower Cont. Annulus	[illegible]	—	[illegible]	6.932×10^{6} R
	TOTAL	5.353×10^{7} R	~~1.912×10^{7}~~ R 1.885×10^{7}	3.056×10^{7} R	6.932×10^{6} R

SUPERCEDED By Page 7.1 thru 7.9

SUBJECT ____________ PROJECT ____________

TI-RPS-48

COMPUTED BY JCO DATE 3/22/80 CHECKED BY [signature] DATE 21 Jul 81

INTEGRATED DOSE: 1 YEAR POST LOCA

	Source in Region	Upper Containment	Ice Condenser	Lower Containment	Lower Cont. Annulus
#5	Upper Contain Dome	2.714×10^{7} R	1.293×10^{7} R	—	—
#3	Upper Containment	4.449×10^{7} R	5.969×10^{2} R	8.575×10^{2} R	3.157×10^{-4} R
#4	Ice Condenser	1.061×10^{3} R	1.234×10^{7} R	1.261×10^{2} R	—
	Lower Containment	6.981×10^{2} R	3.125×10^{-4} R	4.098×10^{7} R	5.48×10^{2} R
#2	Lower Contain Annulus	—	—	8.411×10^{2} R	9.297×10^{6}
	TOTAL	7.163×10^{7} R	2.527×10^{7} R	4.098×10^{7} R	9.297×10^{6} R

SUPERCEDED BY

Pages 7.1 thru 7.9

TVA 489H (EN DES-2-78)

TENNESSEE VALLEY AUTHORITY

SHEET 10 OF 12

SUBJECT ______ PROJECT TI-RPS-48

COMPUTED BY JCO DATE 3/22/80 CHECKED BY [illegible] DATE 21 Jul 81

INTEGRATED DOSE : 2 YEARS POST LOCA

SOURCE IN REGION :	UPPER CONTAINMENT	ICE CONDENSER	LOWER CONTAINMENT	LOWER CONTAINMENT ANNULUS
UPPER CONTAIN. DOME	2.794×10^{7} R	1.330×10^{7} R	—	—
UPPER CONTAINMENT	4.581×10^{7} R	6.035×10^{2} R	8.675×10^{2} R	3.164×10^{-4} R
ICE CONDENSER	1.074×10^{3} R	1.271×10^{7} R	1.275×10^{2} R	—
LOWER CONTAINMENT	7.062×10^{2} R	3.133×10^{-4} R	4.22×10^{7} R	5.542×10^{2} R
LOWER CONTAIN. ANNULUS	—	—	8.511×10^{2} R	9.574×10^{6} R
TOTAL	7.375×10^{7} R	2.601×10^{7} R	4.220×10^{7} R	9.574×10^{6} R

SUPERCEDED By Pages 7.1 thru 7.9

IV. RESULT

DOSE RATE DUE TO THE AIRBORNE ACTIVITY (MR/HR)

TIME (HR)	DETECTOR NUMBER ONE	TWO	THREE	FOUR	FIVE	SIX
0.0	2.4235E+09	4.8260E+09	4.7378E+09	1.6708E+09	1.3416E+09	3.0854E+09
0.01	2.2138E+09	4.4078E+09	4.3272E+09	1.5265E+09	1.2260E+09	2.8186E+09
0.02	2.0041E+09	3.9896E+09	3.9166E+09	1.3822E+09	1.1104E+09	2.5518E+09
0.05	1.7184E+09	3.4203E+09	3.3578E+09	1.1854E+09	9.5247E+08	2.1882E+09
0.10	1.4988E+09	2.9829E+09	2.9285E+09	1.0340E+09	8.3084E+08	1.9086E+09
0.20	1.2661E+09	2.5197E+09	2.4737E+09	8.7358E+08	7.0204E+08	1.6124E+09
0.50	9.0956E+08	1.8097E+09	1.7768E+09	6.2784E+08	5.0475E+08	1.1585E+09
1.00	6.9636E+08	1.3854E+09	1.3602E+09	4.8076E+08	3.8656E+08	8.8701E+08
2.00	4.8840E+08	9.7179E+08	9.5416E+08	3.3720E+08	2.7108E+08	6.2210E+08
5.00	2.5639E+08	5.1043E+08	5.0122E+08	1.7700E+08	1.4217E+08	3.2654E+08
10.00	1.3779E+08	2.7453E+08	2.6964E+08	9.5110E+07	7.6287E+07	1.7546E+08
20.00	7.3821E+07	1.4714E+08	1.4457E+08	5.1002E+07	4.0865E+07	9.4024E+07
24.00	6.3700E+07	1.2694E+08	1.2475E+08	4.4035E+07	3.5285E+07	8.1148E+07
50.00	3.6934E+07	7.3500E+07	7.2273E+07	2.5614E+07	2.0550E+07	4.7102E+07
720.00	1.3440E+06	2.6822E+06	2.6357E+06	9.2800E+05	7.4230E+05	1.7111E+06
8760.00	1.8565E+03	3.7102E+03	3.6416E+03	1.2745E+03	1.0181E+03	2.3598E+03

Integrated Accident Dose
Inside Primary Containment
7.1 & 12
PREPARED: [illegible] 4/6/82
CHECKED: SAK 5/7/82

TTEP-S-48

ISE_RATE D[illegible]O THE SHINE FROM SUMP (MR/HR)

TIME (HR)	DETECTOR NUMBER					
	ONE	TWO	THREE	FOUR	FIVE	SIX
0.0	2.9162E+08	1.3951E+04	6.9504E+03	1.8014E-02	5.2467E+03	2.2377E+08
0.01	2.7360E+08	1.2257E+04	6.1192E+03	1.4427E-02	4.5839E+03	2.0989E+08
0.02	2.5558E+08	1.0563E+04	5.2880E+03	1.0840E-02	3.9211E+03	1.9601E+08
0.05	2.3264E+08	8.7367E+03	4.3887E+03	6.8621E-03	3.2122E+03	1.7838E+08
0.10	2.1857E+08	7.7178E+03	3.8858E+03	4.7249E-03	2.8187E+03	1.6756E+08
0.20	2.0214E+08	6.6393E+03	3.3515E+03	3.0038E-03	2.4071E+03	1.5494E+08
0.50	1.6689E+08	4.7604E+03	2.4136E+03	1.5221E-03	1.7060E+03	1.2786E+08
1.00	1.2881E+08	3.1046E+03	1.5827E+03	7.7589E-04	1.0971E+03	9.8639E+07
2.00	8.8304E+07	1.7058E+03	8.7748E+02	2.8472E-04	5.8873E+02	6.7596E+07
5.00	4.9577E+07	8.0377E+02	4.1737E+02	6.3183E-05	2.7030E+02	3.7952E+07
10.00	3.1442E+07	4.5966E+02	2.3904E+02	2.6941E-05	1.5393E+02	2.4067E+07
20.00	1.8300E+07	2.0094E+02	1.0455E+02	1.1209E-05	6.7203E+01	1.3995E+07
24.00	1.5626E+07	1.5431E+02	8.0293E+01	8.7125E-06	5.1608E+01	1.1946E+07
50.00	8.3320E+06	6.4631E+01	3.3547E+01	4.1659E-06	2.1754E+01	6.3659E+06
720.00	1.6042E+06	1.2705E+01	6.5885E+00	8.9293E-07	4.2911E+00	1.2239E+06
8760.00	4.9787E+05	6.7241E-01	3.6929E-01	1.7304E-08	2.0013E-01	3.7864E+05

RESULT (continued)

Integrated Accident Dose inside Primary Containment

7.2 & 12

PREPARED: [illegible] 4/26/82

CHECKED: SAK 5/7/82

TI-RPS-48

RESULT (continued)

DETECTOR NUMBER = 1 (AT SURFACE OF SUMP WATER)

INTEGRATED DOSES (R)

TIME (HR)	AIR DOSE	SUMP DOSE	TOTAL AIR	TOTAL SUMP	TOTAL DOSE
0.01	2.3186E+04	2.8261E+03	2.3186E+04	2.8261E+03	2.6013E+04
0.02	2.0952E+04	2.6346E+03	4.4139E+04	5.4607E+03	4.9599E+04
0.05	5.5084E+04	7.2662E+03	9.9223E+04	1.2727E+04	1.1195E+05
0.10	7.9677E+04	1.1236E+04	1.7890E+05	2.3963E+04	2.0286E+05
0.20	1.3659E+05	2.0931E+04	3.1549E+05	4.4894E+04	3.6038E+05
0.50	3.1541E+05	5.4392E+04	6.3089E+05	9.9286E+04	7.3018E+05
1.00	3.9303E+05	7.2428E+04	1.0239E+06	1.7171E+05	1.1956E+06
2.00	5.7440E+05	1.0498E+05	1.5983E+06	2.7669E+05	1.8750E+06
5.00	1.0285E+06	1.9264E+05	2.6268E+06	4.6933E+05	3.0962E+06
10.00	9.2143E+05	1.9397E+05	3.5483E+06	6.6330E+05	4.2116E+06
20.00	9.8884E+05	2.3536E+05	4.5371E+06	8.9866E+05	5.4358E+06
24.00	2.7393E+05	6.7549E+04	4.8110E+06	9.6621E+05	5.7772E+06
50.00	1.2351E+06	2.9025E+05	6.0461E+06	1.2565E+06	7.3026E+06
720.00	3.6279E+06	1.9314E+06	9.6740E+06	3.1879E+06	1.2862E+07
8760.00	5.8181E+05	6.0299E+06	1.0256E+07	9.2177E+06	1.9474E+07

TOTAL INTEGRATED DOSE = 1.9474E+07

Integrated Accident Dose Inside Primary Containment

7.3 of 12

PREPARED: JAK 4/26/82

CHECKED: SAK 5/7/82

-48

DETECTOR NUMBER = 2 (AT CENTER OF UPPER CONTAINMENT)

RESULT (Continued)

INTEGRATED DOSES (R)

TIME (HR)	AIR DOSE	SUMP DOSE	TOTAL AIR	TOTAL SUMP	TOTAL DOSE
0.01	4.6169E+04	1.3104E-01	4.6169E+04	1.3104E-01	4.6169E+04
0.02	4.1713E+04	1.1292E-01	8.7882E+04	2.4396E-01	8.7882E+04
0.05	1.0965E+05	2.8452E-01	1.9753E+05	5.2848E-01	1.9753E+05
0.10	1.5858E+05	4.0792E-01	3.5611E+05	9.3640E-01	3.5611E+05
0.20	2.7183E+05	7.1033E-01	6.2794E+05	1.6467E+00	6.2794E+05
0.50	6.2761E+05	1.6522E+00	1.2556E+06	3.2989E+00	1.2556E+06
1.00	7.8195E+05	1.8898E+00	2.0375E+06	5.1887E+00	2.0375E+06
2.00	1.1428E+06	2.2567E+00	3.1803E+06	7.4454E+00	3.1804E+06
5.00	2.0471E+06	3.3966E+00	5.2274E+06	1.0842E+01	5.2274E+06
10.00	1.8351E+06	2.9814E+00	7.0625E+06	1.3822E+01	7.0625E+06
20.00	1.9706E+06	2.9814E+00	9.0331E+06	1.6805E+01	9.0331E+06
24.00	5.4593E+05	7.0357E-01	9.5790E+06	1.7508E+01	9.5790E+06
50.00	2.4595E+06	2.5411E+00	1.2039E+07	2.0049E+01	1.2039E+07
720.00	7.2288E+06	1.5165E+01	1.9267E+07	3.5214E+01	1.9267E+07
8760.00	1.1615E+06	1.8490E+01	2.0429E+07	5.3704E+01	2.0429E+07

TOTAL INTEGRATED DOSE = 2.0429E+07

Integrated Accident Dose Inside Primary Containment

PREPARED: [illegible] 4/28/82

CHECKED: SAK 5/2/82

TMRPS-4-8

DETECTOR NUMBER = 3 (AT CONTAINMENT DOME)

RESULT (Continue)

INTEGRATED DOSES (R)

TIME (HR)	AIR DOSE	SUMP DOSE	TOTAL AIR	TOTAL SUMP	TOTAL DOSE
0.01	4.5325E+04	6.5348E-02	4.5325E+04	6.5348E-C2	4.5325E+04
0.02	4.0950E+04	5.6460E-02	8.6275E+04	1.2181E-C1	8.6275E+04
0.05	1.0764E+05	1.4271E-01	1.9392E+05	2.6451E-C1	1.9392E+05
0.10	1.5569E+05	2.0517E-01	3.4960E+05	4.6968E-C1	3.4960E+05
0.20	2.6687E+05	3.5815E-01	6.1647E+05	8.2784E-C1	6.1647E+05
0.50	6.1618E+05	8.3603E-01	1.2327E+06	1.6639E+CC	1.2327E+06
1.00	7.6773E+05	9.6089E-01	2.0004E+06	2.6248E+CC	2.0004E+06
2.00	1.1221E+06	1.1557E+00	3.1225E+06	3.7805E+CC	3.1225E+06
5.00	2.0100E+06	1.7557E+00	5.1325E+06	5.5362E+CC	5.1325E+06
10.00	1.8022E+06	1.5493E+00	6.9347E+06	7.0855E+CC	6.9347E+06
20.00	1.9358E+06	1.5508E+00	8.8705E+06	8.6363E+CC	8.8705E+06
24.00	5.3646E+05	3.6608E-01	9.4070E+06	9.0024E+00	9.4070E+06
50.00	2.4178E+06	1.3206E+00	1.1825E+07	1.0323E+C1	1.1825E+07
720.00	7.1060E+06	7.8671E+00	1.8931E+07	1.8190E+C1	1.8931E+07
8760.00	1.1410E+06	9.8482E+00	2.0072E+07	2.8038E+C1	2.0072E+07

TOTAL INTEGRATED DOSE = 2.CC72E+C7

Integrated Accident Dose
Inside Primary Containment

7.5 of 12

PREPARED: [illegible] 4/8/82

CHECKED: SAK 5/7/82

TI-RPS-#8

DETECTOR NUMBER = 4 (AT [illegible]E. CONDENSER)

RESULT (continued)

INTEGRATED DOSES (R)

TIME (HR)	AIR DOSE	SUMP DOSE	TOTAL AIR	TOTAL SUMP	TOTAL DOSE
0.01	1.5987E+04	1.6220E-07	1.5987E+04	1.6220E-07	1.5987E+04
0.02	1.4449E+04	1.2344E-07	3.0435E+04	2.8564E-07	3.0435E+04
0.05	3.7995E+04	2.5211E-07	6.8431E+04	5.3775E-07	6.8431E+04
0.10	5.4966E+04	2.8028E-07	1.2340E+05	8.1802E-07	1.2340E+05
0.20	9.4237E+04	3.7018E-07	2.1763E+05	1.1882E-06	2.1763E+05
0.50	2.1767E+05	6.2102E-07	4.3531E+05	1.8092E-06	4.3531E+05
1.00	2.7132E+05	5.3265E-07	7.0663E+05	2.3419E-06	7.0663E+05
2.00	3.9657E+05	4.6257E-07	1.1032E+06	2.8044E-06	1.1032E+06
5.00	7.1007E+05	3.9428E-07	1.8133E+06	3.1987E-06	1.8133E+06
10.00	6.3607E+05	2.0243E-07	2.4493E+06	3.4012E-06	2.4493E+06
20.00	6.8287E+05	1.7059E-07	3.1322E+06	3.5717E-06	3.1322E+06
24.00	1.8931E+05	3.9482E-08	3.3215E+06	3.6112E-06	3.3215E+06
50.00	8.5521E+05	1.5318E-07	4.1767E+06	3.7644E-06	4.1767E+06
720.00	2.5111E+06	1.0285E-06	6.6878E+06	4.7929E-06	6.6878E+06
8760.00	4.0120E+05	8.4968E-07	7.0890E+06	5.6426E-06	7.0890E+06

TOTAL INTEGRATED DOSE = 7.0890E+06

Integrated Accident Dose
Inside Primary Containment
70' # 12

PREPARED: [illegible] 4/26/82

CHECKED: SAK 5/7/82

TI-RPS-48

DETECTOR NUMBER = 5 (LO[illegible] CONTAINMENT ANNULUS)

INTEGRATED DOSES (R)

TIME (HR)	AIR DOSE	SUMP DOSE	TOTAL AIR	TOTAL SUMP	TOTAL DOSE
0.01	1.2838E+04	4.9153E-02	1.2838E+04	4.9153E-02	1.2838E+04
0.02	1.1606E+04	4.2060E-02	2.4444E+04	9.1213E-02	2.4444E+04
0.05	3.0527E+04	1.0505E-01	5.4971E+04	1.9626E-01	5.4971E+04
0.10	4.4166E+04	1.4943E-01	9.9137E+04	3.4570E-01	9.9137E+04
0.20	7.5727E+04	2.5840E-01	1.7486E+05	6.0409E-01	1.7486E+05
0.50	1.7497E+05	5.9522E-01	3.4983E+05	1.1993E+00	3.4983E+05
1.00	2.1814E+05	6.7231E-01	5.6797E+05	1.8716E+00	5.6798E+05
2.00	3.1884E+05	7.8797E-01	8.8681E+05	2.6596E+00	8.8681E+05
5.00	5.7058E+05	1.1568E+00	1.4574E+06	3.8164E+00	1.4574E+06
10.00	5.1054E+05	1.0005E+00	1.9679E+06	4.8169E+00	1.9679E+06
20.00	5.4743E+05	9.9777E-01	2.5154E+06	5.8146E+00	2.5154E+06
24.00	1.5169E+05	2.3530E-01	2.6670E+06	6.0499E+00	2.6670E+06
50.00	6.8572E+05	8.5251E-01	3.3528E+06	6.9024E+00	3.3528E+06
720.00	2.0119E+06	5.1146E+00	5.3647E+06	1.2017E+01	5.3647E+06
8760.00	3.2082E+05	5.8934E+00	5.6855E+06	1.7910E+01	5.6855E+06

TOTAL INTEGRATED DOSE = 5.6855E+06

RESULT (Continued)

Integrated Accident Dose
Inside Primary Containment

7 of 12

PREPARED: [illegible] 4/26/82

CHECKED: SAK 5/5/82

TRP-84-8

DETECTOR NUMBER = 6 (CENTER OF LOWER CONTAINMENT)

RESULT (continue)

INTEGRATED DOSES (R)

TIME (HR)	AIR DOSE	SUMP DOSE	TOTAL AIR	TOTAL SUMP	TOTAL DOSE
0.01	2.9520E+04	2.1683E+03	2.9520E+04	2.1683E+C3	3.1688E+04
0.02	2.6677E+04	2.0208E+03	5.6197E+04	4.1891E+C3	6.0386E+04
0.05	7.0141E+04	5.5719E+03	1.2634E+05	9.7610E+C3	1.3610E+05
0.10	1.0146E+05	8.6147E+03	2.2780E+05	1.8376E+C4	2.4618E+05
0.20	1.7394E+05	1.6045E+04	4.0174E+05	3.4420E+C4	4.3616E+05
0.50	4.0170E+05	4.1680E+04	8.0345E+05	7.6101E+04	8.7955E+05
1.00	5.0061E+05	5.5475E+04	1.3041E+06	1.3158E+C5	1.4356E+06
2.00	7.3165E+05	8.0375E+04	2.0357E+06	2.1195E+C5	2.2477E+06
5.00	1.3100E+06	1.4746E+05	3.3457E+06	3.5942E+C5	3.7051E+06
10.00	1.1734E+06	1.4848E+05	4.5191E+06	5.0789E+C5	5.0270E+06
20.00	1.2593E+06	1.8007E+05	5.7785E+06	6.8797E+C5	6.4664E+06
24.00	3.4893E+05	5.1650E+04	6.1274E+06	7.3962E+C5	6.8670E+06
50.00	1.5743E+06	2.2182E+05	7.7017E+06	9.6144E+C5	8.6631E+C6
720.00	4.6232E+06	1.4744E+06	1.2325E+07	2.4359E+C6	1.4761E+07
8760.00	7.4045E+05	4.5915E+06	1.3065E+07	7.0274E+C6	2.0093E+07

TOTAL INTEGRATED DOSE = 2.CC93E+07

Integrated Accident Dose
Inside Primary Containment
TI & 12

Prepared: [illegible] 4/6/62

CHECKED: SAK 5/17/62

TI-RPS-46

INTEGRATED BETA DOS

TIME (HR)	SOURCE STRENGTH (MEV/SEC( )	DOSE RATE (R/HR)	INTEGRATED DOSE (R)
0.0		6.9378E+07	
0.01	4.7450E+19	6.0293E+07	3.0147E+C5
0.02	4.0300E+19	5.1208E+07	8.5254E+C5
0.05	3.0750E+19	3.9073E+07	2.1713E+C6
0.10	2.4820E+19	3.1538E+07	3.9083E+C6
0.20	2.0380E+19	2.5896E+07	6.7385E+C6
0.50	1.7380E+19	2.2084E+07	1.3834E+C7
1.00	1.5540E+19	1.9746E+07	2.4214E+C7
2.00	1.1890E+19	1.5108E+07	4.1273E+C7
5.00	6.3080E+18	8.0154E+06	7.3265E+C7
10.00	3.2900E+18	4.1805E+06	1.0164E+C8
20.00	1.8550E+18	2.3571E+06	1.3243E+C8
24.00	1.6550E+18	2.1029E+06	1.4132E+C8
50.00	1.1060E+18	1.4054E+06	1.8523E+C8
720.00	4.0210E+16	5.1093E+04	3.2322E+C8
8760.00	5.5090E+15	6.9988E+03	4.4318E+C8

TOTAL INTEGRATED DOSE = 4.4318E+C8

RESULT (Continue)

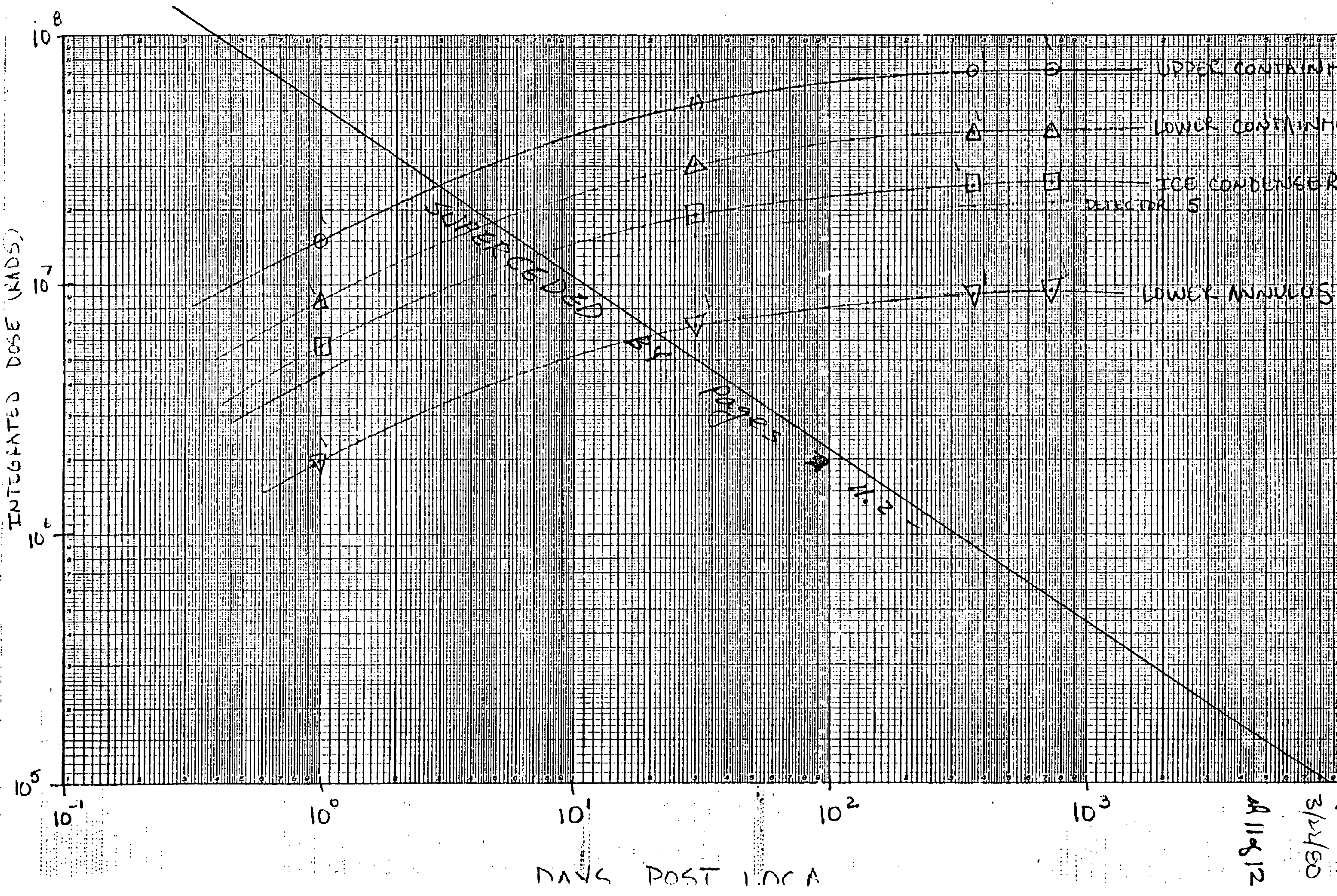
Integrated Accident Dose Inside Primary Containment

7.9 of 12

PREPARED: [illegible] 4/30/82

CHECKED: SAK 5/7/82

TI-RPS-48



TI-RPS-48

3/24/80

TVA 489 (EN DES-11-76)

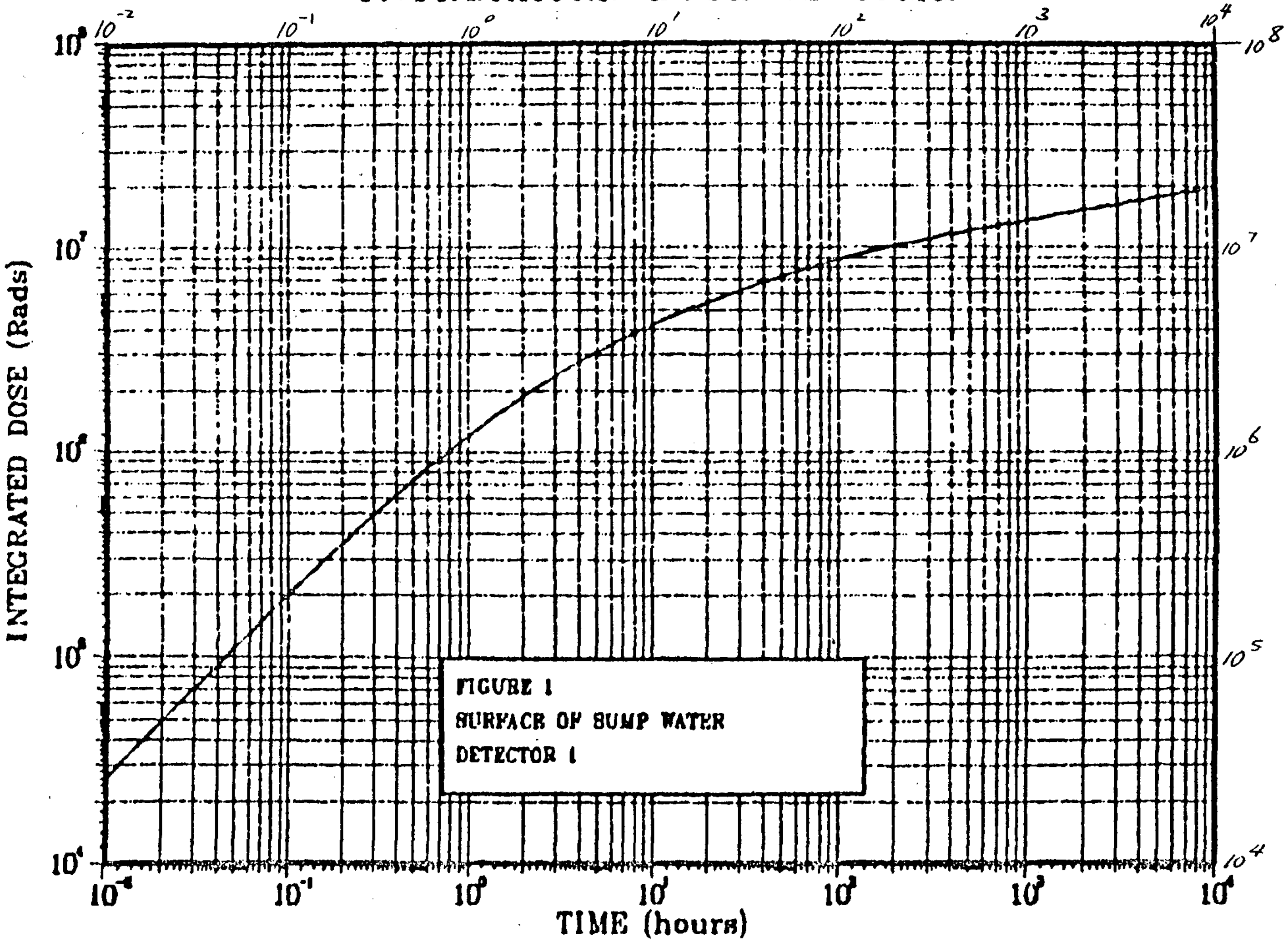
TI-RPS-48

COMPUTED SMW DATE 8/28/91

CHECKED ____ DATE ____

The variation of dose with position is due to the finite geometry modeled. The shielding effect of the crane wall and main floor is shown by the lower dose in the ice condenser and lower annulus regions compared to the upper containment

INTEGRATED DOSE vs TIME



TI-RPS-48

RESULT (continue)

Integrated Accident Dose
Inside Primary Containment

11.2 of 12

PREPARED: [initials] 4/26/82

CHECKED: WMR 5/7/82

RESULT (continue)

Integrated Accident Dose
Inside Primary Containment

11.3 of 12

PREPARED: [illegible] 4/28/82

CHECKED: WMB 5/1/82

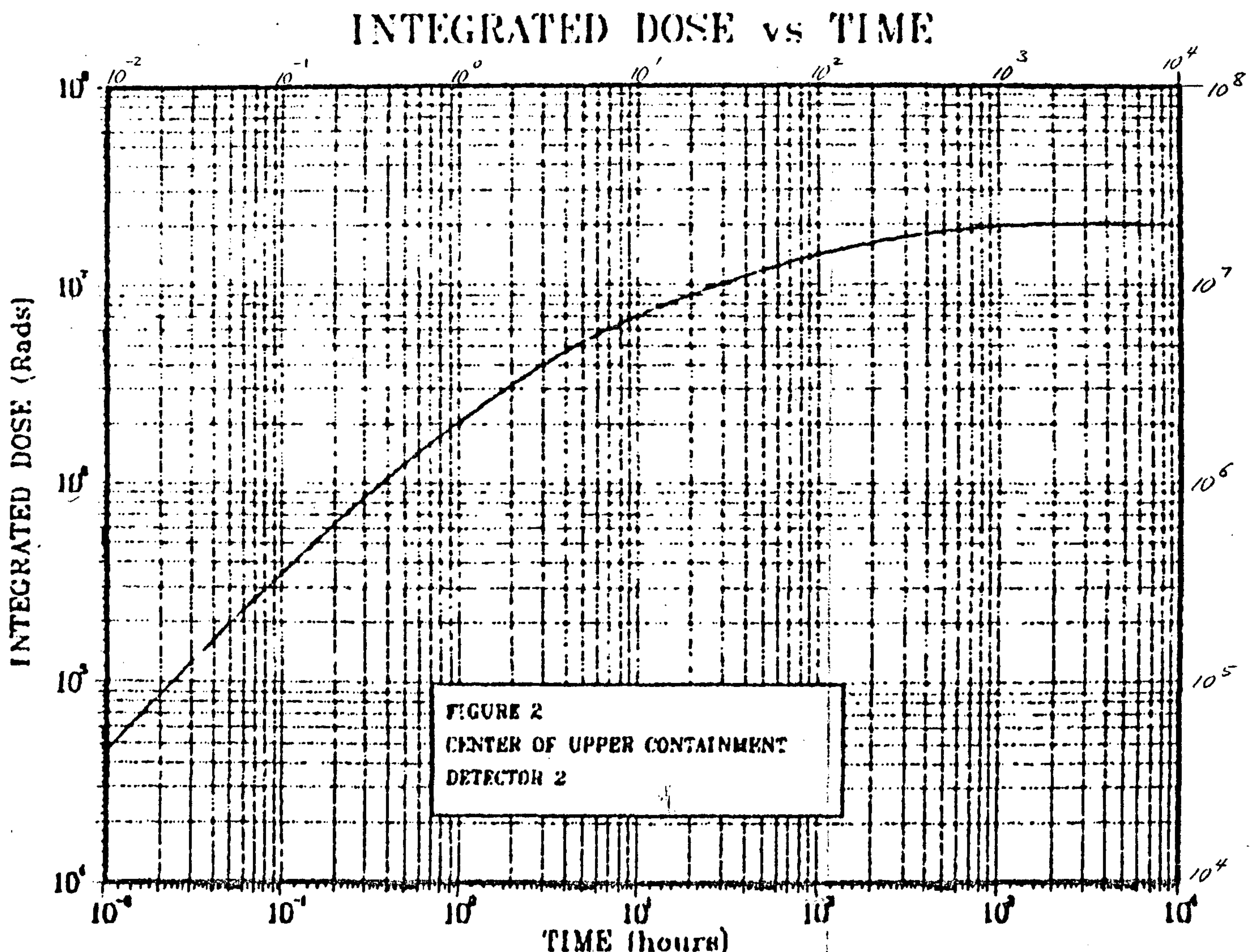


FIGURE 2
CENTER OF UPPER CONTAINMENT
DETECTOR 2

RESULT (continue)

INTEGRATED DOSE vs TIME

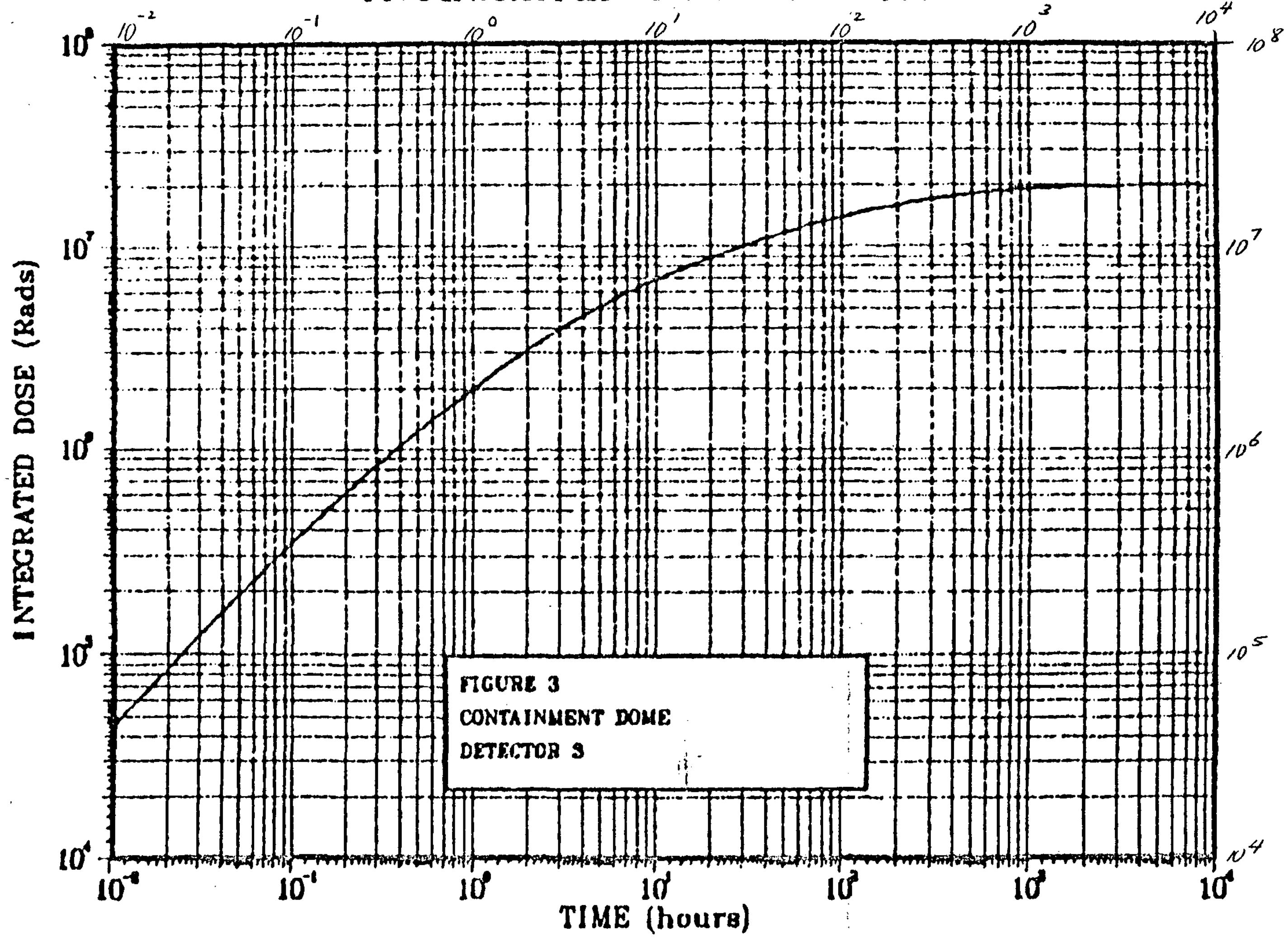


FIGURE 3
CONTAINMENT DOME
DETECTOR 3

Integrated Accident Dose
Inside Primary Containment

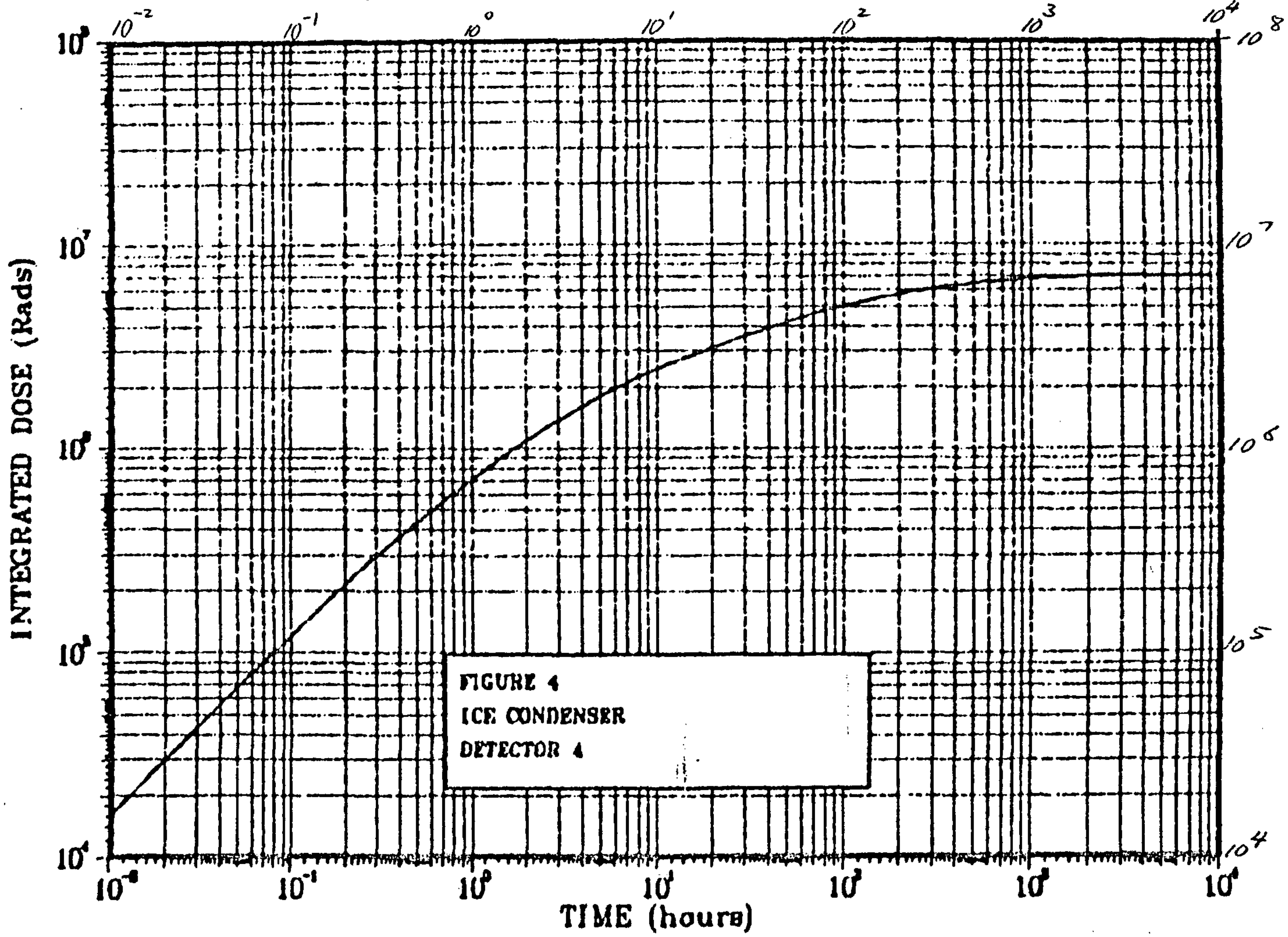
11.4 of 12

PREPARED: FRL 4/28/82

CHECKED: WMB 5/7/82

RESULT (continue)

INTEGRATED DOSE vs TIME



Integrated Accident Dose
Inside Primary Containment

11.5 of 12

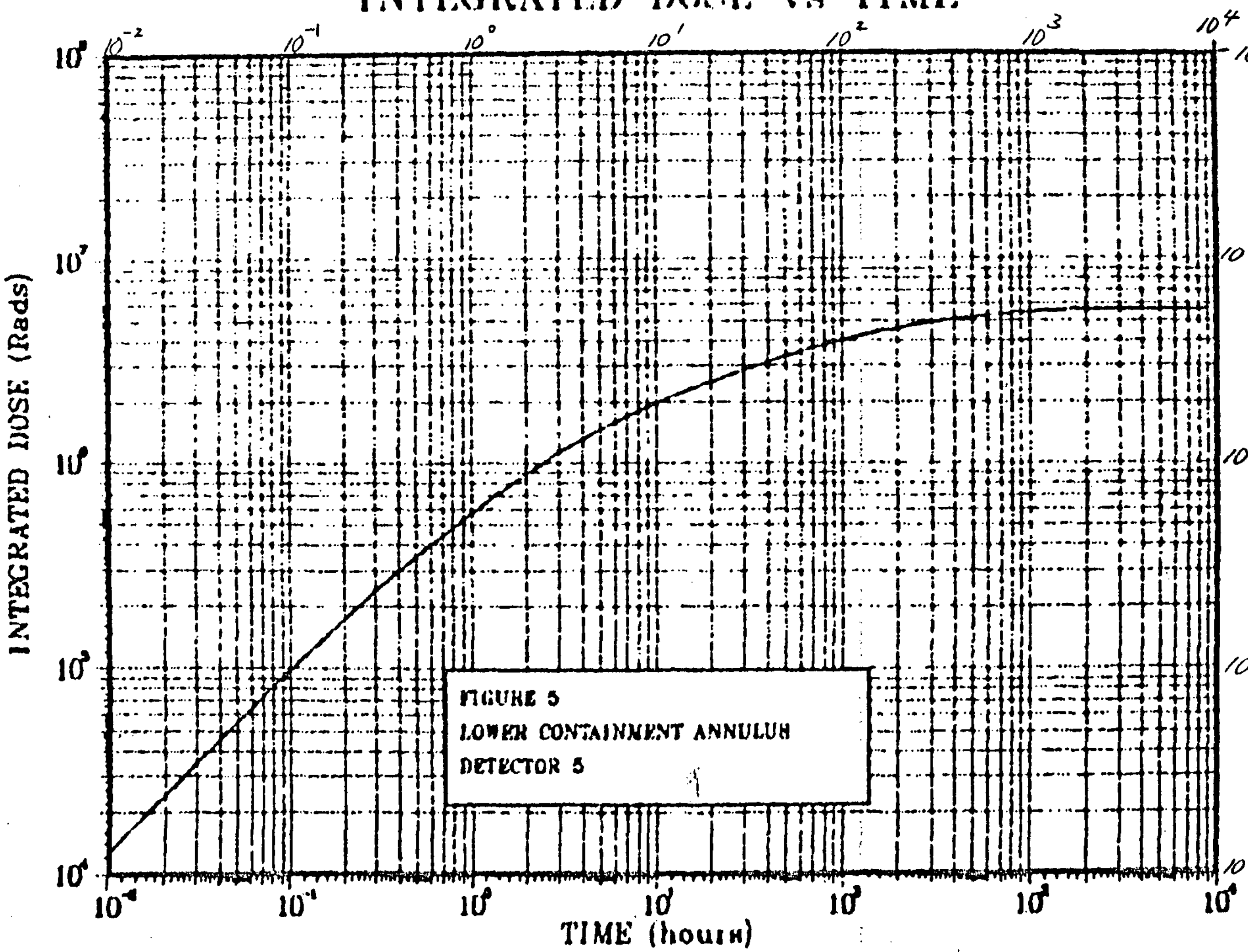
PREPARED: FHL 4/28/82

CHECKED: WMB 5/1/82

TI-RPS-48

RESULT (continue)

INTEGRATED DOSE vs TIME



TIPS-48

Integrated Accident Dose
Inside Primary Containment
11.6 of 12
PREPARED: [initials] 4/21/82
CHECKED: WMB 5/7/82

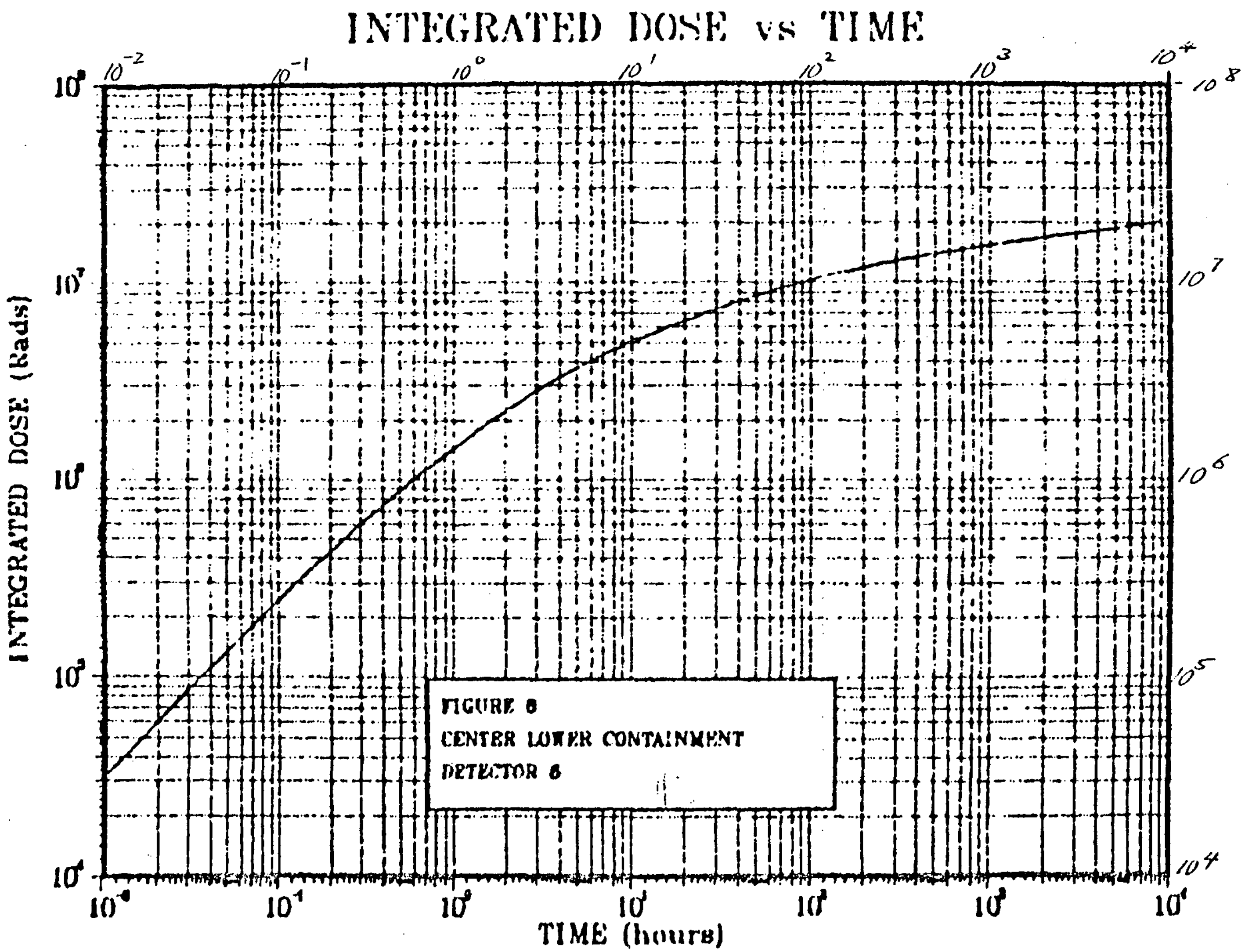
RESULT (continue)

Integrated Accident Dose Inside Primary Containment

11.7 of 12

PREPARED: 4/26/82

CHECKED: 5/7/82



RESULT (continue)

INTEGRATED BETA DOSE vs TIME

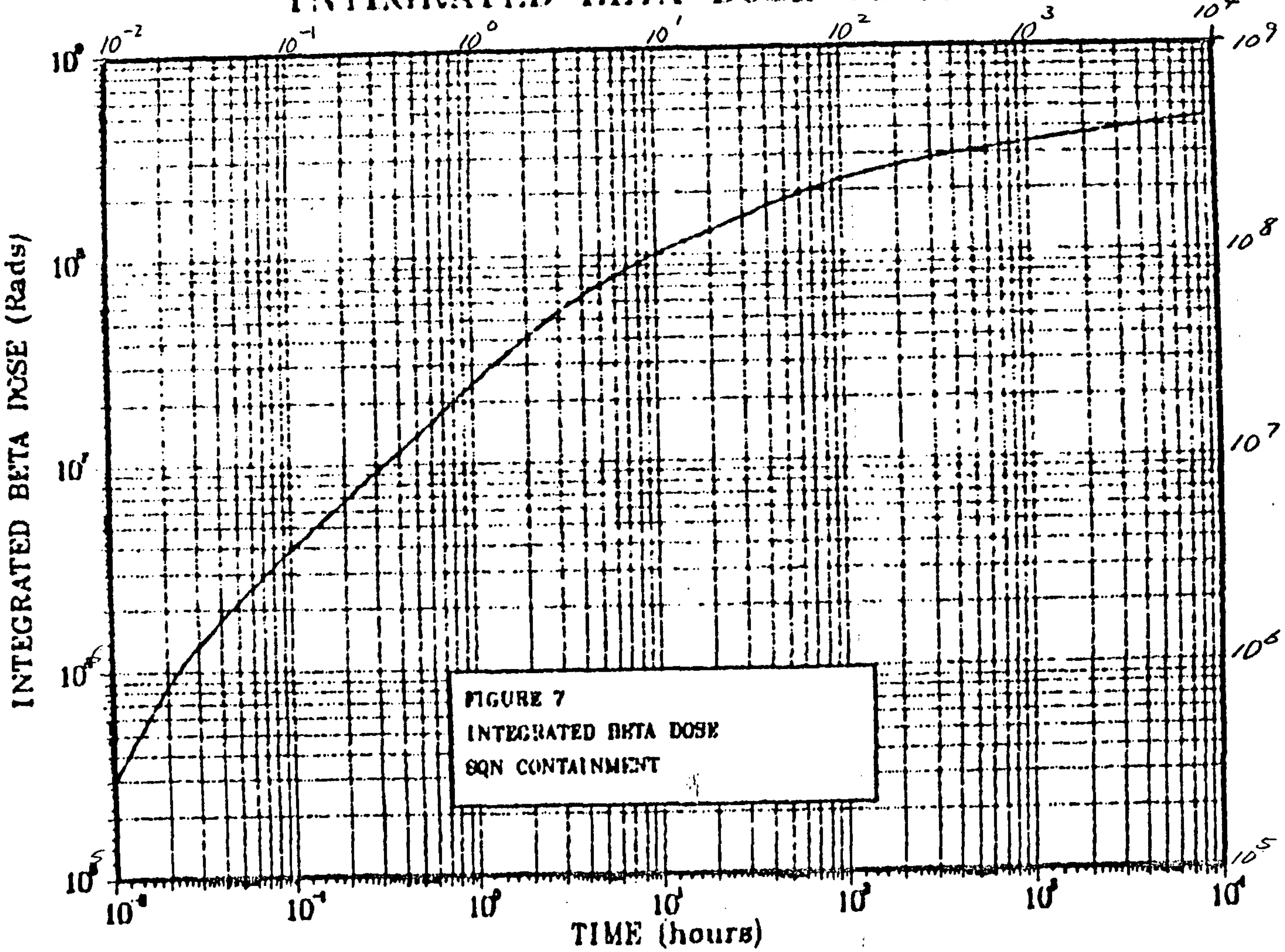


FIGURE 7
INTEGRATED BETA DOSE
SQN CONTAINMENT

Integrated Accident Dose Inside Primary Containment

11.8 of 12

PREPARED: [illegible] 4/26/82

CHECKED: WHB 5/?/82

TI-RPS-48

APPENDIX I

(SOURCE TERMS)

~~DELETED~~

WHOLE APPENDIX I
WAS DELETED
AND REPLACED BY
PAGES 6.2 thru 6.8
of THIS ANALYSIS, REV 1.

SUBJECT Integrated Accident Dose Inside Primary Containment PROJECT SQN

TI-RPS-48

COMPUTED BY YHI DATE 4/26/82 CHECKED BY SHC DATE 5/7/82

APPENDIX II

12.2 : A memo from P.G. Ioannides to L.E. Stanford

12.3 : SQN FSAR TABLE 15.1-4

12.4-12.6 : SQN FSAR TABLE 15.5-4

12.7 : SQN FSAR TABLE 15.5-5

12.8-12.11 : Isotope Library

APPENDIX II

CK SAK 5/7/82

FOR	NAME: L. E. Stanford	DATE: 9/14/81
	ADDRESS: W10C174	Chatt / Knox / M. S.
	Fold here for return	
FROM	NAME: P. G Ioannides for PGI 9/14	EXTENSION: 4373
	ADDRESS: W10B81	Chatt / Knox / M. S.

Many of the components being qualified for NUREG 0588 are required to remain operable for only a limited time in the LOCA environment, e.g. 1 hr. Currently the 0588 submittal contains only the full integrated accident dose.

Please give us information with respect to how the in-containment accident dose increases as a function of time. We most urgently need this information for Watts Bar, but it would also be useful for Sequoyah.

TVA 45D (OS-1-66) INTEROFFICE MAILING SLIP

Added by Amendment 23, July 1, 1974

APPENDIX II

ck SAK 5/7/82

TI-RPS-48

TABLE 15.1-4

CORE AND GAP ACTIVITIES

BASED ON FULL POWER OPERATION FOR 650 DAYS

FULL POWER: 3565 MWt

Isotope	Curies in Core ($x 10^7$)	Percent of Core Activity in Gap	Curies in Gap ($x 10^5$)
I-131	8.80	0.822	7.24
I-132	13.4	0.0901	1.20
I-133	19.7	0.271	5.34
I-134	23.1	0.0557	1.28
I-135	17.9	0.154	2.75
Xe-131m	0.0668	1.0	0.0669
Xe-133	20.3	0.667	13.6
Xe-133m	0.516	0.437	0.225
Xe-135	5.55	0.180	1.00
Xe-135m	5.46	0.0303	0.165
Xe-138	17.9	0.0316	0.566
Kr-83m	1.64	0.0824	0.135
Kr-85	0.0999	16.7	1.67
Kr-85m	3.95	0.124	0.489
Kr-87	7.59	0.0668	0.507
Kr-88	10.8	0.0988	1.07
Kr-89	14.0	0.0137	0.192

SQN FSAR

TABLE 15.5-4

PARAMETERS USED IN LOCA ANALYSES

	Regulatory Guide 1.4 Analysis[1]
Core thermal power	3582 MWt
Primary containment free volume	1.241×10^6 ft^3
Upper primary containment free volume	7.16×10^5 ft^3
Lower primary containment free volume	4.0×10^5 ft^3
Ice condenser free volume	1.25×10^5 ft^3
Annulus free volume	3.75×10^5 ft^3
Primary containment deck fan flow rate	40,000 cfm
Number of deck fans assumed operating	1 of 2
Activity released to primary containment and available for release	
noble gases	100% of core inventory
iodines	25% of core inventory
Plateout of iodine activity released to primary containment	50%

(1) Reference LOCA.

APPENDIX II

Page 12.4 of 12
Prepared by YHI 7/12/82
Checked by [illegible]

SQN FSAR TABLE 15.5-4 (Cont'd)

PARAMETERS USED IN LOCA ANALYSES

	Regulatory Guide 1.4 Analysis
Form of iodine activity in primary containment available for release	
elemental iodine	91%
methyl iodine	4%
particulate iodine	5%
Ice condenser removal efficiency for elemental iodine	See Table 15.5-5
Primary containment leak rate	0.25% per day 0-24 hours)
	0.125% per day (1-30 days)
Percent of primary containment leakage to auxiliary building	25%
ABGTS filter efficiencies	
elemental iodine	95%
methyl iodine	90%
particulate iodine	95%
Delay time of activity in auxiliary building	0.3 hr
Time ABGTS filters are bypassed following LOCA	10 minutes
EGTS total intake flow	4000 cfm
Percent of annulus free volume available for mixing of activity	50%

APPENDIX II

Page 12.5 of 12
Prepared by YHI 7/12/82
Checked by SAK 7/1[illegible]/82

SQN FSAR

TABLE 15.5-4 (Cont'd)

PARAMETERS USED IN LOCA ANALYSES

	Regulatory Guide 1.4 Analysis
EGTS exhaust flow rate	See Table 15.5-6
Number of EGTS air handling units assumed operating	1 of 2
EGTS filter efficiencies	
elemental iodine	95%
methyl iodine	90%
particulate iodine	95%
Percent of primary containment leakage to EGTS air handling units suction	100%
Meteorology	Accident (see Appendix 15A)

APPENDIX II

Page 12.6 of 12
Prepared by YHI 7/12/82
Checked by SAK 5/17/83

Page 12.7 of 12
Prepared by YHI 7/2/82
Checked by SAK 5/7/82

APPENDIX II

SQN FSAR

TABLE 15.5-5

TI-RPS-48

ICE CONDENSER IODINE REMOVAL EFFICIENCY (1)

Time Interval Post LOCA (Hours)	Iodine Removal Efficiency
0.0 to 0.106	0.96
0.106 to 0.133	0.84
0.133 to 0.244	0.71
0.244 to 0.383	0.67
0.383 to 0.522	0.64
0.522 to 0.578	0.62
0.578 to 0.606	0.30
0.606 to 720	0.0

(1) The ice condenser removal efficiencies given in the above table is used for the conservative Regulatory Guide 1.4 analyses. The inlet steam-air mixture coming into the ice condenser is greater than 90% steam by volume initially due to the delaying of the operation of the deck fans. Without the delay of operation of the deck fans the amount of steam by volume in the inlet mixture initially would be much lower and the ice condenser iodine removal efficiencies would be reduced.

Prepared by YHI 7/21/82

Checked by SAK 7/..

Appendix II

```
IIIIIII   SSSS     OOO     TTTTTTT    OOO    PPPPP   EEEEEE
   I     S    S   O   O       T      O   O   P    P  E
   I      SS     O     O      T     O     O  P    P  EEE
   I        SS   O     O      T     O     O  PPPPP   E
   I     S    S   O   O       T      O   O   P       E
IIIIIII   SSSS     OOO        T       OOO    P       EEEEEE

L        IIIIIII  BBBBB   RRRRR    AAA    RRRRR   Y     Y
L           I     B    B  R    R  A   A   R    R   Y   Y
L           I     BBBBB   R    R A     A  R    R    Y Y
L           I     B    B  RRRRR  AAAAAAA  RRRRR      Y
L           I     B    B  R   R  A     A  R   R      Y
LLLLLL   IIIIIII  BBBBB   R    R A     A  R    R     Y
```

DATE: 02-12-80

Reference: "Isotope Library," section file.

Appendix II

	ISOTOPE		HALFLIFE (SEC)	FISSION YIELD (ATM/FIS)	AVERAGE BETA ENERGY (MEV/DIS)	AVERAGE GAMMA ENERGY (MEV/DIS)
1	H	3	3.8973E+08	0.0	5.6800E-03	0.0
2	N	13	5.9820E+02	0.0	4.9090E-01	1.0201E+00
3	N	16	7.2000E+00	0.0	1.7420E+00	4.6072E+00
4	N	17	4.1600E+00	0.0	1.1550E+00	3.7951E-02
5	O	19	2.9000E+01	0.0	1.0160E+00	1.0489E+00
6	F	18	6.5880E+03	0.0	2.4130E-01	9.8827E-01
7	NA	24	5.4000E+04	0.0	5.5460E-01	4.1216E+00
8	AL	28	1.3440E+02	0.0	1.2400E+00	1.7787E+00
9	SI	31	9.4320E+03	0.0	4.4400E-01	8.8200E-04
10	P	32	1.2347E+06	0.0	6.9500E-01	0.0
11	AR	41	6.5760E+03	0.0	4.6232E-01	1.2793E+00
12	CR	51	2.3950E+06	0.0	3.7540E-03	3.2763E-02
13	MN	54	2.7000E+07	0.0	4.1670E-03	8.3592E-01
14	MN	56	9.2740E+03	0.0	7.9280E-01	1.7599E+00
15	FE	55	8.5204E+07	0.0	4.1920E-03	1.5291E-03
16	FE	59	3.8530E+06	0.0	1.1800E-01	1.1923E+00
17	CO	58	6.1603E+06	0.0	2.0490E-01	9.7586E-01
18	COM	60	6.3000E+02	0.0	1.5000E-03	6.1870E-02
19	CO	60	1.6599E+08	0.0	9.6840E-02	2.5043E+00
20	NI	63	2.9032E+09	0.0	1.7150E-02	0.0
21	NI	65	9.2160E+03	0.0	6.1490E-01	5.6886E-01
22	CU	64	4.6080E+04	0.0	1.2490E-01	1.9754E-01
23	ZN	65	2.1064E+07	0.0	6.8940E-03	5.8169E-01
24	ZNM	69	5.0400E+04	0.0	0.0	4.1501E-01
25	ZN	69	3.3360E+03	1.4300E-08	3.1949E-01	0.0
26	AS	76	9.4680E+04	1.9300E-09	1.0714E+00	4.3770E-01
27	SE	84	1.9800E+02	9.4511E-03	5.3591E-01	4.0770E-02
28	BR	83	8.6400E+03	5.3069E-03	3.2280E-01	7.2940E-03
29	BRM	84	3.6000E+02	1.9217E-04	8.9530E-01	2.7202E+00
30	BR	84	1.9080E+03	9.6650E-03	1.2842E+00	1.6816E+00
31	BR	85	1.8000E+02	1.2953E-02	1.0360E+00	8.4002E-01
32	BR	87	5.5700E+01	2.2016E-02	2.7637E+00	2.0048E+00
33	KRM	83	6.6960E+03	5.3069E-03	3.7080E-02	2.4834E-03
34	KRM	85	1.6128E+04	1.3017E-02	2.5290E-01	1.5862E-01
35	KR	85	3.3862E+08	2.8825E-03	2.5060E-01	2.2102E-03
36	KR	87	4.5780E+03	2.5421E-02	1.3237E+00	7.9284E-01
37	KR	88	1.0080E+04	3.5840E-02	3.7500E-01	1.9629E+00
38	KR	89	1.9080E+02	4.6812E-02	1.2310E+00	2.0837E+00
39	KR	90	3.2320E+01	4.6891E-02	1.1970E+00	1.6387E+00
40	KR	91	8.6000E+00	3.5118E-02	2.7277E+00	4.7601E-01
41	KR	92	1.8400E+00	1.5392E-02	2.6430E+00	7.4295E-01
42	KR	93	1.1700E+00	5.1931E-03	3.8224E+00	2.6966E-01
43	RB	86	1.6110E+06	9.8100E-07	6.5830E-01	9.4776E-02
44	RB	88	1.0680E+03	3.6243E-02	2.0617E+00	6.8631E-01
45	RB	89	9.1200E+02	4.8470E-02	0.0	2.4050E+00
46	RBM	90	2.5600E+02	1.0034E-02	9.5880E-02	3.6858E+00
47	RB	90	1.5400E+02	4.9249E-02	1.2105E+00	2.5797E+00
48	RB	91	5.8000E+01	5.7450E-02	1.2131E+00	2.7928E+00
49	RB	92	4.4800E+00	4.8466E-02	3.6530E+00	2.1193E-01
50	RB	93	5.8000E+00	3.4910E-02	3.3504E+00	3.8110E-01

Appendix II

	ISOTOPE		HALFLIFE (SEC)	FISSION YIELD (ATM/FIS)	AVERAGE BETA ENERGY (MEV/DIS)	AVERAGE GAMMA ENERGY (MEV/DIS)
51	SR	89	4.3632E+06	4.8501E-02	5.7300E-01	1.3636E-04
52	SR	90	8.9937E+08	5.9155E-02	1.9630E-01	0.0
53	SR	91	3.4200E+04	5.9163E-02	6.5050E-01	6.9508E-01
54	SR	92	9.7560E+03	5.9482E-02	1.9540E-01	1.3390E+00
55	SR	93	4.5600E+02	6.2663E-02	1.6080E+00	6.2808E-01
56	SR	94	7.8000E+01	6.0148E-02	5.4274E-01	1.4072E+00
57	YM	90	1.1484E+04	1.6500E-07	7.9196E-04	6.9127E-01
58	Y	90	2.3040E+05	5.9157E-02	9.3610E-01	0.0
59	YM	91	2.9826E+03	3.6685E-02	0.0	5.5557E-01
60	Y	91	5.0553E+06	5.9171E-02	6.0600E-01	3.6147E-03
61	Y	92	1.2744E+04	5.9560E-02	1.4434E+00	2.5043E-01
62	Y	93	3.6360E+04	6.3667E-02	1.1721E+00	8.9414E-02
63	Y	94	1.1460E+03	6.4079E-02	1.6764E+00	9.5002E-01
64	Y	95	6.4200E+02	6.4304E-02	1.7153E+00	4.6625E-01
65	Y	96	1.3800E+02	5.9745E-02	1.5023E+00	3.2987E+00
66	ZRC	95	5.5279E+06	0.0	1.1990E-01	7.3474E-01
67	ZR	95	5.5279E+06	6.4593E-02	1.1990E-01	7.3474E-01
68	ZR	97	6.1200E+04	5.9446E-02	9.0390E-02	1.8303E-01
69	NBM	95	3.1176E+05	6.4736E-04	2.8470E-01	5.8745E-02
70	NB	95	3.0370E+06	6.4594E-02	4.4970E-02	7.6430E-01
71	NBM	97	6.0000E+01	5.5931E-02	0.0	7.4336E-01
72	NB	97	4.3260E+03	5.9603E-02	4.6840E-01	6.6696E-01
73	MO	99	2.3832E+05	6.1327E-02	3.9570E-01	1.6238E-01
74	TCM	99	2.1672E+04	5.3968E-02	4.8500E-03	1.4263E-01
75	TC	99	6.7210E+12	6.1327E-02	8.3790E-02	0.0
76	TC	101	7.5200E+02	5.0440E-02	4.6640E-01	3.3715E-01
77	RU	103	3.4214E+06	3.1351E-02	6.7400E-02	4.8394E-01
78	RU	105	1.5984E+04	9.8670E-03	4.0194E-01	7.9132E-01
79	RU	106	3.1882E+07	3.9171E-03	1.0100E-02	0.0
80	RU	107	2.5200E+02	1.7339E-03	1.2148E+00	2.4056E-01
81	RHM	103	3.4200E+03	3.1038E-02	3.4620E-02	2.2148E-05
82	RHM	105	4.5000E+01	2.6641E-03	0.0	2.5940E-02
83	RH	105	1.2730E+05	9.8670E-03	1.5180E-01	7.8895E-02
84	RH	106	3.0400E+01	3.9171E-03	7.0960E-01	2.0348E-01
85	RH	107	1.3020E+03	1.7340E-03	4.3529E-01	3.1618E-01
86	SN	130	2.2320E+02	9.0010E-03	3.5127E-01	6.5527E-01
87	SB	127	3.0931E+05	1.2844E-03	3.0390E-01	6.7331E-01
88	SB	129	1.5552E+04	6.3718E-03	4.0576E-01	1.3358E+00
89	SBM	130	3.7800E+02	1.1157E-02	9.7784E-01	2.6454E+00
90	SB	130	2.4000E+03	2.9877E-03	6.9522E-01	3.2693E+00
91	SB	133	1.6200E+02	2.2346E-02	4.2947E-01	2.2478E+00
92	TEM	125	5.0110E+06	6.7480E-05	9.7300E-02	2.6708E-03
93	TEM	127	9.4176E+06	2.2418E-04	5.6621E-03	8.7619E-02
94	TE	127	3.3660E+04	1.2799E-03	2.2342E-01	4.9463E-03
95	TEM	129	2.9030E+06	1.9080E-03	1.9150E-01	9.4832E-02
96	TE	129	4.1760E+03	6.2156E-03	5.2260E-01	5.9948E-02
97	TEM	131	1.0800E+05	3.5440E-03	2.1240E-01	1.4092E+00
98	TE	131	1.5000E+03	2.5405E-02	7.5970E-01	4.1616E-01
99	TE	132	2.8080E+05	4.1877E-02	1.0020E-01	2.0507E-01
100	TEM	133	3.3240E+03	3.9298E-02	7.4112E-01	1.9619E+00

Prepared by YHI 7/21/82
Checked by SAK 7/23/82

Appendix II

	ISOTOPE		HALFLIFE (SEC)	FISSION YIELD (ATM/FIS)	AVERAGE BETA ENERGY (MEV/DIS)	AVERAGE GAMMA ENERGY (MEV/DIS)
101	TE	133	7.4700E+02	3.0283E-02	7.9711E-01	9.5553E-01
102	TE	134	2.5080E+03	6.7648E-02	1.4738E-01	9.1626E-01
103	I	129	4.9540E+14	6.6493E-03	4.0220E-02	3.7695E-03
104	IM	130	5.4000E-02	7.9200E-07	1.8540E-01	1.1241E-01
105	I	130	4.4496E+04	2.4100E-06	2.8020E-01	2.1478E+00
106	I	131	6.9638E+05	2.8352E-02	1.9430E-01	3.8097E-01
107	I	132	8.2080E+03	4.2083E-02	5.1430E-01	2.3332E+00
108	I	133	7.4880E+04	6.7653E-02	4.0800E-01	6.0998E-01
109	I	134	3.1560E+03	7.6117E-02	6.1020E-01	2.5928E+00
110	I	135	2.3796E+04	6.4065E-02	3.6800E-01	1.5802E+00
111	IM	136	4.6000E+01	2.1095E-02	2.2100E+00	1.9166E+00
112	XEM	131	1.0282E+06	3.9694E-04	1.4280E-01	2.0058E-02
113	XEM	133	1.9440E+05	1.9140E-03	1.8980E-01	4.1559E-02
114	XE	133	4.5706E+05	6.7705E-02	1.3540E-01	4.5385E-02
115	XEM	135	9.3900E+02	1.0564E-02	9.5000E-02	4.3176E-01
116	XE	135	3.2940E+04	6.6334E-02	3.1680E-01	2.4696E-01
117	XE	137	2.2980E+02	6.1325E-02	1.6420E+00	1.9356E-01
118	XE	138	8.5020E+02	6.2836E-02	6.0580E-01	1.1830E+00
119	XE	139	4.0000E+01	5.1578E-02	1.8354E+00	8.3268E-01
120	XE	140	1.3600E+01	3.7182E-02	1.1166E+00	1.2859E+00
121	XE	141	1.7300E+00	1.2265E-02	2.2247E+00	8.5185E-01
122	XE	142	1.2200E+00	3.8409E-03	1.7850E+00	8.6998E-01
123	CS	134	6.5070E+07	4.5000E-07	1.5690E-01	1.0361E+00
124	CS	135	7.2580E+13	6.6348E-02	5.7450E-02	0.0
125	CS	136	1.1215E+06	5.2710E-05	1.0140E-01	2.1985E+00
126	CS	137	9.4671E+08	6.2626E-02	1.8840E-01	0.0
127	CS	138	1.9320E+03	6.7178E-02	1.2280E+00	2.3004E+00
128	CS	139	5.6400E+02	6.4137E-02	1.6749E+00	3.1672E-01
129	CS	140	6.3700E+01	5.9022E-02	1.9084E+00	1.3110E+00
130	CS	141	2.4900E+01	4.4186E-02	1.5011E+00	1.4236E+00
131	CS	142	1.7000E+00	2.7637E-02	2.6336E+00	8.7613E-01
132	BAM	137	1.5312E+02	5.9248E-02	6.4260E-02	5.9729E-01
133	BA	139	5.0940E+03	6.4816E-02	6.5389E-01	5.0502E-02
134	BA	140	1.1059E+06	6.3164E-02	3.1500E-01	1.9522E-01
135	BA	141	1.0962E+03	5.8670E-02	9.2804E-01	8.6534E-01
136	BA	142	6.4200E+02	5.8292E-02	3.8189E-01	1.0879E+00
137	LA	140	1.4497E+05	6.3221E-02	5.4050E-01	2.3074E+00
138	LA	141	1.4148E+04	5.8868E-02	9.5610E-01	4.2421E-02
139	LA	142	5.5620E+03	5.9304E-02	8.3560E-01	2.3845E+00
140	LA	143	8.4000E+02	5.9369E-02	1.4035E+00	1.7637E+00
141	CE	141	2.8080E+06	5.8868E-02	1.6930E-01	1.0181E-01
142	CE	143	1.1880E+05	5.9687E-02	3.8420E-01	3.4335E-01
143	CE	144	2.4538E+07	5.4554E-02	9.1300E-02	3.2865E-02
144	CE	145	1.8000E+02	3.9396E-02	6.0262E-01	8.7917E-01
145	CE	146	8.5200E+02	2.9864E-02	2.3568E-01	3.7498E-01
146	PR	143	1.1733E+06	5.9687E-02	3.1430E-01	0.0
147	PR	144	1.0368E+03	5.4555E-02	1.2258E+00	3.1010E-02
148	PR	145	2.1528E+04	3.9408E-02	6.7822E-01	1.3452E-02
149	NP	239	2.0300E+05	0.0	1.2380E-01	2.0845E+00

APPENDIX C

WATTS BAR NUCLEAR PLANT

NUREG-0588: CATEGORY 'C' COMPONENT LIST

Component	Function
1,2-PT -001-001C	SG 1 MAIN STEAM PRESS
1,2-FCV -001-004 (LS)	SG 1 MAIN STM HDR ISO VLV
1,2-HS -001-004B	SG 1 MAIN STM HDR ISO VLV TEST TR-A
1,2-HS -001-004D	SG 1 MAIN STM HDR ISO VLV TEST TR-B
1,2-ZS -001-004F	SG 1 MAIN STM ISOL VLV TR-A TEST SOL VLV POS
1,2-ZS -001-004J	SG 1 MAIN STM ISOL VLV TR-A TEST SOL VLV POS
1,2-FCV -001-007 (LS)	SG 1 BLOWDOWN FLOW CONTROL VLV
1,2-PT -001-008C	SG 2 MAIN STEAM PRESS
1,2-FCV -001-011 (LS)	SG 2 MAIN STM HDR ISO VLV
1,2-HS -001-011B	SG 2 MAIN STM HDR ISO VLV TEST TR-A
1,2-HS -001-011D	SG 2 MAIN STM HDR ISO VLV TEST TR-B
1,2-ZS -001-011F	SG 2 MAIN STM ISOL VLV TR-A TEST SOL VLV POS
1,2-ZS -001-011J	SG 2 MAIN STM ISOL VLV TR-B TEST SOL VLV POS
1,2-FCV -001-014 (LS)	SG 2 BLOWDOWN HDR FLOW CONTROL VLV
1,2-PT -001-019C	SG 3 MAIN STEAM PRESS
1,2-FCV -001-022 (LS)	SG 3 MAIN STM HDR ISOLATION VLV
1,2-HS -001-022B	SG 3 MAIN STM HDR ISO VLV TEST TR-A
1,2-HS -001-022D	SG 3 MAIN STM HDR ISO VLV TEST TR-B
1,2-ZS -001-022F	SG 3 MAIN STM ISOL VLV TR-A TEST SOL VLV POS
1,2-ZS -001-022J	SG 3 MAIN STM ISOL VLV TR-B TEST SOL VLV POS
1,2-FCV -001-025 (LS)	SG 3 BLOWDOWN HDR FLOW CONTROL VLV
1,2-PT -001-026C	SG 4 MAIN STEAM PRESS
1,2-FCV -001-029 (LS)	SG 4 MAIN STM HDR ISOLATION VLV
1,2-HS -001-029B	SG 4 MAIN STM HDR ISO VLV TEST TR-A
1,2-HS -001-029D	SG 4 MAIN STM HDR ISO VLV TEST TR-B
1,2-ZS -001-029F	SG 4 MAIN STM ISOL VLV TR-A TEST SOL VLV POS
1,2-ZS -001-029J	SG 4 MAIN STM ISOL VLV TR-B TEST SOL VLV POS
1,2-FCV -001-032 (LS)	SG 4 BLOWDOWN HDR FLOW CONTROL VLV

Component	Function
1,2-FI -003-147D	SG 3 AUX FW INLET FLOW INDICATOR
1,2-FI -003-155D	SG 2 AUX FW INLET FLOW INDICATOR
1,2-FT -003-035A	SG 1 FW INLET FLOW TRANSMITTER
1,2-FT -003-035B	SG 1 FW INLET FLOW TRANSMITTER
1,2-FT -003-048A	SG 2 FW INLET FLOW TRANSMITTER
1,2-FT -003-048B	SG 2 FW INLET FLOW TRANSMITTER
1,2-FT -003-090A	SG 3 FW INLET FLOW TRANSMITTER
1,2-FT -003-090B	SG 3 FW INLET FLOW TRANSMITTER
1,2-FT -003-103A	SG 4 FW INLET FLOW TRANSMITTER
1,2-FT -003-103B	SG 4 FW INLET FLOW TRANSMITTER
1,2-FI -003-170D	SG 4 AUX FW INLET FLOW INDICATOR
1,2-FI -003-163D	SG 1 AUX FW INLET FLOW INDICATOR
UNIT 1 RELAY B2-1	AFPT T&T VALVE PHOTO ISOLATORS
UNIT 2 RELAY B2-1	AFPT T&T VALVE PHOTO ISOLATORS
UNIT 1 RELAY B2-2	AFPT T&T VALVE PHOTO ISOLATORS
UNIT 2 RELAY B2-2	AFPT T&T VALVE PHOTO ISOLATORS
1,2-LI -003-043B	SG 1 WIDE RANGE LEVEL INDICATION
1,2-LI -003-056B	SG 2 WIDE RANGE LEVEL INDICATION
1,2-LI -003-098B	SG 3 WIDE RANGE LEVEL INDICATION
1,2-LI -003-111B	SG 4 WIDE RANGE LEVEL INDICATION

Component	Function
0-FCV -026-126	HPFP TR-A HDR FLOW CONT VALVE TO AUX BLDG
0-HS -026-126B	HPFP AUX BLDG TR-A HDR VALVE
0-FCV -026-127	HPFP TR-B HDR FLOW CONT VALVE TO AUX BLDG
0-HS -026-127B	HPFP TR-B HDR FLOW CONT SW

Component	Function
1,2-HS -030-038B	CONTAINMENT AIR RETURN FAN LOCAL CONTROLS
1,2-HS -030-039B	CONTAINMENT AIR RETURN FAN LOCAL CONTROLS
1,2-FS -030-074A/B	LOWER COMPT COOL UNIT A-A FLOW
1,2-HS -030-074B	LOWER COMPT COOL UNIT A-A
1,2-FS -030-074C/D	LOWER COMPT COOL UNIT A-A FLOW
1,2-FS -030-074D/C	LOWER COMPT COOL UNIT A-A FLOW
1,2-FS -030-075A/B	LOWER COMPT COOL UNIT B-B
1,2-HS -030-075B	LOWER COMPT COOL UNIT B-B
1,2-FS -030-075C/D	LOWER COMPT COOL UNIT B-B FLOW
1,2-FS -030-075D/C	LOWER COMPT COOL UNIT B-B FLOW
1,2-FS -030-077A/B	LOWER COMPT COOL UNIT C-A
1,2-HS -030-077B	LOWER COMPT COOL UNIT C-A
1,2-FS -030-077C/D	LOWER COMPT COOL UNIT C-A FLOW
1,2-FS -030-077D/C	LOWER COMPT COOL UNIT C-A FLOW
1,2-FS -030-078A/B	LOWER COMPT COOL UNIT D-B
1,2-HS -030-078B	LOWER COMPT COOL UNIT D-B
1,2-FS -030-078C/D	LOWER COMPT COOL UNIT D-B FLOW
1,2-FS -030-078D/C	LOWER COMPT COOL UNIT D-B FLOW
1,2-TS -030-080	CRD COOL UNIT TEMP CONT
1,2-FS -030-080A/B	CRD COOL UNIT D-B FLOW ALM
1,2-HS -030-080B	CRD COOL UNIT D-B FAN CNTL
1,2-FS -030-080B/A	CRD COOL UNIT D-B FLOW
1,2-TCO -030-081 (LS)	CRD COOL UNIT D-B SUCT DMPR
1,2-TSV -030-081	CRD COOL UNIT D-B SUCT DMPR
1,2-TCO -030-082 (LS)	CRD COOL UNIT D-B RM DIV DMPR
1,2-TSV -030-082	CRD COOL UNIT D-B RM DIV DMPR
1,2-TS -030-083	CRD COOL UNIT TEMP CONT
1,2-FS -030-083A/B	CRD COOL UNIT A-A FLOW ALM
1,2-HS -030-083B	CRD COOL UNIT A-A FAN CNTL
1,2-FS -030-083B/A	CRD COOL UNIT A-A FLOW
1,2-TCO -030-084 (LS)	CRD COOL UNIT A-A SUCT DMPR
1,2-TSV -030-084	CRD COOL UNIT A-A SUCT DMPR
1,2-TCO -030-085 (LS)	CRD COOL UNIT A-A RM DIV DMPR
1,2-TSV -030-085	CRD COOL UNIT A-A RM DIV DMPR
1,2-TS -030-088	CRD COOL UNIT TEMP CONT
1,2-FS -030-088A/B	CRD COOL UNIT C-A FLOW ALM
1,2-HS -030-088B	CRD COOL UNIT C-A FAN CNTL
1,2-FS -030-088B/A	CRD COOL UNIT C-A FLOW
1,2-TCO -030-089 (LS)	CRD COOL UNIT C-A SUCT DMPR
1,2-TSV -030-089	CRD COOL UNIT C-A SUCT DMPR
1,2-TCO -030-090 (LS)	CRD COOL UNIT C-A RM DIV DMPR
1,2-TSV -030-090	CRD COOL UNIT C-A RM DIV DMPR
1,2-TS -030-092	CRD COOL UNIT TEMP CONT
1,2-FS -030-092A/B	CRD COOL UNIT B-B FLOW ALM
1,2-HS -030-092B	CRD COOL UNIT B-B FAN CNTL
1,2-FS -030-092B/A	CRD COOL UNIT B-B FLOW
1,2-TCO -030-093 (LS)	CRD COOL UNIT B-B SUCT DMPR
1,2-TSV -030-093	CRD COOL UNIT B-B SUCT DMPR
1,2-TCO -030-094 (LS)	CRD COOL UNIT B-B RM DIV DMPR
1,2-TSV -030-094	CRD COOL UNIT B-B RM DIV DMPR
1-ZS -030-146A	ABGTS FAN A-A ISOL DMPR
1-ZS -030-146B	ABGTS FAN A-A ISOL DMPR

Component	Function
2-ZS -030-157A	AUX BLDG GAS TMT FAN B-B EXH DMPR POS SW
2-ZS -030-157B	AUX BLDG GAS TMT FAN B-B EXH DMPR POS SW
1,2-TS -030-175	RHR PUMP RM CLRS FAN A-A
1,2-TS -030-176	RHR PUMP RM CLRS FAN B-B
1,2-TS -030-177	CS PUMP RM CLRS FAN A-A
1,2-TS -030-178	CS PUMP RM CLRS FAN B-B
1,2-TS -030-179	SIS PUMP RM CLRS FAN B-B
1,2-TS -030-180	SIS PUMP RM CLRS FAN A-A
1,2-TS -030-182	CHG PUMP RM CLRS FAN B-B
1,2-TS -030-183	CHG PUMP RM CLRS FAN A-A
2-TS -030-200	EMERG GAS TMT SYS CLRS FAN A-A
2-TS -030-207	EMERG GAS TMT SYS CLRS FAN B-B
1,2-MTR -030-074	LOWER COMPT COOLER UNIT A-A
1,2-MTR -030-075	LOWER COMPT COOLER UNIT B-B
1,2-MTR -030-077	LOWER COMPT COOLER UNIT C-A
1,2-MTR -030-078	LOWER COMPT COOLER UNIT D-B
1,2-MTR -030-080/1	CRD COOLER UNIT D-B
1,2-MTR -030-080/2	CRD COOLER UNIT D-B
1,2-MTR -030-083/1	CRD COOLER UNIT A-A
1,2-MTR -030-083/2	CRD COOLER UNIT A-A
1,2-MTR -030-088/1	CRD COOLER UNIT C-A
1,2-MTR -030-088/2	CRD COOLER UNIT C-A
1,2-MTR -030-092/1	CRD COOLER UNIT B-B
1,2-MTR -030-092/2	CRD COOLER UNIT B-B

Component	Function
0-LS -031-071	SHTDN BD RM CHILL A-A COMP TK LEVEL
0-PDIS-031-101	SHTDN BD RMS A&B CHIL A-A PMP DIF PRESS
0-PDIS-031-131	SHTDN BD RMS A&B CHIL B-B PMP DIFF P
0-LS -031-147	SHTDN BD RM CHILLER B-B COMP TK
0-PDIS-031-161	MCR CHILLER A-A PUMP DIFF PRESS
0-LS -031-170	MCR CHILLER A-A COMP TK LEVEL
0-PDIS-031-186	MCR CHILLER B-B PUMP DIFF PRESS
0-LS -031-195	MCR CHILLER B-B COMP TK LEVEL
0-FSV -031-116	SHTDN BD RM A&B CHILLER A-A MAKEUP WATER
0-FSV -031-146	SHTDN BD RM A&B CHILLER B-B MAKEUP WATER
0-FSV -031-173	MCR CHILLER A-A MAKEUP WATER
0-FSV -031-198	MCR CHILLER B-B MAKEUP WATER

Component	Function
1,2-HS -043-002A	LOCA CNTMT ISOLATION RESET SW
1,2-FCV -043-054D (LS)	STM GEN NO. 1 SAMPLE CNTMT ISOLATION VLV
1,2-FCV -043-055 (LS)	SG 1 BLOWDOWN ISOL VLV
1,2-FCV -043-056D (LS)	STM GEN NO. 2 SAMPLE CNTMT ISOLATION VLV
1,2-FCV -043-058 (LS)	SG 2 BLOWDOWN ISOL VLV
1,2-FCV -043-059D (LS)	STM GEN NO. 3 SAMPLE CNTMT ISOLATION VLV
1,2-FCV -043-061 (LS)	SG 3 BLOWDOWN ISOL VLV
1,2-FCV -043-063D (LS)	STM GEN NO. 4 SAMPLE CNTMT ISOLATION VLV
1,2-FCV -043-064 (LS)	SG 4 BLOWDOWN ISOL VLV
1,2-FCV -043-201A (LS)	LOCA H2 MONITOR CNTMT ISOL
1,2-FCV -043-202A (LS)	LOCA H2 MONITOR CNTMT ISOL
1,2-FCV -043-207B (LS)	LOCA H2 MONITOR CNTMT ISOL
1,2-FCV -043-208B (LS)	LOCA H2 MONITOR CNTMT ISOL

Component	Function
1,2-FCV -062-059 (LS)	EXCESS LETDOWN DIV FLOW CONT
1,2-FSV -062-059	EXCESS LETDOWN DIV FLOW CONT
1,2-FCV -062-077 (LS)	LETDOWN ISOL VALVE FLOW CONT
1,2-TCV -062-079 (LS)	LETDOWN FLOW TEMP DIVERSION CONT VLV
1,2-TSV -062-079	LETDOWN FLOW TEMP DIVERSION CONT
1,2-FCV -062-084 (LS)	CHARGING FLOW TO RCS SPRAY
1,2-FSV -062-084	CHARGING FLOW TO RCS SPRAY
1,2-FCV -062-085 (LS)	CHARGING FLOW RCS CL LOOP 1
1,2-FSV -062-085	CHARGING FLOW RCS CL LOOP 1
1,2-FCV -062-086 (LS)	CHARGING FLOW RCS CL LOOP 4
1,2-FSV -062-086	CHARGING FLOW RCS CL LOOP 4
1,2-LSV -062-118A	DIVERSION FLOW TO HOLDUP TANKS
1,2-LSV -062-118B	DIVERSION FLOW TO HOLDUP TANKS
1,2-FCV -062-128 (LS)	BORIC ACID BLENDER TO VCT INLET
1,2-FCV -062-138	EMERGENCY BORATION FLOW CONT VLV
1,2-HS -062-138B	EMERGENCY BORATION FLOW CONT VLV
1,2-FSV -062-140A	BORIC ACID TO BLENDER FLOW CONT
1,2-FSV -062-140B	BORIC ACID TO BLENDER FLOW CONT
1,2-FCV -062-143 (LS)	PMW TO BA BLENDER FLOW CONT
1,2-FCV -062-144 (LS)	MAKEUP INJECTION VALVE
1,2-MTR -062-230	BORIC ACID TRANS PUMP A-A MOTOR
1,2-HS -062-230B	BA TRANS PUMP 1A-A CONTROL
1,2-MTR -062-232	BORIC ACID TRANS PUMP B-B MOTOR
1,2-HS -062-232B	BA TRANS PUMP 1B-B CONTROL
1-HS -062-239	BORIC ACID TANK A HTR A CONT
2-HS -062-239	BORIC ACID TANK B HTR A CONT
1,2-TIT -062-239	BORIC ACID TANK A TEMP CONT
1,2-TS -062-239A	BORIC ACID TANK A HTR A CNTL
1,2-TS -062-239B	BORIC ACID TANK A TEMP ALARM
1,2-TS -062-239D	BORIC ACID TANK A LO TEMP ALARM
0-HS -062-243	BA TANK C HTR A CONTROL
0-TIT -062-243	BA TANK C HTR A TEMP CONT
0-TS -062-243A	BORIC ACID TANK C HTR A CNTL
0-TS -062-243B	BORIC ACID TANK C HIGH TEMP ALM
0-TS -062-243D	BORIC ACID TANK C LOW TEMP ALM
1,2-PS -062-244	AUX OIL PUMP B-B CHG B-B CNTL
1-HS -062-245	BA TANK A HTR B CONT
2-HS -062-245	BA TANK B HTR B CONT
1,2-TIT -062-245	BA TANK A HTR B TEMP CONT
1,2-TS -062-245A	BORIC ACID TANK A HTR B CNTL
1,2-TS -062-245B	BORIC ACID TANK A TEMP HIGH
1,2-TS -062-245D	BORIC ACID TANK A TEMP LOW
0-HS -062-246	BA TANK C HTR B CONT
0-TIT -062-246	BA TANK C HTR B TEMP CONT
0-TS -062-246A	BORIC ACID TANK C HTR B CNTL
0-TS -062-246B	BORIC ACID TANK C HIGH TEMP ALM
0-TS -062-246D	BORIC ACID TANK C LOW TEMP ALM
1,2-PS -062-247	AUX OIL PUMP A-A CHG PUMP A-A CNTL
1,2-FCV -062-140B (LS)	BORIC ACID MAKEUP VALVE
1,2-TIS -062-079	LETDOWN FLOW TEMP DIVERSION CONT
1,2-LCV -062-118 (LS)	DIVERSION FLOW TO HOLDUP TANKS
1,2-HTR -062-239	BORIC ACID HEATERS

Component	Function
0-HTR -062-243	BORIC ACID HEATERS
1,2-HTR -062-245	BORIC ACID HEATERS
0-HTR -062-246	BORIC ACID HEATERS
1,2-HTR -062-AOP-A	AUX OIL PUMPS FOR CENTRIFUGAL CHARGING PUMPS
1,2-HTR -062-AOP-B	AUX OIL PUMPS FOR CENTRIFUGAL CHARGING PUMPS

Component	Function
1,2-ZS -063-001	RWST TO RHR PUMP SUCTION
1,2-ZS -063-005	RWST TO RHR PUMP SUCTION
1,2-HS -063-036	SIS BORON INJ TANK HEATER SW
1,2-HTR -063-036	BORON INJ TANK HEATERS
1,2-TIS -063-036	BORON INJ TANK TEMP
1,2-HS -063-037	SIS BORON INJ TANK HEATER SW
1,2-HTR -063-037	BORON INJ TANK HEATERS
1,2-FCV -063-067	SIS ACCUM TK 4 FLOW ISOLATION VLV
1,2-ZS -063-067	SIS ACCUM TK 4 FLOW ISOLATION VLV
1,2-HS -063-067B	SIS ACCUM TK 4 FLOW ISOLATION VLV
1,2-FCV -063-080	SIS ACCUM TK 3 FLOW ISOL VLV
1,2-HS -063-080B	SIS ACCUM TK 3 FLOW ISOLATION VLV
1,2-ZS -063-080	SIS ACCUM TK 3 FLOW ISOLATION VLV
1,2-FCV -063-098	SIS ACCUM TK 2 FLOW ISOL VLV
1,2-HS -063-098B	SIS ACCUM TK 2 FLOW ISOL VLV
1,2-ZS -063-098	SIS ACCUM TK 2 FLOW ISOL VLV
1,2-FCV -063-118	SIS ACCUM TK 1 FLOW ISOLATION VLV
1,2-HS -063-118B	SIS ACCUM TK 1 FLOW ISOL VLV
1,2-ZS -063-118	SIS ACCUM TK 1 FLOW ISOL VLV

Component	Function
2-FCV -065-007 (LS)	EGTS TRAIN A UNIT 2 SUCT
1-FCV -065-008 (LS)	EGTS TRAIN A UNIT 1 SUCT
2-FCO -065-009 (LS)	EGTS TRAIN A UNIT 2 SUCT
1-FCO -065-010 (LS)	EGTS TRAIN A UNIT 1 SUCT
0-ME -065-016	EGTS TRAIN A MOISTURE LEVEL
0-MM -065-016	EGTS TRAIN A MOISTURE LEVEL
1-FCO -065-026 (LS)	UNIT 1 SHIELD BLDG EXH A
1-FCO -065-027 (LS)	UNIT 1 SHIELD BLDG EXH B
0-FCV -065-028A (LS)	EGTS TRAIN A DECAY COOLING DAMPERS
0-FCV -065-028B (LS)	EGTS TRAIN A DECAY COOLING DAMPERS
2-FCO -065-029 (LS)	EGTS TRAIN B UNIT 2 SUCT
1-FCO -065-030 (LS)	EGTS TRAIN B UNIT 1 SUCT
0-ME -065-036	EGTS TRAIN B MOISTURE LEVEL
0-MM -065-036	EGTS TRAIN B MOISTURE LEVEL
2-FCO -065-045 (LS)	UNIT 2 SHIELD BLDG EXH A
2-FCO -065-046 (LS)	UNIT 2 SHIELD BLDG EXH B
0-FCV -065-047A (LS)	EGTS TRAIN B DECAY COOL VLV A
0-FCV -065-047B (LS)	EGTS TRAIN B DECAY COOL VLV B
2-FCO -065-050 (LS)	EGTS TRAIN B UNIT 2 SUCT
1-FCV -065-051 (LS)	EGTS TRAIN B UNIT 1 SUCT
1,2-HS -065-080	CNTMT ANNULUS DP
1,2-PCV -065-081 (LS)	SHIELD BLDG VENT & CNTMT ANNULUS ISOL VLV
1,2-HS -065-082	CNTMT ANNULUS DP
1,2-PCV -065-083 (LS)	SHIELD BLDG VENT & CNTMT ANNULUS ISOL VLV
1,2-PCV -065-086 (LS)	EGTS CNTMT ANNULUS ISOL VLV
1,2-PCV -065-087 (LS)	EGTS CNTMT ANNULUS ISOL VLV
1,2-HS -065-090	CNTMT ANNULUS DP
1,2-HS -065-097	CNTMT ANNULUS DP

Component	Function
1,2-TCV -067-084 (LS)	LOWER CNTMT VENT CLR A TEMP CONT VLV
1,2-TIC -067-084	LOWER CNTMT VENT CLR A TEMP
1,2-TM -067-084	LOWER CNTMT VENT CLR A TEMP
1,2-TSV -067-084	LOWER CNTMT VENT CLR A TEMP CONT VLV
1,2-TCV -067-085 (LS)	CONTROL ROD DRIVE VENT CLR A TEMP CONT VLV
1,2-TIC -067-085	CONTROL ROD DRIVE VENT CLR A TEMP
1,2-TM -067-085	CONTROL ROD DRIVE VENT CLR A TEMP
1,2-TSV -067-085	CONTROL ROD DRIVE VENT CLR A TEMP CONT VLV
1,2-TCV -067-086 (LS)	RC PUMP MOTOR CLRS A SUPPLY CONTROL VLV
1,2-TSV -067-086	RCP 1 MOTOR CLR SUPPLY CONTROL VLV
1,2-TCV -067-092 (LS)	LWR CNTMT VENT CLR C TEMP CONT VLV
1,2-TIC -067-092	LWR CNTMT VENT CLR C TEMP
1,2-TM -067-092	LWR CNTMT VENT CLR C TEMP
1,2-TSV -067-092	LWR CNTMT VENT CLR C TEMP CONT VLV
1,2-TCV -067-093 (LS)	CONTROL ROD DRIVE VENT CLR C TEMP CONT VLV
1,2-TIC -067-093	CONTROL ROD DRIVE VENT CLR C TEMP
1,2-TM -067-093	CONTROL ROD DRIVE VENT CLR C TEMP
1,2-TSV -067-093	CONTROL ROD DRIVE VENT CLR C TEMP CONT VLV
1,2-TCV -067-094 (LS)	RC PUMP 3 MON CLR SUPPLY CONTROL VLV
1,2-TSV -067-094	RCP 3 MOTOR CLR SUPPLY CONTROL VLV
1,2-TCV -067-100 (LS)	LWR CNTMT VENT CLR B TEMP CONT VLV
1,2-TIC -067-100	LWR CNTMT VENT CLR B TEMP
1,2-TM -067-100	LWR CNTMT VENT CLR B TEMP
1,2-TSV -067-100	LWR CNTMT VENT CLR B TEMP CONT VLV
1,2-TCV -067-101 (LS)	CONTROL ROD DRIVE VENT CLR B TEMP CONT VLV
1,2-TIC -067-101	CONTROL ROD DRIVE VENT CLR B TEMP
1,2-TM -067-101	CONTROL ROD DRIVE VENT CLR B TEMP
1,2-TSV -067-101	CONTROL ROD DRIVE VENT CLR B TEMP CONT VLV
1,2-TCV -067-102 (LS)	RC PUMP 2 MON CLR SUPPLY CONTROL VLV
1,2-TSV -067-102	RCP 2 MOTOR CLR SUPPLY CONTROL VLV
1,2-TCV -067-108 (LS)	LWR CNTMT VENT CLR D TEMP CONT VLV
1,2-TIC -067-108	LWR CNTMT VENT CLR D TEMP
1,2-TM -067-108	LWR CNTMT VENT CLR D TEMP
1,2-TSV -067-108	LWR CNTMT VENT CLR D TEMP CONT VLV
1,2-TCV -067-109 (LS)	CONTROL ROD DRIVE VENT CLR D TEMP CONT VLV
1,2-TIC -067-109	CONTROL ROD DRIVE VENT CLR D TEMP
1,2-TM -067-109	CONTROL ROD DRIVE VENT CLR D TEMP
1,2-TSV -067-109	CONTROL ROD DRIVE VENT CLR D TEMP CONT VLV
1,2-TCV -067-110 (LS)	RC PUMP 4 MON CLR SUPPLY CONTROL VLV
1,2-TSV -067-110	RCP 4 MOTOR CLR SUPPLY CONTROL VLV
1,2-FCV -067-127	AUX BLDG AIR CLRS SUP HTR A ISOL VLV
1,2-FCV -067-128	AUX BLDG AIR CLRS SUP HTR B ISOL VLV
0-FCV -067-205	STA SER & CNTL AIR COMP SUP HDR 1A ISOL VLV
0-HS -067-205B	STA SER & CNTLAIR CMPR SUP HDRLA ISOL VLV
0-FCV -067-208	STA SER & CNTL AIR COMP SUP HDR 1A ISOL VLV
0-HS -067-208B	STA SER & CONT AIR SUP HDR 1B ISOL VLV
1-FSV -067-213	SPENT FUEL & TB BSTR PMP SPCE CLR A SUP VLV
1-FSV -067-215	SPENT FUEL & TB BSTR PMP SPCE CLR B SUP VLV

Component	Function
1,2-FT -068-006A	RCS LOOP 1 COOLANT FLOW
1,2-FT -068-006B	RCS LOOP 1 COOLANT FLOW
1,2-FT -068-006D	RCS LOOP 1 COOLANT FLOW
1,2-FT -068-029A	RCS LOOP 2 COOLANT FLOW
1,2-FT -068-029B	RCS LOOP 2 COOLANT FLOW
1,2-FT -068-029D	RCS LOOP 2 COOLANT FLOW
1,2-FT -068-048A	RCS LOOP 3 COOLANT FLOW
1,2-FT -068-048B	RCS LOOP 3 COOLANT FLOW
1,2-FT -068-048D	RCS LOOP 3 COOLANT FLOW
1,2-PT -068-066	RCS LOOP 4 HOT LEG PRESS.
1,2-PS -068-066A	RCS LP 4 HL AUX CONT RHR VALVE INTERLOCK
1,2-PS -068-066D	RCS LP 4 HL AUX CONT RHR VALVE INTERLOCK
1,2-PS -068-068A	RCS LP 4 HL AUX CONT RHR VALVE INTERLOCK
1,2-PS -068-068D	RCS LP 4 HL AUX CONT RHR VALVE INTERLOCK
1,2-FT -068-071A	RCS LOOP 4 COOLANT FLOW
1,2-FT -068-071B	RCS LOOP 4 COOLANT FLOW
1,2-FT -068-071D	RCS LOOP 4 COOLANT FLOW
1,2-LT -068-321	RCS PRZR LEVEL
1,2-PCV -068-334 (LS)	RCS PRZR PWR RELIEF VALVE
2-PCV -068-340A (LS)	RCS PRZR PWR RELIEF VALVE
1,2-PCV -068-340B (LS)	RCS PRZR PRESS
1,2-PCV -068-340D (LS)	RCS PRZR PRESS
1,2-TE -068-398	REACTOR VESSEL HEAD VENT TEMP
1,2-HTR -068-341A/A1-A	PRZR HEATER BACKUP GROUP A-A
1,2-HTR -068-341A/A2-A	PRZR HEATER BACKUP GROUP A-A
1,2-HTR -068-341A/A3-A	PRZR HEATER BACKUP GROUP A-A
1,2-HTR -068-341A/A4-A	PRZR HEATER BACKUP GROUP A-A
1,2-HTR -068-341A/A5-A	PRZR HEATER BACKUP GROUP A-A
1,2-HTR -068-341A/A6-A	PRZR HEATER BACKUP GROUP A-A
1,2-HTR -068-341A/A7-A	PRZR HEATER BACKUP GROUP A-A
1,2-HTR -068-341D/B1-B	PRZR HEATER BACKUP GROUP B-B
1,2-HTR -068-341D/B2-B	PRZR HEATER BACKUP GROUP B-B
1,2-HTR -068-341D/B3-B	PRZR HEATER BACKUP GROUP B-B
1,2-HTR -068-341D/B4-B	PRZR HEATER BACKUP GROUP B-B
1,2-HTR -068-341D/B5-B	PRZR HEATER BACKUP GROUP B-B
1,2-HTR -068-341D/B6-B	PRZR HEATER BACKUP GROUP B-B
1,2-HTR -068-341D/B7-B	PRZR HEATER BACKUP GROUP B-B
1,2-HTR -068-341H/C1-B	PRZR HEATER BACKUP GROUP C-B
1,2-HTR -068-341H/C2-B	PRZR HEATER BACKUP GROUP C-B
1,2-HTR -068-341H/C3-B	PRZR HEATER BACKUP GROUP C-B
1,2-HTR -068-341H/C4-B	PRZR HEATER BACKUP GROUP C-B
1,2-HTR -068-341H/C5-B	PRZR HEATER BACKUP GROUP C-B
1,2-HTR -068-341H/C6-B	PRZR HEATER BACKUP GROUP C-B
1,2-HTR -068-341F/D1-A	PRZR HEATER BACKUP GROUP D-A
1,2-HTR -068-341F/D2-A	PRZR HEATER BACKUP GROUP D-A
1,2-HTR -068-341F/D3-A	PRZR HEATER BACKUP GROUP D-A
1,2-HTR -068-341F/D4-A	PRZR HEATER BACKUP GROUP D-A
1,2-HTR -068-341F/D5-A	PRZR HEATER BACKUP GROUP D-A
1,2-HTR -068-341F/D6-A	PRZR HEATER BACKUP GROUP D-A

Component	Function
1,2-FCV -070-004	MISC EQUIP HDR INLET VLV
1,2-HS -070-004B	MISC EQUIP HDR INLET VLV SW
2-PT -070-017C	CCS HTX B INLET PRESS XMTR
1,2-FIS -070-081	THRM BARRIER SUP HDR FLOW SW PMP ON
1,2-FT -070-081A	THRM BARRIER RET HDR FLOW TRANS
1,2-FT -070-081B	THRM BARRIER RET HDR FLOW TRANS
1,2-FT -070-081D	THRM BARRIER RET HDR FLOW TRANS
1,2-FT -070-081E	THRM BARRIER RET HDR FLOW TRANS
1,2-HS -070-087B	RC PMP THRM BAR RET CONTMNT ISOL VLV SW
1,2-HS -070-089B	RC PMP OIL CLR RET CONTMNT ISOL VLV SW
1,2-HS -070-090B	RC PMP THRM BAR RET CONTMNT ISOL VLV SW
1,2-HS -070-130B	THRM BARR BST PMP B-B MOTOR CONTROL
1,2-HS -070-131B	THRM BARR BST PMP A-A MOTOR CONTROL
1,2-HS -070-133B	RC PMP THRM BAR CONT ISOL VLV SW
1,2-HS -070-134B	RC PMP THRM BAR CONT ISOL VLV SW
1,2-FCV -070-139	RC PMP OIL CLR HDR CONT ISOL VLV
1,2-HS -070-139B	RCP OIL CLR HDR ISOL VLV
1,2-HS -070-143B	EXCESS LTDN HTX CONT INLET ISOL VLV SW
1,2-FCV -070-168	BA GAS STR EVAP PKG A FLOW CONT VLV
1,2-HS -070-168B	BA GAS STRP EVP PKG A FLOW CONT VLV SW
1,2-FCV -070-183	SAMPLE HX HDR OUTLET VLV
1,2-HS -070-183B	SAMPLE HTX HDR OUTLET VLV SW
0-HS -070-206B	COND DEMIN WASTE EVAP BLDG RETURN
0-HS -070-111	AUX WASTE EVAP PKG OUTLET VALVE
THERMAL BARRIER BOOSTER PUMP MOTOR	
070-1A-A	THERMAL BARRIER COOLING
070-2A-A	THERMAL BARRIER COOLING
070-1B-B	THERMAL BARRIER COOLING
070-2B-B	THERMAL BARRIER COOLING

Component	Function
1,2-HS -072-040B	RHR SPRAY HDR A ISOL VLV HAND SWITCH
1,2-HS -072-041B	RHR SPRAY HDR B ISOL VLV HAND SWITCH
1,2-FCV -072-040 (LS)	RHR SPRAY HDR A ISOL VLV
1,2-FCV -072-041 (LS)	RHR SPRAY HDR B ISOL VLV
1,2-ZS -072-044	CNTMNT SUMP TO HDR A FLOW CNT VLV STM LMT SW
1,2-ZS -072-045	CNTMNT SUMP TO HDR A FLOW CNT VLV STM LMT SW

Component	Function
1,2-TS -074-043	RHR RETURN LINE PIPE BREAK DETECTOR
1,2-TS -074-044	RHR RETURN LINE PIPE BREAK DETECTOR
1,2-TS -074-045	RHR RETURN LINE PIPE BREAK DETECTOR
1,2-TS -074-046	RHR RETURN LINE PIPE BREAK DETECTOR

Component	Function
1,2-FCV -077-010 (LS)	RCDT PUMP DISCHARGE VALVE FLOW CONTROL
1,2-FCV -077-017 (LS)	RCDT TO GA FLOW CONTROL
1,2-FCV -077-019 (LS)	RCDT TO VENT HDR FLOW CONTROL
1,2-FCV -077-020 (LS)	RCDT N2 SUPPLY FLOW CONTROL
1,2-LI -077-410	REAC BLDG AUX FL&EQ DR SUMP LEVEL INDICATOR
1,2-LI -077-411	REAC BLDG AUX FL&EQ DR SUMP LEVEL INDICATOR

Component	Function
0-HS -078-019	REFUELING WATER PURIFICATION PUMP A-A MOTOR SWITCH
0-HS -078-020	REFUELING WATER PURIFICATION PUMP B-B MOTOR SWITCH
0-MTR -078-019A	REFUELING WATER PURIFICATION PUMP A-A MOTOR
0-MTR -078-020B	REFUELING WATER PURIFICATION PUMP B-B MOTOR

Component	Function
1,2-FCV -087-017	CHGNG PMP RECIRC VALVE FLOW CONTROL
1,2-HS -087-017B	POSITIVE DISPLACEMENT PUMP RECIRC VALVE

Component	Function
1,2-FS -090-106A	CNTMT BLDG LWR COMPT AIR MON PART LO FLOW
1,2-FS -090-106B	CNTMT BLDG LWR COMPT MON IODINE LOW FLOW
1,2-FS -090-112A	CNTMT BLDG UP COMPT MON PART LOW FLOW
1,2-FS -090-112B	CNTMT BLDG UP COMPT MON IODINE LOW FLOW

Component	Function
1,2-NM -092-031A(NM-31A)	NEUTRON MON SYS SOURCE RANGE PREAMP
1,2-NM -092-032A(NM-32A)	NEUTRON MON SYS SOURCE RANGE PREAMP
1,2-NMB -092-NE31	SOURCE RANGE DETECTORS
1,2-NMB -092-NE32	SOURCE RANGE DETECTORS
1,2-NMB -092-NE35	INTERMEDIATE RANGE DETECTORS
1,2-NMB -092-NE36	INTERMEDIATE RANGE DETECTORS

Component	Function
1,2-HTR -268-001	HYDROGEN IGNITORS
1,2-HTR -268-002	HYDROGEN IGNITORS
1,2-HTR -268-003	HYDROGEN IGNITORS
1,2-HTR -268-004	HYDROGEN IGNITORS
1,2-HTR -268-005	HYDROGEN IGNITORS
1,2-HTR -268-006	HYDROGEN IGNITORS
1,2-HTR -268-007	HYDROGEN IGNITORS
1,2-HTR -268-008	HYDROGEN IGNITORS
1,2-HTR -268-009	HYDROGEN IGNITORS
1,2-HTR -268-010	HYDROGEN IGNITORS
1,2-HTR -268-011	HYDROGEN IGNITORS
1,2-HTR -268-012	HYDROGEN IGNITORS
1,2-HTR -268-013	HYDROGEN IGNITORS
1,2-HTR -268-014	HYDROGEN IGNITORS
1,2-HTR -268-015	HYDROGEN IGNITORS
1,2-HTR -268-016	HYDROGEN IGNITORS
1,2-HTR -268-017	HYDROGEN IGNITORS
1,2-HTR -268-018	HYDROGEN IGNITORS
1,2-HTR -268-019	HYDROGEN IGNITORS
1,2-HTR -268-020	HYDROGEN IGNITORS
1,2-HTR -268-021	HYDROGEN IGNITORS
1,2-HTR -268-022	HYDROGEN IGNITORS
1,2-HTR -268-023	HYDROGEN IGNITORS
1,2-HTR -268-024	HYDROGEN IGNITORS
1,2-HTR -268-025	HYDROGEN IGNITORS
1,2-HTR -268-026	HYDROGEN IGNITORS
1,2-HTR -268-027	HYDROGEN IGNITORS
1,2-HTR -268-028	HYDROGEN IGNITORS
1,2-HTR -268-029	HYDROGEN IGNITORS
1,2-HTR -268-030	HYDROGEN IGNITORS
1,2-HTR -268-031	HYDROGEN IGNITORS
1,2-HTR -268-032	HYDROGEN IGNITORS
1,2-HTR -268-033	HYDROGEN IGNITORS
1,2-HTR -268-034	HYDROGEN IGNITORS
1,2-HTR -268-035	HYDROGEN IGNITORS
1,2-HTR -268-036	HYDROGEN IGNITORS
1,2-HTR -268-037	HYDROGEN IGNITORS
1,2-HTR -268-038	HYDROGEN IGNITORS
1,2-HTR -268-039	HYDROGEN IGNITORS
1,2-HTR -268-040	HYDROGEN IGNITORS
1,2-HTR -268-041	HYDROGEN IGNITORS
1,2-HTR -268-042	HYDROGEN IGNITORS
1,2-HTR -268-043	HYDROGEN IGNITORS
1,2-HTR -268-044	HYDROGEN IGNITORS
1,2-HTR -268-045	HYDROGEN IGNITORS
1,2-HTR -268-046	HYDROGEN IGNITORS
1,2-HTR -268-047	HYDROGEN IGNITORS
1,2-HTR -268-048	HYDROGEN IGNITORS
1,2-HTR -268-049	HYDROGEN IGNITORS
1,2-HTR -268-050	HYDROGEN IGNITORS
1,2-HTR -268-051	HYDROGEN IGNITORS
1,2-HTR -268-052	HYDROGEN IGNITORS

Category 'C' Component List

Component	Function
1,2-HTR -268-053	HYDROGEN IGNITORS
1,2-HTR -268-054	HYDROGEN IGNITORS
1,2-HTR -268-055	HYDROGEN IGNITORS
1,2-HTR -268-056	HYDROGEN IGNITORS
1,2-HTR -268-057	HYDROGEN IGNITORS
1,2-HTR -268-058	HYDROGEN IGNITORS
1,2-HTR -268-059	HYDROGEN IGNITORS
1,2-HTR -268-060	HYDROGEN IGNITORS
1,2-HTR -268-061	HYDROGEN IGNITORS
1,2-HTR -268-062	HYDROGEN IGNITORS
1,2-HTR -268-063	HYDROGEN IGNITORS
1,2-HTR -268-064	HYDROGEN IGNITORS