FORM NO. GE-38
Z539R3-85MAE

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPECIFICATION CHANGE SHEET

CHANGE SHEET NO. 1

SPECIFICATION NO. DCCFP101QCN REVISION NO. 9

TITLE: Material & Application Specification - Initial and Repair Installations

PG. 1 OF 1

AUTHOR: R. T. Cooper DATE: November 5, 1985

APPROVED BY: DATE:

QUAL. ASSUR.: D Wanger DATE: 11-12-85

TO BE COMPLETED BY AUTHOR

TYPE OF CHANGE: [X] PERMANENT [ ] TEMPORARY

EFFECTIVE DATE: December 10, 1985

EXPIRATION DATE:

TO BE COMPLETED BY AEPSC NS&L

DOES THIS SPEC. CHANGE IMPACT PLANT TECH. SPEC. COMPLIANCE? [X] YES [ ] NO AMD'T NO WEH

IF YES: [X] COMPLIANCE ALREADY ACHIEVED AT TIME OF ISSUE.

[ ] COMPLIANCE TO BE ACHIEVED _____ DAYS FROM DATE SPEC. RECEIVED BY PLANT.

NS&L REVIEW: DATE: 11-11-85

DESCRIPTION OF CHANGE

Revision of Appendix "D" Silicone Foam Scope of Work

REASON(S) FOR CHANGE

New identified fire barriers and general revision for cross referencing of fire zones.

INSTRUCTIONS FOR INCORPORATING CHANGE

Remove all 20 pages of Appendix D - Replace with 34 pages of this change sheet

FORM QC-40

INDIANA AND MICHIGAN ELECTRIC COMPANY
DONALD C. COOK NUCLEAR PLANT

AEP

SPECIFICATION ADDENDUM

Specification No.	Revision No.	Addendum Letter	Dated
DCCFP101QCN	9	A	2/25/85

TITLE: MATERIAL & APPLICATION SPECIFICATIONS - INITIAL & REPAIR INSTALLATIONS

SYSTEM: Wall, Floor, Ceiling Openings: Fire Barrier & Air Seals

This addendum is an authorized supplement to the above Specification Revision.

SPEC PAGE NO.	SPEC PAR. NO.	SUPPLEMENT
		In Appendix D on pages 15 through 20, delete the existing Drawing Number Reference and add the new Fire Protection Drawing Number.

APPROVAL SIGNATURES		COPIES TO:
Author	R.T. Cooper	
Approved by	[signature] 2/26/85	
Quality Assurance	[signature] 2/26/85	

7387.1(3-84)IAP50
FORM QC-19
REV. 5/81

INDIANA & MICHIGAN ELECTRIC COMPANY
DONALD C. COOK NUCLEAR PLANT

AMERICAN ELECTRIC AEP POWER SYSTEM

SPECIFICATION COVER SHEET

Specification No.	Dated	Revision No.	Dated
DCCFP101QCN	7/22/74	9	12/13/84

ATTACHMENTS

Appendix "B"
Appendix "C"
Appendix "D"
Appendix "E"

TITLE: Material & Application Specification - Initial and Repair Installations

SYSTEM: Wall, Floor, Ceiling Openings: Fire Barrier & Air Seals

SCOPE OF REVISION: 9.

- Added Areas to Appendix "D" for work conducted under Appendix "R" RFC's 2677 and 2693
- Revised Appendix "E" to allow 90 day use of temporary seals
- Incorporated Rev. 8 Addendum 8 – Adds Section 5.5.11.2 & a sentence to Section 6.8
- Deleted Appendix "F", "G", "H", & "I"
- Renumbered the Technical Support Center Fire Area from 108 to 126
- General Revision of Appendix D Drawings show all Fire Areas & Zone Numbers
- Added Section 1.3
- Revised Section Nos. 4.1, 5.1, 5.3, 5.5.4, 6.0, 6.8, 8.1, 9,0

INTERNAL APPROVAL SIGNATURES

	ORIGINAL ISSUE	REV. 9	REV.	REV.	REV.	REV.
Author		R.T. Cooper				
Approved by		L.D. Dixon				
Quality Assurance		E.E. Hoffmeister				

SPECIFICATION DCC FP 101 QCN

SILICONE FOAM FIRE AND SEALS

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B. ANI Seal Repair Requirements

C. ANI Waiver of submitting details of penetrations

D. Silicone Foam Scope of Work

E. Temporary Seals

F. Deleted

G. Deleted

H. Deleted

I. Deleted

SPECIFICATION DCCFP101QCN

Silicone Foam Fire Seals

For Openings in Fire Rated

Walls, Floors, or Ceilings

D. C. COOK NUCLEAR PLANT

1.0 SCOPE

Cable tray, instrument tubing, pipe, duct, and conduit openings existing or as later to be added or altered in fire rated walls, floors, or ceilings, shall be sealed with foamed-in-place Silicone Foam or gun caulked, flame retardant silicone adhesive/sealant. Such fire seals are to act as (1) fire resistant barriers in the openings in fire rated walls, floors, or ceilings to prevent horizontal or vertical propagation of fire from one area to another, (2) seals to prevent leakage of gaseous fire fighting agents from the area of application, or (3) seals to prevent air infiltration into or out of areas such as the control rooms.

1.1 The term "Applicator" as used herein shall mean the Contractor making the initial installation or repairs, or I&M Electric installation or repairs.

1.2 Contractor shall furnish with his bid document, when required by I&M Electric, 3 copies of ANI approval letters and/or reports certifying that (1) Contractor has performed and passed ASTM-E119 fire and hose stream tests; and (2) Contractor's silicone foam, damming materials, and installation meets ANI requirements for fire rated opening seals.

1.3 The defect/noncompliance reporting requirements of 10CFR Part 21 are applicable to all safety related/interace items in this specification.

2.0 APPROVED SEALANT MATERIALS

2.1 Machine injected four-part silicone foam (BISCO SF 20) used in the initial sealing and for repair sealing as tested and approved in ASTM-E119-73 and hose stream tests.

2.2 Two-part silicone foam made with Dow Corning 3-6548 components or equal produced by machines or repair kits. This material is compatible with the material in 2.1 above and has been tested and approved in ASTM-E119 and hose stream tests in accordance with the ANI test method.

2.3 Caulking materials shall be compatible with the above silicone foam. The following materials meet this requirement:

2.3.1 Dow Corning 96-081 RTV silicone rubber, flame retardant adhesive/sealant.

2.3.2 Dow Corning 732 RTV (BISCO SA273) silicone rubber, flame retardant adhesive/sealant.

2.3.3 General Electric RTV 124, flame retardant adhesive/sealant. (No longer available)

2.3.4 Delete

2.4 Non-combustible forming and damming materials shall be used. The following non-combustible materials can be left in place following the sealing operation:

2.4.1 Johns-Manville Ceraform, Cerafelt, Cerafiber Refractory Fiber, bulk, blanket, board.

2.4.2 Carborundum Company Fibergrax refractory insulation, bulk, blanket, board.

2.4.3 Babcock & Wilcox Kaowool refractory insulation, bulk, blanket, board.

2.4.4. Precured Dow Corning 3-6548 Silicone foam (QA Traceability and documentation must be maintained).

2.4.5 Mineral Wool is acceptable, however, repairs or replacement of any seals equipped with mineral wool shall be made using one of the above listed materials because of their better resistance to burning at higher temperatures.

2.5 Other forming/damming materials acceptable for use but which shall be removed, due to flammability, after sealing operation:

2.5.1 Duct Tape

2.5.2 Corrugated Cardboard

2.5.3 Wood

2.5.4 Foam Plastics

2.5.5 Paper

2.5.6 Fiberglass

2.6 Proposals to use materials not listed in 2.4 must be submitted to and have the prior written approval of the AEPSC Cognizant Engineer-Fire Protection. Such approval shall take the form of an addendum or revision to this specification.

3.0 MATERIAL QUALIFICATION

3.1 Two-part silicone foam furnished for application shall be provided with certification, for each shipment, that it meets the specifications of Dow Corning 3-6548 Silicone foam. This certification shall be in the form of material receipts from Dow Corning and evidence that integrity and shelf-life of the material have been maintained since shipment from Dow Corning.

3.2 Caulking materials as listed under 2.3 shall be provided with certification, for each shipment, that it meets the specifications set by the manufacturer. This certification shall be in the form of material receipts from the manufacturer and evidence that integrity and shelf-life of the material have been maintained since shipment from the manufacturer.

3.3 Forming and damming materials, as covered by 2.4 above, shall be identified by carton markings as being the material specified in 2.4.

3.4 Sealant components and working materials brought to the site must be identified with receipt data and [redacted]. For materials coming in sealed cartons, this information may be marked on the carton. When cartons of these materials are opened, the shelf-life information shall be applied to each container with a felt tip marking pen. Additionally, certification shall state that the supplier has met the requirements of this specification.

3.5 Applicators or Suppliers furnishing silicone foam or caulking materials, specified above, which are packaged under another name or relabeled in such a way that the specified identification is lost, must furnish certification to I&M Electric Company that such material meets the specification requirements listed above.

NOTE: Four-part silicone foam (BISCO SF20) used in the initial seals was certified as stated in 2.1 above. This material is not likely to be used in future applications since it has been replaced by two-part silicone foam (Dow Corning 3-6548 components.

4.0 APPLICATION EQUIPMENT & CALIBRATION REQUIREMENTS

4.1 The two part silicone foam dispensing machine should be set for a ratio of 1:1 according to the foam manufacturer's specification. Actual ratio limits and methods of testing are detailed in Procedure No. **12QHP2270QC.004, Title "QC Inspection for Ratio, Density and Quality of Machine Installed Silicone Foam".

4.2 Filled guns or kits used for repair foam injection shall be labeled to show the contents, method of operation for mixing foam materials, and the shelf-life dates required under 3.4 above.

Measuring and test equipment used to measure or control the quality of the silicone foam material shall be calibrated. The Applicator shall maintain current calibration certification papers. The recalibration date shall be on the equipment.

4.4 Deleted.

4.5 Deleted.

5.0 APPLICATION PROCEDURES

5.1 Seal Identification

The I&M Electric QC Department shall survey, log, and permanently identify, by wall, floor and ceiling markings, all openings in each of the areas to be sealed. A prescribed number system is to be utilized. All references to seals will be by this designated number. To avoid conflicting numbers where seals are made in a common wall separating adjacent areas, the identification shall be the same and the resulting number then is to be applied to both sides of the seal. Where one side is inaccessible, only the accessible needs to be numbered.

5.5.1 Applicable Plant Personnel shall prepare drawings showing relative positions of new openings to be sealed and identifications as indicated above.

Opening Preparation

All openings shall be cleaned of any substances which could interfere with the sealing action or curing of the sealant. This cleaning shall be performed just prior to the sealant application and shall be performed using non-combustible cleaning agents.

5.3 Forming

Openings should be formed using non-combustible material as specified in 2.4. These materials can be left in place following curing of the sealant. Combustible forming/damming materials shall be removed after the sealant has cured. R9

5.4 Ventilation/Safety

Portable air handling equipment shall be set up on the pouring side of the wall or floor being sealed, except in well ventilated areas, to diffuse possible hazardous concentrations of hydrogen given off during the curing process of the silicone foam. Plant procedures and instructions regarding prohibition of smoking and open flames shall be observed at all times. If such prohibitions do not apply to the area being sealed, smoking and open flames shall be prohibited in any event until such time as the foam is cured (8 hours minimum) to avoid possible ignition of hydrogen. Such prohibition shall be posted by signs at access points to the work area.

5.5 Sealing Application Procedure

Silicone foam or silicone caulking is to be applied as outlined below:

5.5.1 Cables in openings to be sealed shall be spread apart to allow the sealant to flow between all cables to assure an adequate seal. Cured silicone foam may be used for this purpose, provided QC traceability is maintained and documented.

5.5.2 Before sealant is injected into an opening, all QC procedures such as those regarding batch samples shall be observed in accordance with the Applicators QA Manual.

5.5.3 Deleted.

5.5.4 All openings in areas outlined in Appendix "D" shall be sealed to a 12 inch depth, unless otherwise specified in this specification, or to a depth approved in writing by the AEPSC Cognizant Engineer - Fire Protection. R9

5.5.5 Openings in 3 hour rated walls less than 12 inches thick shall be sealed by forming a permanent collar 2 inches beyond the perimeter or circumference of the cable tray, duct, or pipe

opening. The depth shall be adjusted so that a total 12 inch wall and seal thickness is obtained. This volume shall then be filled with silicone foam. Examples of such areas are (a) Computer above the Control Room, (b) Diesel Generator Room Day Tank Enclosures, (c) Turbine Oil Tank Room, and (d) Lube Oil Room. Alternate methods must be approved in writing by AEPSC Engineering.

5.5.6 All seals should be approximately flush with the floors or curbs to prevent dirt accumulation.

5.5.7 Silicone foam shall be used to seal around conduits, pipe, and instrument tubing passing through sleeves to the depths specified above. This assumes that sufficient space exists to insert the foam applicating hose. For those cases where the hose cannot be inserted, the space shall be packed with refractory fiber or felt (see Section 2.4) to a 9 inch depth followed by a 1 inch depth of silicone caulk, (see Section 2.3) to the face of the wall or floor.

5.5.8 Space around the cable trays or ducts and the openings through which they run shall be sealed with silicone foam to the same depth as specified above. Where insufficient space exists to use the silicone foam, the space shall be packed with refractory fiber of felt (see Section 2.4) to a 9 inch depth followed by a 1 inch depth of silicone caulk (see Section 2.3) to the face of the wall or floor.

5.5.9 Applicator shall apply a 12 inch long bead of silicone caulk, measured from the face of the opening, to the top and bottom of the joint between the sides of cable trays which are touching.

5.5.10 Conduits that penetrate a fire barrier shall be sealed at the first break with a fire seal. The first break can be open-ended or at a junction box, pull box, condulet, electrical panel or at the equipment. A seal is required only on one side of the fire barrier. The side which has its first break closest to the fire barrier shall be the side that is sealed.

5.5.11 Approved methods of sealing conduits.

5.5.11.1 Conduits shall be sealed with silicone foam to a 12 inch depth to obtain a fire seal (see Section 2.2 and 5.5.4).

5.5.11.2 Conduits shall be sealed by using a dam of approved non-combustible material (see Section 2.4) of at least 1 inch depth to be packed into the space between the circumference of the cable or cables and the inner wall of the conduit, leaving a minimum of 2 inch depth to the end of the conduit. This 2 inch space shall be filled with Dow Corning 96-081 RTV caulking to obtain a fire seal (see Section 2.3.1).

The preferred seal is described in Section 5.5.11.1. For those cases where insufficient space exists between the inside wall of a conduit and the cable (a minimum of 1 inch to insert the foam applicating hose) 5.5.11.2 is to be used.

If in the plant's judgement, it is determined that foaming is not possible due to the inaccessibility of an area of the foam machine or other causes, Section 5.5.11.2 can be applied for conduits up to 4 inches in diameter maximum.

Conduits larger than 4 inches in diameter shall be sealed using the method described in Section 5.5.11.1.

Empty conduits that are not to be used but are being kept as spares can be sealed with a steel or malleable iron pipe cap. (See Section 4 of Appendix "E").

5.5.12 Application of sealant must be done in a neat manner. Excess sealant shall be trimmed or cleaned away after application.

<u>Cleaning</u>

5.6.1 Any combustible materials used in the foaming process, such as ladders, scaffolding, clean-up materials, forming/damming materials listed in 2.5, etc. shall be removed from the work area when no longer needed.

5.6.2 Flammable liquids, such as solvents to clean the application equipment, or sealant spills shall be contained and disposed of only in UL/FM approved safety cans furnished by Applicator. Only the minimum quantity of such solvents necessary to the performance of one day's work are permitted in the work area. Stocks of any flammable liquids shall be stored in a designated area outside and away from the plant building and important equipment. The precautionary measures of 5.4 shall apply to use of flammable liquids.

5.6.3 All trash generated during the sealing operation shall be deposited in UL/FM approved waste disposal containers, furnished by the Applicator, and removed from the plant at the end of each shift's work. Containers filled prior to the end of the shift shall be removed from the plant immediately.

6.0 REPAIRS

Over the course of time, repairs will become necessary to various of the seals due to damage resulting from addition or deletion of cables, piping, or tubing, and other causes. It is vital that the seals be restored to their original condition to maintain the proper degree of protection.

Technical Specifications require that fire barriers remain functional. They may be non-functional only when subject to certain specified restrictions. When seals are repaired, or new seals are required due to openings cut through walls intended to confine CO_2 or Halon and/or prevent the spread of fire, installation shall be in accordance with written procedures.

The penetration fire barrier is made functional by the installation of the permanent seal or by the installation of a temporary seal (See Appendix "E").

A non-functional fire seal as defined by Section 6.3.1 through 6.3.7 shall have installed either a permanent or temporary seal within one hour after the seals are made non-functional, unless personnel are present or a continuous fire watch is established. R9

6.1 Care shall be exercised when altering a seal to minimize damage. Methods of adding cable, pipe, or tubing which may be proposed, must be tested and approved before use, by I&M Electric.

6.2 If repairs are necessary, documentation shall be prepared which shall identify the opening. The identification shall correspond with the marking specified in 5.1. Each repair to a seal shall be documented.

6.3 Seals requiring repair shall be determined in the following manner:

6.3.1 Seals with 2" depth portions missing.

6.3.2 Seals with cable holes following removal of cable.

6.3.3 Seals with newly added cable with a tight fit around the cable and no evidence of seal deterioration at interface.

6.3.4 Seals with newly added cable with evidence of seal deterioration and cables in oversized cable holes.

6.3.5 Seals showing evidence of breaking adherence between the opening or between the cables, pipe, or tubing running through the opening.

6.3.6 New openings.

6.3.7 Seals exposed to fire.

6.4 Section 6.3 above, while referring to cable, applies equally to pipe or tubing openings.

6.5 Conditions 6.3.5, 6.3.6, and 6.3.7 above require removal of the existing seal in total and replacement with new sealant in accordance with this specification.

6.6 Conditions 6.3.1 and 6.3.2 above can be corrected by reforming the opening and repouring the silicone foam in accordance with this specification to restore the seal to its original depth (See Section 6.9.1, 2).

6.7 Condition 6.3.4 above can be corrected by reforming and repouring the silicone foam (See Sections 5.5.7 and 6.9.3). In the condition where excessive deterioration exists, remove part of the seal to a point where reforming and repouring of silicone foam is possible or repour the entire seal.

6.8 Condition 6.3.3 above can be corrected by a heavy bead of gun caulked silicone (See Section 2.3) around the new cable. To assure adequacy of the seal, the bead of silicone caulk shall be applied to the cable on both sides of the seal. If one side is inaccessible, then and only then, is it acceptable to seal just the accessible side.

6.9 Foam Repair Kits are to be used only where machine application is impractical, such as limited space, small foam quantity requirement, etc. Some guidelines for the limited use of Foam Repair Kits are as follows:

6.9.1 Seals with 2" depth portions missing - the amount of foam to be used is not to exceed one 20 oz. Repair Kit. This type of repair is applicable to both Vertical and Horizontal openings.

6.9.2 Seals with cable holes following the removal of a cable - Openings 2" in diameter and smaller can be filled using repair kits. Care must be taken to prevent voids from forming. This type of repair can only be used for vertical openings.

6.9.3 Seals with newly added cable in oversized cable holes - If the distance from the cable to the inside of the oversize hole is 1" or smaller, the repair kit can be used. This type of repair can only be used for vertical openings.

7.0 APPLICATION DOCUMENTATION & RECORDS

7.1 I&M Maintenance Department shall prepare a check sheet type form containing the following information:

7.1.1 Name of area which sealing was accomplished.

7.1.2 Floor elevation of area.

7.1.3 Opening identification numbers (See 5.1).

7.1.4 Seal material (foam or caulk).

7.1.5 Depth of seal.

7.1.6 Lot/Batch number of seal material.

7.1.7 Foam Machine number.

7.1.8 Filled gun (Repair Kit) number.

7.1.9 Applicating person's name.

7.1.10 Accept or Reject indication.

7.1.11 Remarks.

7.1.12 Inspector's name.

7.2 The original of such forms shall be sent to and retained by the I&M Maintenance Department.

8.0 [redacted]

8.1 The Contractor, when required, shall submit to the AEPSC Cognizant Engineer - Fire Protection, 3 copies of his Quality Assurance Manual with his proposal. The QA Manual shall be prepared in accordance with 10CFR50 Appendix B and applicable regulatory requirements, codes, and standards. The applicable criteria need only cover those specific tasks that will be accomplished under the contract but must include sections on procurement document control, control of purchased material, identification and control of materials, control of special processes, inspection, test control, control of measuring and test equipment, non-conforming materials, corrective action and records. The QA Manual will be reviewed and approved by the Cognizant Engineer, [redacted] and American Nuclear Insurers. The Applicator will, on receipt of this approved manual, be permitted to start operations. R9 R9

The Applicator shall comply with all requests of I&M Electric Company concerning QA matters. He will be subject to audits and "stop incorrect work" authority of the [redacted] He shall furnish all documentation in his QC procedures to the I&M Electric Company QC Representative.

9.0 I&M INSPECTIONS

The I&M Electric Company QA and QC Representatives will assure through inspections and audits that the Applicator is performing his work in accordance with his approved procedure. The Representative will also verify through inspection of documentation and record that these meet the requirements of the procedure and that the information contained herein meets the intent of the record requirements. These inspections and audits will be performed periodically and documented on standard I&M forms. R9

DELETED

AMERICAN NUCLEAR INSURERS

BURT C. PROOM, CPCU
President

PROPERTY ENGINEERING DEPARTMENT
John J Carney Vice President

October 16, 1979

Mr. R. J. Daley
Mechanical Engineering Division
American Electric Power Service Corporation
2 Broadway
New York, N.Y. 10004

Dear Ray:

AMERICAN ELECTRIC POWER COMPANY, INC. ETAL
DONALD C. COOK NUCLEAR PLANT
ANI PROPERTY FILE NO. N-181

This letter is in confirmation of our recent telephone conversation regarding replacement seals in fire barrier penetrations.

It will be acceptable for insurance purposes to have AEP personnel replace seals in cable and mechanical penetrations in fire barriers provided the following criteria are met:

1. Only fire stop systems which have been subjected to the "ANI/MAERP Standard Method of Fire Tests of Cable and Pipe Penetration Fire Stops" and found to be acceptable to the American Nuclear Insurers should be utilized. The limitations outlined in the ANI "Notification of ANI/MAERP Cable and Pipe Penetration Fire Stops" for the specific fire stop system should be observed.

2. Materials, procedures, and equipment used should be identical to those used for the test installation.

3. Personnel performing the installation should be properly trained in the equipment and procedures to be used. Documentation should be maintained on the training and qualifications of the installers.

4. Complete details of fire stop installations should be submitted to American Nuclear Insurers prior to actual installation. In order to avoid delays in our portion of the review process, the following details should be submitted to Mr. R. F. MacMillan, Project Engineer - Fire Stop Systems, in the Farmington Office of American Nuclear Insurers:

a. Penetration Identification, including wall or floor.
b. Penetration Size.
c. Penetrating Items.
d. Forming of Damming Details, if applicable.
e. Fire Stop Details - type or model of fire stop to be used, thickness of stop, if applicable, etc. If "Typical Drawings" are submitted as part of the review, then the specific typical should be indicated by each penetration listed.
f. Q/A-Q/C procedures and Sign-off for each penetration.
g. Densities, Hardness Tests, or other required verification tests or data.

If the above criteria is not adhered to, the penetration seal will be considered unacceptable for insurance purposes as a permanent fire stop. Such temporary seals should be ultimately replaced by acceptable, permanent fire stops.

This letter is intended only to outline general requirements which, if followed, will result in fire seal penetrations which will be acceptable to the American Nuclear Insurers for insurance purposes only.

Since vendors or suppliers which have previously subjected fire stop systems to the ANI Method of Test for Fire Stop Systems may consider their system to be proprietary, it may be necessary to obtain the permission of the vendor or supplier prior to using any previously accepted fire stop system. We suggest that the vendor or supplier be contacted if the use of any previously accepted fire stop system is contemplated.

Sincerely,

Wayne D Holmes

W. D. Holmes
Administrative Engineer
Fire/All-Risk Section

WDH/jms
cc; Mr. J. M. McSweeney - Marsh & McLennan, New York

AMERICAN NUCLEAR INSURERS
BURT C. PROOM, CPCU
President

PROPERTY ENGINEERING DEPARTMENT
John J. Carney, Vice President

March 20, 1980

Mr. R. J. Daley
Mechanical Engineering Division
American Electric Power Service Company
2 Broadway
New York, N.Y. 10004

Dear Ray:

AMERICAN ELECTRIC POWER COMPANY
DONALD C. COOK NUCLEAR PLANT
ANI PROPERTY FILE NO. N-181

REPLACEMENT PENETRATION SEALS

Thank you for your cooperation in providing procedure manuals for the installation and repair of fire barrier penetration seals for review by our Project Engineer for Fire Stop Systems, R. F. MacMillan.

Mr. MacMillan has passed along to me your letter of March 4, 1980. Since time constraints included in the facility Technical Specifications preclude the submittal of details of fire stop installations for review by ANI prior to actual installation, we are agreeable that such will not be necessary in this case. However, we still require submittal of details of all penetrations for review by our Technical Review Department as per Item No. 4 of my October 16, 1979 letter to you. Subsequent to review and acceptance by our Technical Review Department, our Regional Field Engineer will wish to review actual seals and documentation during his regular visits to the plant.

Thank you again for your cooperation.

Sincerely,

Wayne D. Holmes

Wayne D. Holmes
Administrative Engineer
Fire/All-Risk Section

WDH/jms

cc: Mr. T. F. Hartley, Marsh & McLennan Nuclear Consultants

APPENDIX "D"

SILICONE FOAM SCOPE OF WORK

Fire Zone No.	18 Month Surveillance Tech. Spec.	Non Tech. Spec.	Requiring Seals Walls (11,12)	Floors	Ceiling	*Comments
1	Y		Y*	N/A	All	Includes walls to Elev. Shaft Walls(1) to Unit 1 & 2 pipe tunnels, and CVCS hold up tank areas
1A & 1B	Y		Y*	N/A	Y*	Walls to FZ 12 Ceiling to FZ 62A,B
1C & 1D	Y		Y*	N/A	Y*	Walls to FZ 12 Common wall between FZ 1C & 1D including "T" shaped shield wall Ceiling to FZ 62B,C
1E & 1F	Y		Y*	N/A	Y*	Walls to FZ 22 Ceiling to FZ 63A,B
1G & 1H	Y		Y*	N/A	Y*	Walls to FZ 22 Common wall between FZ 1G & 1H including "T" shaped shield wall Ceiling to FZ 63A,B,C
2	Y		N/A	N/A	Y*	Ceiling to FZ 17A,B, D,E,F& G
3	Y		Y*	N/A	N/A	Wall to FZ 5
4	Y		All	N/A	Y*	Ceiling to FZ 69

APPENDIX "D"

SILICONE FOAM SCOPE OF WORK

Fire Zone No.	18 Month Surveillance Tech. Spec.	Non Tech. Spec.	Requiring Seals Walls (11,12)	Floors	Ceiling	*Comments
5	Y		All*	Y*	Y*	1. Wall to FZ 61(6) 2. Includes walls to Elev. Shaft Floor to FZ 1 Ceiling to FZ 6A, 32, 36, 44N, 69
6N	Y		Y*	Y*	Y*	Walls to FZ 12, 80, 110 Floor to FZ 1 Ceiling to FZ 43, 44N
6M	Y		Y*	Y*	Y*	Wall to FZ 17C, 62C, 63C, Elev. Shaft Floor to FZ 1 Ceiling to FZ 44N, 44S
6S	Y		Y*	Y*	Y*	Walls to FZ 22, 84, 111 Floor to FZ 1 Ceiling to FZ 44S

APPENDIX "D"

SILICONE FOAM SCOPE OF WORK

Fire Zone No.	18 Month Surveillance Tech. Spec.	Non Tech. Spec.	Requiring Seals Walls (11,12)	Floors	Ceiling	*Comments
6A	Y		Y*[2,3]	Y*[2]	Y*[2,3]	Walls to FZ 4, 12, 17C, 22, 69, 80, 84 Wall[(4)] between 6A and FZ 44A, 44N, and 44E Floors to FZ 62A-C, 63A-C Ceiling to FZ 44N, 44S
7	Y		All*	N/A	Y*[(8)]	Includes exterior east wall Ceiling to FZ 49
8	Y		All	N/A	All[(8)]	
9	Y		All	Y*	All	Floor to FZ 116
10	Y		All	Y*	All[8]	Floor to FZ 116
11	Y		All	Y*	Y*[(8)]	Floor to FZ 116 Ceiling to 33A & 105
12	Y		All*	N/A	All*[7]	Includes vertical shaft walls Includes ceiling of vertical shaft to FZ 69
13	Y		All	N/A	All	
14	Y		All	N/A	All	
15	Y		All*	N/A	All	Include Day Tank Room

APPENDIX "D"

SILICONE FOAM SCOPE OF WORK

Fire Zone No.	18 Month Surveillance Tech. Spec.	Non Tech. Spec.	Requiring Seals Walls (11,12)	Floors	Ceiling	*Comments
16	Y		All*	N/A	All	Include Day Tank Room
17A-G	Y		All*	All	All	Includes seismic gap at top of walls Includes all walls between FZ 17A-G
18	Y		All*	N/A	All	Include Day Tank Room
19	Y		All*	N/A	All	Include Day Tank Room
20	Y		All	N/A	All	
21	Y		All	N/A	All	
22	Y		All*	N/A	All(7)	Includes vertical shaft walls Includes ceiling of vertical shaft to FZ 69
23	Y		All	Y*	Y*(8)	Ceiling to 34A Floor to FZ 117
24	Y		All	Y*	All(8)	Ceiling to 34A Floor to FZ 117
25	Y		All	Y*	All	Ceiling to 34A Floor to FZ 117
26	Y		All	N/A	All(8)	
27	Y		All	N/A	All(8)	

APPENDIX "D"

SILICONE FOAM SCOPE OF WORK

Fire Zone No.	18 Month Surveillance Tech. Spec.	Non Tech. Spec.	Requiring Seals Walls (11,12)	Floors	Ceiling	*Comments
28	Y		Y*	N/A	N/A	Wall to 81[6] Wall to 83
29A,B,E	Y		All	N/A	Y[5]	
29C,D,F	Y		All	Y*	Y[5]	Floor of 29C&D to 29G
29G	Y		N/A	N/A	Y*	Ceiling to FZ 29C&D
30	Y		Y*	N/A	N/A	Wall to FZ 87[6]
31	Y		Y*	N/A	N/A	Wall to Zone 32[6]
32	Y		Y*	Y*	N/A	Wall to FZ.31[6] Floor to FZ 5
		N/A	N/A*	N/A	N/A	Exterior north wall need not be sealed[13]
33	Y		Y*	All[7]	N/A	Containment wall[10]
		Y	Y*	N/A	N/A	Exterior south and east walls
33A	Y		Y*	All[7]	N/A	Containment wall[10] Wall to FZ 41, 55, 105, & 110
33B	Y		All*	All[7]	All[7]	Except wall to FZ 33A
34	Y		Y*	All[7]	N/A	Containment wall[10]

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SILICONE FOAM SCOPE OF WORK

Fire Zone No.	18 Month Surveillance Tech. Spec.	Non Tech. Spec.	Requiring Seals Walls (11,12)	Floors	Ceiling	*Comments
34A	Y		Y*	All[7]	N/A	Containment wall[10] Wall to FZ 45, 60,& 111
34B	Y		All*	All[7]	All[7]	Except wall to FZ 34A
35	Y		Y*	N/A	N/A	Wall to FZ 27 Wall to FZ 36[6]
36	Y		Y*	All	N/A	Wall to FZ 35[6] Wall to FZ 27 Floor to FZ 5
37	Y		All	N/A[2]	All[2],[9]	
38	Y		All	All[8]	All[8]	
39	Y		All	All[8]	All[8]	
40A-B	Y		All*	All	All*	Includes exterior walls Includes wall between 40A and 40B No seal in ceiling ventilation shafts
41	Y		All*	All	All*	No seal at vent opening to underfloor space No seal in ceiling ventilation shaft

APPENDIX "D"

SILICONE FOAM SCOPE OF WORK

Fire Zone No.	18 Month Surveillance Tech. Spec.	Non Tech. Spec.	Requiring Seals Walls (11,12)	Floors	Ceiling	*Comments
42A-D	Y		All*	All	All*	Includes wall between 42C & 42D No seals in ceiling ventilation shafts in FZ 42A and 42D
43	Y		All*	All	All	Except wall between FZ 43 and 44N
44A-D	Y		Y*	All	All	Walls to FZ 12 and 51 Wall to FZ 6A(2),(4)
44E-H	Y		Y*	All	All	Walls to FZ 22 and 51 Wall to FZ 6A(2),(4)
44N	Y		Y*	All	All	Walls to FZ 6A,12,38, 55,56,57,58,91,96, Elev. Shaft
44S	Y		All*	All	All	Walls except to FZ 44N, 44H
45	Y		All*	All*	All*	No seal at vent opening to underfloor space No seal in ceiling ventilation shafts
46A-D	Y		All*	All	All*	Includes walls between 46C and 46D No seals in ceiling ventilation shafts in FZ 46A and 46D

APPENDIX "D"

SILICONE FOAM SCOPE OF WORK

Fire Zone No.	18 Month Surveillance Tech. Spec.	Non Tech. Spec.	Requiring Seals Walls (11,12)	Floors	Ceiling	*Comments
47A-B	Y		All*	All	All	Includes wall between 47A and 47B Includes exterior walls
48	Y		Y*	N/A	N/A	Wall to FZ 27 and 107
49	Y		Y*	All[7]	N/A[7]	Walls to FZ 12, 33B, 44A, 106, 108, Containment[10]
		Y	Y*	N/A	N/A	Exterior east wall 5
50	Y		Y*	All[7]	N/A[7]	Walls to FZ 22, 34B, 44E, 107, 109, Containment[10]
51	Y		Y*	All	N/A	Walls to 44A-H & Elev. Shaft
52	Y		All*	All	Y	Except walls to FZ 49, 50, 51
53	Y		All*	All*	All*	Including Hot Shutdown Panel Enclosure
54	Y		All*	All*	All*	Including Hot Shutdown Panel Enclosure (Future)

APPENDIX "D"

SILICONE FOAM SCOPE OF WORK

Fire Zone No.	18 Month Surveillance Tech. Spec.	Non Tech. Spec.	Requiring Seals Walls (11,12)	Floors	Ceiling	*Comments
55	Y		All*	All	All	Includes walls to charger, CD Battery and Panel Rooms, and stairs No seals at "Marinite" walls at corridor Includes north and east exterior walls
56	Y		All	All	All	
57	Y		All*	All	All	Including Hot Shutdown Panel Cable Rooms
58	Y		All*	All	All	Including Hot Shutdown Panel Cable Rooms
59	Y		All	All	All	
60	Y		All*	All	All	Includes walls to charger, CD Battery and Panel Rooms, and stairs No seals at "Marinite walls at corridor Includes south and east exterior walls
61	Y		All*	N/A	All	Walls to FZ 5 (6)
62A,B,C	Y		All	All	All	
63A,B,C	Y		All	All	All	
64A,B	Y		Y*	All	All	Walls to FZ 12 and 62C

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SILICONE FOAM SCOPE OF WORK

Fire Zone No.	18 Month Surveillance Tech. Spec.	Non Tech. Spec.	Requiring Seals Walls (11,12)	Floors	Ceiling	*Comments
65A,B	Y		Y*	All	All	Walls to FZ 22 and 63C
66	Y		Y*	N/A	N/A	Containment wall(10)
67	-	-				
68	Y		Y*	N/A	N/A	Containment wall(10)
69	Y		Y*	Y*7	N/A(7)	Walls to FZ 6A, 7, 27, 37(9), 38, 39, 70, 71, 72, 73, 108, 109, Elev. Shaft, Containment(10)
						Floor to FZ 4, 5, 12, 22, 44A-44H, 61
		Y	Y*	N/A	N/A	Includes exterior north wall
70	Y		All	All	N/A	
71	Y		All16	All16		
		Y			All(16)	
72	Y		All16	All16	N/A	
		Y			All(16)	
73	Y		All	All	N/A	
74	Y		Y*	N/A	N/A	Containment wall(10)
75						
76	Y		Y*	N/A	N/A	Containment wall(10)

APPENDIX "D"

SILICONE FOAM SCOPE OF WORK

Fire Zone No.	18 Month Surveillance		Requiring Seals			*Comments
	Tech. Spec.	Non Tech. Spec.	Walls (11,12)	Floors	Ceiling	
77		Y	Y*	N/A	N/A	Wall to FZ 131
78		Y	All	N/A	All*	No seal required around exhaust stack
79	Y		Y*	N/A	Y*	Walls to FZ 10, 14, 15, 16, 116 Ceiling to FZ 41 and 42A
80	Y		Y*	N/A	N/A	Walls to FZ 6A, 6N, 16, 17A, 17C-E
		Y	Y*	N/A	N/A	Wall to FZ 84
81	Y		Y*	N/A	N/A	Wall to FZ 29A, 29C, 87 Wall(6) to FZ 28 and screenhouse
		Y	Y*	N/A	N/A	Wall to FZ 83
82		Y	Y*	N/A	N/A	Wall to FZ 131 and 78
83	Y		Y*	N/A	N/A	Wall(6) to FZ 28 and screenhouse
		Y	Y*	N/A	All[16]	Walls to FZ 81
84	Y		Y*	N/A	N/A	Wall to FZ 6A, 6S, 17B, 17C, 17F, 17G, 18
		Y	Y*	N/A	N/A	Wall to FZ 80

APPENDIX "D"

SILICONE FOAM SCOPE OF WORK

Fire Zone No.	18 Month Surveillance Tech. Spec.	Non Tech. Spec.	Requiring Seals Walls (11,12)	Floors	Ceiling	*Comments
85	Y		Y*	N/A	Y*	Walls to FZ 18,19,20, 24,25,&117
						Ceiling to FZ 45 & 46A
86		Y	Y*	N/A	N/A	Walls to 89 & 124
87	Y		Y*	N/A	N/A	Wall to FZ 29C
						Wall[6] to FZ 30 and screenhouse
		Y	Y*	N/A	N/A	Wall to FZ 81
88	Y		Y*	N/A	N/A	Wall to screen-house[6]
		Y	All[16]	N/A	All[16]	
89		Y	All	N/A	All	
90	Y		Y*	N/A	N/A	Wall to FZ 40B,42A,&55
		Y	Y*	N/A	N/A	Includes exterior walls facing transformer area
91	Y		Y*	N/A	N/A	Wall to FZ 42C, 42D, 43, 44N, 55, 56, & 57
		Y	Y*	N/A	N/A	Wall to FZ 96
92		Y	Y*	N/A	N/A	Wall to FZ 99 and 95
93		Y	Y*	N/A	N/A	Wall to FZ 94
94		Y	All	All*	All*	No seal required around exhaust stack

APPENDIX "D"

SILICONE FOAM SCOPE OF WORK

Fire Zone No.	18 Month Surveillance Tech. Spec.	Non Tech. Spec.	Requiring Seals Walls (11,12)	Floors	Ceiling	*Comments
95		Y	All[16]	All[16]	All[16]	
96	Y		Y*	Y*	N/A	Walls to FZ 44N, 44S, 46C, 46D, 58, 59, & 60 Floor to 17C,F,G
		Y	Y*	N/A	N/A	Wall to FZ 91
97	Y		Y*	N/A	N/A	Walls to FZ 46A, 47B, & 60
		Y	Y*	N/A	N/A	Includes exterior walls facing transformer area
98		Y	N/A	Y*	N/A	Floor to FZ 89
99		Y	Y*	Y*	N/A	Wall to Zones 92 & 100 Floor to FZ 88
100		Y	All[16]	All[16]	All[(16)]	
101	Y		Y*	N/A	N/A	Containment wall[(10)]
102	Y		Y*	N/A	N/A	Containment wall[(10)]
103	-	-				
104	-	-				
105	Y		Y*	Y*	N/A	Wall to FZ 33A Floor to FZ 9, 10 & 11
106	Y		All	All	All	
107	Y		All	All	All	

APPENDIX "D"

SILICONE FOAM SCOPE OF WORK

Fire Zone No.	18 Month Surveillance: Tech. Spec.	18 Month Surveillance: Non Tech. Spec.	Requiring Seals: Walls (11,12)	Requiring Seals: Floors	Requiring Seals: Ceiling	*Comments
108	Y		All	Y*[7]	N/A[7]	Except floor to 110
109	Y		All	Y*[7]	N/A[7]	Except floor to 111
110	Y		All*	All*	All*	Except walls to FZ 80, 91, 114 Includes walls of vertical shaft to FZ 108 Floor of shaft to FZ 12 Except ceiling to FZ 108
111	Y		All*	All*	All*	Except walls to FZ 84, 96, 115 Includes walls of vertical shaft to FZ 109 Floor of shaft to FZ 22 Except ceiling to FZ 109
112	Y		All*	N/A	Y*	Except wall to FZ 2 and 113 Ceiling to FZ 17C,E,F
113	Y		All*	N/A	Y*	Except wall to FZ 2 and 112 Ceiling to FZ C,F,G

APPENDIX "D"

SILICONE FOAM SCOPE OF WORK

Fire Zone No.	18 Month Surveillance Tech. Spec.	Non Tech. Spec.	Requiring Seals Walls (11,12)	Floors	Ceiling	*Comments
114	Y		All*	N/A	All	Except walls to FZ 80 and 110
115	Y		All*	N/A	All	Except wall to FZ 84 and 111
114	Y		All*	N/A	All	Except walls to FZ 80 and 110
115	Y		All*	N/A	All	Except wall to FZ 84 and 111
116	Y		All*	N/A	All*	Walls except trench opening to FZ 12 Except ceiling opening to FZ 33
117	Y		All*	N/A	Y*	Walls except trench opening to FZ 22 Except ceiling opening to FZ 34
118	Y		Y*	N/A	N/A	Containment wall[10]
119	Y		Y*	N/A	N/A	Containment wall[10]
120	Y		Y*	N/A	N/A	Containment wall[10]
121	Y		Y*	N/A	N/A	Containment wall[10]
122	Y		Y*	N/A	N/A	Containment wall[10]
123	Y		Y*	N/A	N/A	Containment wall[10]
124		Y	All	N/A	All	

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SILICONE FOAM SCOPE OF WORK

Fire Zone No.	18 Month Surveillance Tech. Spec.	Non Tech. Spec.	Requiring Seals Walls (11,12)	Floors	Ceiling	*Comments
125		Y	All[16]	Y*[16]	All[16]	Floor including under the raised floor
126		Y	All[16]	All[16]	All[(16)]	
	Y		Y*	N/A	N/A	Wall to FZ 53, 54, 70, and 73
127	Y		Y*	All	N/A	Wall to FZ 70
		Y	Y*[16]	All[16]	All[16]	Wall to FZ 129
						Wall between Battery Room and Inverter Room
						Includes exterior walls
128						
129	Y		Y*	N/A	N/A	Wall to FZ 52, 53, 55, and 70
		N/A	N/A*	N/A	N/A	Exterior walls need not be sealed[(14)]
130	Y		Y*	N/A	N/A	Wall to FZ 52, 54, 60, and 73
		N/A	N/A*	N/A	N/A	Exterior walls need not be sealed[(14)]

APPENDIX "D"

SILICONE FOAM SCOPE OF WORK

Fire Zone No.	18 Month Surveillance Tech. Spec.	Non Tech. Spec.	Requiring Seals Walls (11,12)	Floors	Ceiling	*Comments
131		Y	All*	N/A	All*	All walls and ceilings of the Service Building Misc. Oil Room, Telephone Equipment Room, and Basement Record Storage
		Y	Y*	N/A	N/A	Wall between FZ 131, 77, 78 and 82
		Y	All*	All*	All*	All walls, floors, and ceilings of the Second floor record vault Exterior walls need not be sealed (13)
Elev. Sh.	Y		All	N/A	N/A	
Guard House		Y	All*	All*	All*	All walls, floors, and ceilings of the Guards Island, Transformer Switchgear.Battery Room, Telephone Equipment Room, and Cable Tunnel

APPENDIX "D"

FOOTNOTES

(1) The fire zone abuts an area (NFZ-No fire zone) not previously evaluated for Appendix R. The NFZ does not contain safe shutdown equipment or cables. An evaluation to combine the abutting NFZ into the Fire Area containing this fire zone will be performed. No penetration seals are presently required for the walls, floors or ceiling noted which abut the NFZ.

(2) Refer to EPM Boundary Evaluation for the Auxiliary Building 601 ft. Pipe Tunnel for required sealing and exemptions to sealing.

(3) Penetration seals are either silicone foam, high density lead or combination of the two.

(4) Penetrations are sealed with unrated high density lead.

(5) An EPM boundary evaluation for the fire zone is being performed. Sealing requirements may change.

(6) The fire area boundary which separates two different fire areas is currently being evaluated to form one large fire area. No penetration seals are presently required for walls, floors or ceilings noted. The sealing requirements may change pending the evaluation.

(7) An exemption has been granted by the NRC from fire ratings for seismic gaps in this zone. Seismic gaps are not required to be sealed.

(8) An exemption has been granted by the NRC from fire ratings for seismic gaps in this zone. However, the seismic gaps are required to be maintained for containment of the gaseous fire suppression agent within the zone.

(9) Zone is sealed for radiological reasons. Fire rated seals not required.

(10) The requirement for fire rated penetrations through the containment wall are superseded by radiation protection requirements.

(11) A designation of "All" in the columns for Requiring Seals is defined as:

A. For Walls;

1. The fire zone boundaries

2. Does not include partial walls within a zone

3. Does not include full interior walls unless otherwise noted.

B. For Floors and Ceiling - Entire floor or ceiling within the fire zone boundary.

(12) Exterior walls do not require fire rated penetration seals except for where exposure hazards exist.

(13) Exterior walls of unrated metal construction do not require fire rated penetration seals.

(14) Deluge water curtain protection on unrated metal construction provided equivalent protection in lieu of fire rated seals.

(15) Hatches are not a part of this specification.

(16) Seal walls, floors, and ceiling to the thickness of the barrier or 12 inches for zones/rooms that have gaseous suppression systems unless otherwise specified in this Appendix.

Fire Zone	Identification
1	Auxiliary Building, El. 573 ft. 0 in. - Both Units
1A	Containment Spray Pump East, Auxiliary Building, El. 573 ft. 0 in. - Unit 1
1B	Containment Spray Pump West, Auxiliary Building, El. 573 ft. 0 in. - Unit 1
1C	Residual Heat Removal Pump East, Auxiliary Building, El. 573 ft. 0 in. - Unit 1
1D	Residual Heat Removal Pump West, Auxiliary Building, El. 573 ft. 0 in. - Unit 1
1E	Containment Spray Pump East, Auxiliary Building, El. 573 ft. 0 in. - Unit 2
1F	Containment Spray Pump West, Auxiliary Building, El. 573 ft. 0 in. - Unit 2
1G	Residual Heat Removal East, Auxiliary Building, El. 573 ft. 0 in. - Unit 2
1H	Residual Heat Removal West, Auxiliary Building, El. 573 ft. 0 in. - Unit 2
2	Pump Bay Turbine Building, El. 569 ft. 6 in. - Both units
3	Drumming/Drum Storage, El. 587 ft. 0 in.
4	Sampling Room Auxiliary Building, El. 587 ft. 0 in.
5	Auxiliary Building, El. 587 ft. 0 in. (East End)
6A	Auxiliary Building Pipe Tunnel, El. 601 ft. 0 in.
6N	Auxiliary Building, El. 587 ft. 0 in. (West End)
6M	Auxiliary Building, El. 587 ft. 0 in. (West End)
6S	Auxiliary Building, El. 587 ft. 0 in. (West End)
7	Quadrant 1 Cable Tunnel, El. 596 ft. 3-1/2 in. - Unit 1
8	Quadrant 4 Cable Tunnel, El. 596 ft. 3-1/2 in. - Unit 1
9	Quadrant 3N Cable Tunnel, El. 596 ft. 3-1/2 in. - Unit 1
10	Quadrant 3M Cable Tunnel, El. 596 ft. 3-1/2 in. - Unit 1
11	Quadrant 3S Cable Tunnel, El. 596 ft. 3-1/2 in. - Unit 1

Fire Zone	Identification
12	Quadrant 2 Piping Tunnel, El. 596 ft. 3-1/2 in. - Unit 1
13	Diesel Oil Pump Room, El. 587 ft. 0 in. - Unit 1
14	Transformer Room, El. 591 ft. 0 in. - Unit 1
15	1CD Diesel Room, El. 587 ft. 0 in. - Unit 1
16	1AB Diesel Room, El. 587 ft. 0 in. - Unit 1
17A	West Auxiliary Feed Pump Room, El. 591 ft. 0 in. - Unit 1
17B	West Auxiliary Feed Pump Room, El. 591 ft. 0 in. - Unit 2
17C	Corridor to Auxiliary Feed Pump Rooms, El. 591 ft. 0 in. Both Units
17D	East Auxiliary Feed Pump Room, El. 591 ft. 0 in. - Unit 1
17E	Turbine Auxiliary Feed Pump Room, El. 591 ft. 0 in. - Unit 1
17F	Turbine Auxiliary Feed Pump Room, El. 591 ft. 0 in. - Unit 2
17G	East Auxiliary Feed Pump Room, El. 591 ft. 0 in. - Unit 2
18	2CD Diesel Room, El. 587 ft. 0 in. - Unit 2
19	2AB Diesel Room, El. 587 ft. 0 in. - Unit 2
20	Transformer Room, El. 591 ft. 0 in. - Unit 2
21	Diesel Oil Pump Room, El. 587 ft. 0 in. - Unit 2
22	Quadrant 2 Piping Tunnel, El. 591 ft. 0 in. - Unit 2
23	Quadrant 3N Cable Tunnel, El. 596 ft. 3-1/2 in. - Unit 2
24	Quadrant 3M Cable Tunnel, El. 596 ft. 3-1/2 in. - Unit 2
25	Quadrant 3S Cable Tunnel, El. 596 ft. 3-1/2 in. - Unit 2
26	Quadrant 4 Cable Tunnel, El. 596 ft. 3-1/2 in. - Unit 2
27	Quadrant 1 Cable Tunnel, El. 596 ft. 3-1/2 in. - Unit 2
28	Unit 1 Diesel Fire Pump Room, El. 591 ft. 0 in.
29A	Essential Service Water Pump PP-1E, El. 591 ft. 0 in. Unit 1

Fire Zone	Identification
29B	Essential Service Water Pump PP-1W, El. 591 ft. 0 in. Unit 1
29C	Essential Service Water Pump PP-2E, El. 591 ft. 0 in. Unit 2
29D	Essential Service Water Pump PP-2W, El. 591 ft. 0 in. Unit 2
29E	Motor Control Center for ESW Pumps, El. 591 ft. 0 in. Unit 1
29F	Motor Control Center for ESW Pumps, El. 591 ft. 0 in. Unit 2
29G	Screen House Motor Control Room for ESW, El. 575 ft. 0 in. Units 1 & 2
30	Unit 2 Diesel Fire Pump Room, El. 591 ft. 0 in.
31	Concrete Mixing Building/Drumming Area, El. 609 ft. 0 in. Unit 2
32	Cask Handling Area, El. 609 ft. 0 in. - Both Units
33	Main Steam Valve Enclosure, East El. 612 ft. 0 in. - Unit 1
33A	Main Steam Line Area, East El. 612 ft. 0 in. - Unit 1
33B	Non Essential Service Water Valve Area, West El. 612 ft. 0 in. - Unit 1
34	Main Steam Valve Enclosure, East El. 612 ft. 0 in. - Unit 2
34A	Main Steam Line Area, East El. 612 ft. 0 in. - Unit 2
34B	Non Essential Service Water Valve Area, West El. 612 ft. 0 in. - Unit 2
35	Instrument Calibration Room, El. 609 ft. 0 in. - Unit 2
36	Spent Fuel Heat Exchanger Pit Pump Room, El. 609 ft. 0 in. Unit 2
37	Valve Gallery, El. 617 ft. 0 in. - Both Units
38	Quadrant 2 Penetration Cable Tunnel, El. 612 ft. 0 in. Unit 1

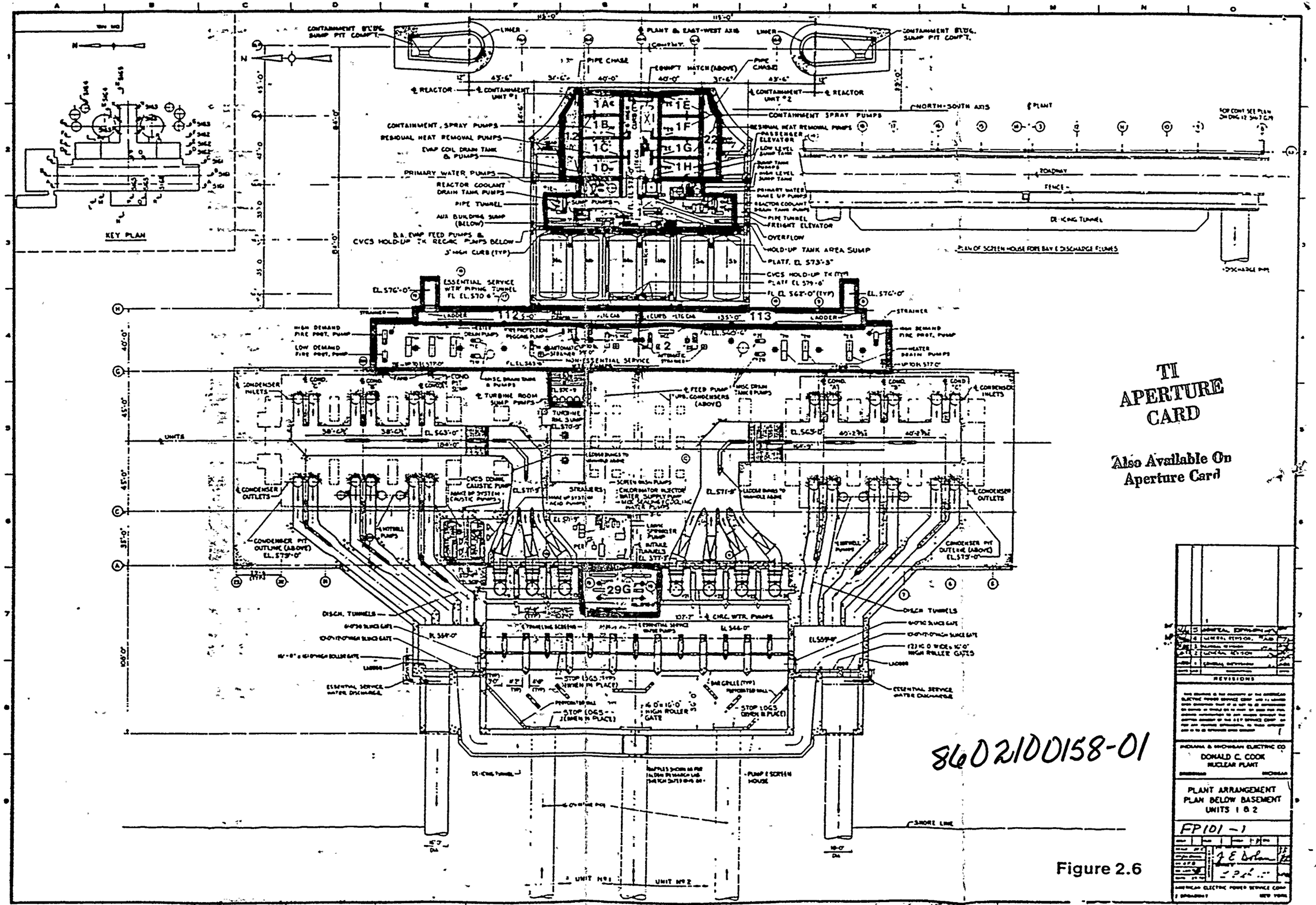
Fire Zone	Identification
39	Quadrant 2 Penetration Cable Tunnel, El. 612 ft. 0 in. Unit 2
40A	4kV Switchgear Room, El. 609 ft. 6 in. - Unit 1
40B	4kV Switchgear Room, El. 609 ft. 6 in. - Unit 1
41	Eng. Safety System & MCC Room, El. 609 ft. 0 in. (& Underfloor) - Unit 1
42A	E.P.S. Transformer Room, El. 609 ft. 6 in. - Unit 1
42B	E.P.S. Control Rod Drive Room, El. 609 ft. 6 in. - Unit 1
42C	E.P.S. Motor Control Room, El. 609 ft. 6 in. - Unit 1
42D	E.P.S. (AB) Battery Room, El. 609 ft. 6 in. - Unit 1
43	Access Control Area, El. 609 ft. 0 in. - Unit 1
44N	Auxiliary Building North, El. 609 ft. 0 in. - Both Units
44S	Auxiliary Building South, El. 609 ft. 0 in. - Unit 2
44A	Containment Spray Heat Exchanger Room #18E, Auxiliary Building, El. 609 ft. 0 in. - Unit 1
44B	Containment Spray Heat Exchanger Room #18W, Auxiliary Building, El. 609 ft. 0 in. - Unit 1
44C	Residual Heat Removal Heat Exchanger Room #17E, Auxiliary Building, El. 609 ft. 0 in. - Unit 1
44D	Residual Heat Removal Heat Exchanger Room #17W, Auxiliary Building, El. 609 ft. 0 in. - Unit 1
44E	Containment Spray Heat Exchanger Room #18E, Auxiliary Building, El. 609 ft. 0 in. - Unit 2
44F	Containment Spray Heat Exchanger Room #18W, Auxiliary Building, El. 609 ft. 0 in. - Unit 1
44G	Residual Heat Removal Heat Exchanger Room #17E, Auxiliary Building, El. 609 ft. 0 in. - Unit 2

Fire Zone	Identification
44H	Residual Heaat Removal Heat Exchanger Room 17W, Auxiliary Building, El. 609 ft. 0 in. - Unit 2
45	Eng. Safety System & MCC Room, El. 609 ft. 6 in. (& Underfloor) - Unit 2
46A	E.P.S. Transformer Room, El. 609 ft. 6 in. - Unit 2
46B	E.P.S. Control Rod Drive Room, El. 609 ft. 6 in. - Unit 2
46C	E.P.S. Motor Control Room, El. 609 ft. 6 in. - Unit 2
46D	E.P.S. (AB) Battery Room, El. 609 ft. 6 in. - Unit 2
47A	4kV Switchgear Room, El. 609 ft. 6 in. - Unit 2
47B	4kV Switchgear Room, El. 609 ft. 0 in. - Unit 2
48	New Fuel Storage Room, El. 633 ft. 0 in. - Unit 2
49	HVAC Vestibule, El. 633 ft. 0 in. - Unit 1
50	HVAC Vestibule, El. 633 ft. 0 in. - Unit 2
51	Auxiliary Building, El. 633 ft. 0 in. (East End) - Both Units
52	Auxiliary Building, El. 633 ft. 0 in. (West End) - Both Units.
53	Unit 1 Control Room, El. 633 ft. 0 in.
54	Unit 2 Control Room, El. 633 ft. 0 in.
55	Switchgear Room Cable Vault, El. 625 ft. 10 in. - Unit 1
56	Auxiliary Cable Vault, El. 620 ft. 6 in. - Unit 1
57	Control Room Cable Vault, El. 624 ft. 0 in. - Unit 1
58	Control Room Cable Vault, El. 624 ft. 0 in. - Unit 2
59	Auxiliary Cable Vault, El. 622 ft. 6 in. - Unit 2
60	Switchgear Room Cable Vault, El. 625 ft. 10 in. - Unit 2
61	Spray Additive Tank Room, El. 587 ft. 0 in. - Unit 1
62A	Reciprocating Pump, El. 587 ft. 0 in. - Unit 1
62B	Charging Pump, El. 587 ft. 0 in. - Unit 1

Fire Zone	Identification
62C	Charging Pump, El. 587 ft. 0 in. - Unit 1
63A	CVCS Reciprocating Pump, El. 587 ft. 0 in. - Unit 2
63B	CVCS Charging Pump, El. 587 ft. 0 in. - Unit 2
63C	CVCS Charging Pump, El. 587 ft. 0 in. - Unit 2
64A	Safety Injection Pump East, El. 587 ft. 0 in. - Unit 1
64B	Safety Injection Pump West, El. 587 ft. 0 in. - Unit 1
65A	Safety Injection Pump East, El. 587 ft. 0 in. - Unit 2
65B	Safety Injection Pump West, El. 587 ft. 0 in. - Unit 2
66	Containment Piping Annulus, El. 598 ft. 9-3/8 in. - Unit 1
67	Containment Lower Volume, El. 598 ft. 9 3/8 in. - Unit 1
68	Containment Upper Volume, El. 650 ft. 0 in. - Unit 1
69	Auxiliary Building, El. 650 ft. 0 in. - Both Units
70	Control Room HVAC Equipment Room, El. 650 ft. 0 in. - Unit 1
71	Computer Room, El. 650 ft. 0 in. - Unit 1
72	Computer Room, El. 650 ft. 0 in. - Unit 2
73	Control Room HVAC Equipment Room, El. 650 ft. 0 in. - Unit 2
74	Containment Piping Annulus, El. 598 ft. 9-3/8 in. - Unit 2
75	Containment Lower Volume, El. 598 ft. 9-3/8 in. - Unit 2
76	Containment Upper Volume, El. 650 ft. 0 in. - Unit 2
77	Welding Shop, Turbine Building, El. 591 ft. 0 in. - Unit 1
78	Heating Boiler Room Unit 1, El. 591 ft. 0 in. Turbine Building
79	Turbine Room Unit 1 (N.E. Portion), El. 591 ft. 0 in.
80	Turbine Room Unit 1 (S.E. Portion), El. 591 ft. 0 in.
81	Turbine Room Unit 1 (S.W. Portion), El. 591 ft. 0 in.
82	Turbine Room Unit 1 (N.W. Portion), El. 591 ft. 0 in.

Fire Zone	Identification
83	Turbine Room Unit 1 Lube Oil Room, El. 591 ft. 0 in.
84	Turbine Room Unit 2 (N.E. Portion), El. 591 ft. 0 in.
85	Turbine Room Unit 2 (S.E. Portion), El. 591 ft. 0 in.
86	Turbine Room Unit 2 (S.W. Portion), El. 591 ft. 0 in.
87	Turbine Room Unit 2 (N.W. Portion), El. 591 ft. 0 in.
88	Turbine Room Unit 2 Lube Oil Room, El. 591 ft. 0 in.
89	Turbine Room Unit 2 Misc. Oil Room, El. 591 ft. 0 in.
90	Turbine Room Unit 1 (N.E. Portion), El. 609 ft. 0 in.
91	Turbine Room Unit 1 (S.E. Portion), El. 609 ft. 0 in.
92	Turbine Room Unit 1 (S.W. Portion), El. 609 ft. 0 in.
93	Turbine Room Unit 1 (N.W. Portion), El. 609 ft. 0 in.
94	Turbine Room Unit 1 Aux. Heating Boiler, El. 609 ft. 0 in.
95	Turbine Room Unit 1 Turb. Oil Tank Room, El. 609 ft. 11 in.
96	Turbine Room Unit 2 (N.E. Portion), El. 609 ft. 0 in.
97	Turbine Room Unit 2 (S.E. Portion), El. 609 ft. 0 in.
98	Turbine Room Unit 2 (S.W. Portion), El. 609 ft. 0 in.
99	Turbine Room Unit 2 (N.W. Portion), El. 609 ft. 0 in.
100	Turbine Room Unit 2 Turbine Tank Room, El. 609 ft. 0 in.
101	Containment 1 Accumulator Enclosure, El. 612 ft. 0 in. (West)
102	Containment 2 Accumulator Enclosure, El. 612 ft. 0 in. (West)
103	Reactor Head Enclosure Unit 1, El. 567 ft. 2 in.
104	Reactor Head Enclosure Unit 2, El. 567 ft. 2 in.
105	Contractor Access Control Bldg., El. 612 ft. 0 in. - Unit 1
106	Auxiliary F.W. Battery Room #1, Auxiliary Building, El. 633 ft. 0 in. - Unit 1
107	Aux. F.W. Battery Room #2, El. 633 ft. 0 in. - Unit 2

Fire Zone	Identification
108	West Steam Valve Enclosure Unit 1, El. 635 ft. 0 in.
109	West Steam Valve Enclosure Unit 2, El. 635 ft. 0 in.
110	Main Steam Accessway Unit 1, El. 587 ft. 0 in.
111	Main Steam Accessway Unit 2, El. 587 ft. 0 in.
112	Essential Service Water Pipe Tunnel Unit 1, El. 570 ft. 6 in.
113	Essential Service Water Pipe Tunnel Unit 2, El. 570 ft. 6 in.
114	Essential Service Water Pipe Tunnel Unit 1, El. 570 ft. 6 in.
115	Essential Service Water Pipe Tunnel Unit 2, El. 570 ft. 6 in.
116	RW, CS, PW Tank Area Pipe Tunnel Unit 1, El. 593 ft. 0 in.
117	RW, CS, PW Tank Area Pipe Tunnel Unit 2, El. 593 ft. 0 in.
118	Containment Regen Heat Exchanger Room Unit 1 El. 609 ft. 0 in.
119	Containment Regen Heat Exchanger Room Unit 2 El. 609 ft. 0 in.
120	Containment 1 Accumulator Enclosure East, El. 625 ft. 0 in.
121	Containment 2 Accumultor Enclosure East, El. 625 ft. 0 in.
122	Containment 1 Instrumentation Room Unit 1, El. 625 ft. 0 in.
123	Containment 2 Instrumentation Room Unit 2, El. 625 ft. 0 in.
124	UPS Inverter Room Security, El. 591 ft. 0 in. - Unit 2
125	CAS Security, El. 633 ft. 0 in. - Unit 2
126	Tech Support Center, El. 633 ft. 0 in. - Both Units
127	TSC, UPS Battery, and Inverter Rooms, El. 650 ft. 0 in. Unit 1
128	UPS Battery Room Security, El. 591 ft. 0 in. - Unit 2
129	Unit 1 Turbine Deck, El. 633 ft. 0 in.
130	Unit 2 Turbine Deck, El. 633 ft. 0 in.
131	Service Building, El. 595 ft. 0 in.



TI APERTURE CARD

Also Available On Aperture Card

8602100158-01

Figure 2.6

APPENDIX "E"

Temporary Seals

Penetration fire barriers when violated can be made functional during an interim period before a permanent seal is installed by using one of the following methods of forming a temporary seal.

1. Close opening with non-combustible materials identified in Section 2.4. Pack the bulk fiber material into the opening to provide a seal and apply a ¼" to ½" thick layer of RTV caulking (Section 2.3) over the bulk fiber material to act as a gas or air seal. This entire seal must be removed before a permanent seal is installed.

2. Damming for floor and ceiling openings can be considered a temporary seal only if it is formed with a minimum of one inch thick refractory board (Section 2.4) firmly secured in place and gas sealed with a one inch layer of silicone foam (Machine or repair kit) over the entire opening. This temporary seal can be left in place when installing a permanent seal.

3. Damming for wall openings can be considered a temporary seal only if it is formed with a minimum of one inch thick refractory board (Section 2.4) firmly secured in place and gas sealed with at least a ½ inch bead of RTV Silicone caulking (Section 2.3) on the perimeter of the opening. Caulking should be applied on the pour side of the dam. This temporary seal can be left in the place when installing a permanent seal.

4. For empty conduits waiting for cables to be pulled, an accepted method to seal other than method (1.) above is to use a metal cap made of steel or malleable iron. Some typical configurations which are acceptable are: a solid metal cap, a metal bushing with a metal disc cover or a metal bushing with a screw on metal plug. These shall be used on rigid and thin walled conduits.

5. The following conditions apply to the use of Temporary Seals:

   A. The interim period permitting the use of temporary seals is not to exceed 9.0 days except when authorized in writing by AEPSC engineering. | R9

   B. The 9.0 day limit commences on the day the Temporary Seal is installed. | R9

   C. Method 4. above, dealing with empty conduits can be left as a permanent seal.

Attachment 1 to AEP:NRC:0775AE

Summary of Open Item Resolution

Resolution of Potential Enforcement/Unresolved Items

1. Item: The Impell Aging Analysis Report did not include the calculation for the Limitorque valve operators.

   Response: We have performed the calculation and have confirmed the 40-year qualified life. (See Attachment 2.)

2. Item: The Impell Aging Analysis Report did not include the calculation for the Penn Union and Marathon terminal blocks.

   Resolution: We have performed the calculations and confirmed the 40-year qualified life. (See Attachment 3.)

3. Item: SCEW sheet TC-13 did not contain data for the manufacturer and model number.

   Resolution: The SCEW sheet has been revised and contains the following information:

   Penn Union Terminal Block
   Model 6000 Series

   Marathon Terminal Block
   Model 1600 Series

   (See Attachment 4.)

4. Item: Conax Electrical Penetration Model EP-14 was not sufficiently described in the EQ file or specifically mentioned in the Conax test report for the environmental qualification of the D. C. Cook electrical penetration.

   Response: We have performed an engineering review to describe the electrical penetration model EP-14 and identify its environmental qualification. For the sake of completeness, we have also written to Conax Corporation asking that they provide a Certificate of Conformance identifying the environmental qualification of EP-14 by one of the Conax test reports already in our possession. (See Attachment 5.)

5. Item: There was no similarity statement for the electrical penetration extension.

   Resolution: This has been done. (See Attachment 6.)

6. Item: The installed configuration of the Foxboro transmitters does not match the tested configuration.

Resolution: We have performed an engineering review of the D. C. Cook installed configuration and have concluded that the tested and installed configuration of the Foxboro transmitters is functionally identical. (See Attachment 7.)

7. Item: There are several issues regarding Limitorque valves.

Response: We believe we have addressed the concerns which have only recently been identified in the industry. We have conducted a walkdown of the Unit 2 motor-operated valves; we have performed and documented our engineering review of the jumper wire issue; we are in communication with Limitorque and the Nuclear Utility Group on Equipment Qualification for the resolution of the other Limitorque issues. T-drains have been ordered, and they will be installed in the required operators as soon as practicable after they are received at the D. C. Cook Plant.

A specific question was raised regarding why we had not reported finding undocumented wire in Limitorque valve operators. The following is a response to the inquiry:

After receipt of IE Notice 86-03, we began an inspection of the jumper wires inside the Limitorque valve operators. When the issue of undocumented wiring was first addressed, it was conservatively assumed that all Limitorque valves on the Master Equipment List were located in areas which could be subjected to a harsh environment. Thus, instructions were developed which included the preparation of a Licensee Event Report in the event undocumented wire was found. During the inspection, three valve operators were found which had undocumented wire. Subsequent investigation revealed that these valves were not located in areas which could be subjected to a harsh environment. Thus, no Licensee Event Report was prepared. (See Attachment 8.)

A broader question was raised during the course of the audit; specifically, if we had found three valves with undocumented wiring during the Unit 2 inspection, what were the implications with respect to Unit 1. In response to this question, we again reviewed the engineering evaluation included in Attachment 8 and again concluded that if undocumented wires of the type indicated had been found, they would not have prohibited the valves from operating. We have continued our walkdown process and so far, of the 40 additional valves inspected, no similar problems have been found.

8. Item: The acceptance criteria for cable tests are not documented.

Response: We have reviewed the cable test reports and are working to establish the adequacy of the D. C. Cook Plant electrical cable. (See Attachment 9.)

9. Item: No solenoid-operated valve enclosure was specified for ASCO valves S3-1 and S-11 through S-17.

Response: This is felt to be a misunderstanding on the part of the auditor. ASCO valves are provided with a NEMA Class IV or higher enclosure over the solenoid. There is no enclosure for the entire valve.

10. Item: The installation of ASCO valves XSO-122, XSO-292, and XSO-297 was not representative of the test configuration.

Response: XSO-122 is a containment ventilation isolation valve located inside containment. It is required to operate for 5 seconds following an accident. It is a fail-closed valve, and its auxiliary electrical installation does not need to be environmentally qualified.

XSO-292 and XSO-297 are feedwater regulating valves installed outside containment. A review of the environmental qualification test report for these valves did not reveal any special test configuration such as conduit seals or Raychem splices.

11. Item: The EQ Files were not auditable.

Response: We are presently developing a program to improve the auditability of the EQ file. Under this program we are contemplating:

a) Eliminating all superseded material from the EQ working file. This superseded material would be placed in a historical EQ file.

b) Revising SCEW sheets to explicitly include devices covered and make detailed references to qualification documents.

c) Providing cross-reference information from the qualification documents back to the SCEW sheets.

d) Providing a Summary Information Packet for each SCEW sheet referencing all applicable qualification packets; referencing the applicable article in the S/M/R program; stating the level of qualification (DOR Guidelines or NUREG 0588, Category I); and making a positive statement of the environmental qualification of the subject device.

Attachment 2 to AEP:NRC:0775AE

Limitorque Valve Operator Aging Analysis

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
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COLUMBUS, OHIO

SUBJECT Thermal Aging Calculations for Limitorque Valve Actuators
Final Design Report

1- Objective

The purpose of this FDR is to provide the calculations which determine the estimated thermal life of the valve actuators at DC Cook plant, Units 1 and 2, manufactured by Limitorque Corporation. The calculations were not included in the aging analysis made by Impell Corporation for Limitorque valve actuators (CEE QF # 142)

2- Scope

These calculations apply to the motor insulation of the valve actuator. The organic materials of the motor insulation respond to thermal aging, while other materials,

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DATE 5-16-86 BY J A Rig CK
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PLANT DC Cook

SUBJECT Thermal Aging Calculations for Limitorque Valve Actuators

such as metalic parts, do not respond at all.

The switch material used by Limitorque is a molded phenolic which has a temperature index of 150°C. Limitorque considers that degradation of the switch material on the valve actuator, an intermident device, should be negligible and for purposes of qualification, artificial aging should be disregarded. See Limitorque Report # B-0058 (CEEQF-5513)

The Class Insulation Systems of the Limitorque Valve actuator motors are as follow

Class RH ——— SCEW's V-1, V-2, V-7, V-12

" H (Rad.H) " V-5, V-7, V-10

" B ——— " V-4, V-6, V-9, V-11

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3- Engineering Review

A) Class RH and Class B Insulation

Limitorque Report # B0058 (CEEQF2513) includes life of Limitorque Class RH and B motor insulation at various ambient temperatures as per the modified Arrhenius formula

$$\text{Log Life} = \frac{K}{Ta} - C \qquad (a$$

Ta = Ambient temperature, °Kelvin

K and C = Constants from thermal tests.

In accordance with Limitorque, 20 motorettes, built by Reliance, were exposed to elevated temperatures for short periods of time, establishing the K and C values on formula (a above;

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$$\text{Log Life} = \frac{5123}{Ta} - 5.893 \qquad (b$$

for Class RA insulation, and

$$\text{Log Life} = \frac{4675.475}{Ta} - 7.095 \qquad (c$$

for Class B insulation

A.1 Activation Energy

From the Arrhenius formula:

$$\Delta = \frac{K \, \text{Log}_n \left(\frac{X_1}{X_2}\right)}{\frac{1}{T_1} - \frac{1}{T_2}}$$

Δ = Activation energy, electron volts (ev)

K = Boltzman constant, 8.617×10^{-5}

X_1 = Time at temperature T_1, ° Kelvin

X_2 = Time at temperature T_2, ° Kelvin

and using values from Limitorque Report # B 0058 (CEEQF# 513), we get:

$\Delta = 1.016$ eV for Class RA insulation (d

$\Delta = .927$ eV for Class B insulation

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SUBJECT Thermal Aging Calculations for Limitorque Valve Actuators

A.2 - Thermal Life of Class RA and B Insulation

Using the Arrhenius formula

$$X_1 = X_2 \, e^{\frac{A}{K}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]}$$

for a maximum normal temperature of 160°F (Unit 1, pressurizer doghouse location) and data from the thermal regression curve. See equations (b and (c above - a thermal life of more than 40 years is obtained for Limitorque valve actuators with motor insulation Class RA and B.

B) Class H Insulation

Limitorque test report # 600198 (CEEQF #22) refers to motor insulation type H. According to Limitorque (phone conversation 2/13/86) the Class H insulation used between 1968-1972 in their motors included radiation resistance materials

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and was designated as Rad H insulation. It is rated above Class B and since its materials are basically the same as on RH insulation, we conclude that the Activation Energy of Rad H insulation should be the same as for RH insulation, 1.016 eV

B. 1) Thermal Life of Class Rad H Insulation

Limitorque test report # 600198 (CLEEQF# 22) describes the heating test made on the electric motor of valve actuators. The motor was baked at 180°C for a total of 100 hours with no adverse effects on the motors, and motor insulation resistance measured infinity to ground.

Using the above test data on the

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PLANT D C Cook

SUBJECT Thermal Aging Calculations for Limitorque Valve Actuators

Arrhenius formula:

$$X_1 = X_2 e^{\frac{A}{K}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]}$$

$A = 1.016$ eV
$X_2 = 100$ hours
$T_2 = 180 + 273 = 453°K$
$K = 8.617 \times 10^{-5}$

for the maximum normal temperature at Unit 1 (pressurizer doghouse location) a 45 year expentancy is obtained.

Conclusion

Thermal life of Limitorque valve actuators has been calculated by using the Arrhenius formula on their electric motor insulation, Class RH, Rad. H, and B. Results indicate more than 40 year life expentancy.

Input Data

a) Limitorque test report # 600198 (CEE QF #22)

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b) Limitorque Report # B 0058 (CEEQF #513)

c) Impell Corp. Calculation. # 0120-083-019 (CEEQF #142)

d) Calculations - J.A. Pria - This report

2/9/82

J.A.P.

Limitorque RH Motor Insulation

A) Activation Energy

$$Ln\left(\frac{X_1}{X_2}\right) = \frac{A}{K}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$ — Arrhenius Equation

$$A = \frac{K \; Log_n \left(\frac{X_1}{X_2}\right)}{\left[\frac{1}{T_1} - \frac{1}{T_2}\right]}$$

$K = 8.617 \times 10^{-5}$

$T_2 > T_1$

A = Activation Energy

1) $T_1 = 343°K$ $X_1 = 1,096,338,000$ Hrs
$T_2 = 373°K$ $X_2 = 69,008,000$ Hrs
} Limitorque Report # B0058

$$A = \frac{8.617 \times 10^{-5} \; Ln \; \frac{1096338000}{69008000}}{\frac{1}{343} - \frac{1}{373}} = \frac{23.830382 \times 10^{-5}}{2.34476 \times 10^{-4}} = 1.0$$

$A = 1.016$ eV

2) $T_1 = 353°K$ $X_1 = 9,216,906,000$
$T_2 = 363°K$ $X_2 = 164,889,000$
} Limitorque Test Report # B0058

$$A = \frac{8.617 \times 10^{-5} \; Ln \; \frac{9216906000}{164889000}}{\frac{1}{323} - \frac{1}{363}} = \frac{34.677066 \times 10^{-5}}{3.411594 \times 10^{-4}} = 1.$$

$A = 1.016$ eV

Limitorque RH motor insulation

B) Thermal Life @ 160° F

$$X_1 = X_2 e^{\frac{A}{K}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)}$$

$A = 1.016$ eV (See sheet 1)

$K = 8.617 \times 10^{-5}$ eV

$T_1 = 160°F = 344°K$ $\quad X_1 = ?$

$T_2 = 100°C = 373°K$ $\quad X_2 = 69\,008\,000$ Hrs

$$X_1 = 69\,008\,000\, e^{\frac{1.016}{8.617 \times 10^{-5}}\left(\frac{1}{344} - \frac{1}{373}\right)} = 91,911,325.520 \text{ Hrs}$$

$X_1 > 40$ Years

2/9/84

J.A.P.

Limitorque B Motor Insulation

A) Activation Energy

$$Ln\left(\frac{X_1}{X_2}\right) = \frac{A}{K}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$ → Arrhenius Equation

$K = 8.617 \times 10^{-5}$

$T_2 > T_1$

A = Activation Energy

$$A = \frac{K \, Log_n\left(\frac{X_1}{X_2}\right)}{\left[\frac{1}{T_1} - \frac{1}{T_2}\right]}$$

1) $T_1 = 343^\circ K$ $X_1 = 3,855870$ Hrs } Limitorque Report # 80058

$T_2 = 373^\circ K$ $X_2 = 309\,000$ Hrs

$$A = \frac{8.617 \times 10^{-5} \; Ln \frac{3855870}{309000}}{\frac{1}{343} - \frac{1}{373}} = \frac{2.17494 \times 10^{-5}}{2.34486 \times 10^{-4}} = .927$$

$A = .927$ eV

2) $T_1 = 323^\circ K$ $X_1 = 26\,925\,000$ Hrs } Limitorque Test Report # 80058

$T_2 = 363^\circ K$ $X_2 = 684000$ Hrs

$$A = \frac{8.617 \times 10^{-5} \; Ln \frac{26925000}{684000}}{\frac{1}{323} - \frac{1}{363}} = \frac{31.6896 \times 10^{-5}}{3.41154 \times 10^{-4}} = .92$$

$A = .927$ eV

Limitorque B Motor Insulation

B) Thermal Life @ 160° F

$$X_1 = X_2 e^{\frac{A}{K}\left(\frac{1}{T_1}-\frac{1}{T_2}\right)}$$

$A = .917$ eV

$K = 8.617 \times 10^{-5}$ eV

$T_1 = 160°F = 344°K$ $\quad X_1 = ?$

$T_2 = 100°C = 373°K$ $\quad X_2 = 309\,000$ Hrs

$$X_1 = 309\,000\, e^{\frac{.917}{8.617\times10^{-5}}\left(\frac{1}{344}-\frac{1}{373}\right)} = 3,423,782 \text{ Hrs}$$

$X_1 = > .40$ Years

5/16/84
JAP

Limitorque Rad H motor insulation

A) Activation Energy

same as for Class RH insulation = 1.016 eV

B) Thermal Life at 160°F.

$$X_1 = X_2 e^{\frac{A}{K}\left(\frac{1}{T_1}-\frac{1}{T_2}\right)}$$

$A = 1.016$
$K = 8.617 \times 10^{-5}$ eV

$T_1 = 160°F = 344°K$
$T_2 = 180°F = 453°K$
$X_2 = 100$ Hours

} Limitorque Test Report # 6001.98 - (CEEQF#22)

$$X_1 = 100 e^{\frac{1.016}{8.617 \times 10^{-5}}\left[\frac{1}{344}-\frac{1}{453}\right]} = 381,698 \text{ Hours}$$

$X_1 > 40$ Years

Attachment 3 to AEP:NRC:0775AE

Penn Union and Marathon Terminal

Block Aging Calculations

Penn Union Terminal Blocks
Thermal Aging Analysis

TB type: 6012-N3-AEP
Material: PPO (poly-phenoline-oxide) } as per G.E
Grade: SE1GFN3

From U.L. Thermal Aging Program (Arrhenius Plot)

50% Loss of the original tensile strength

370 Hours	150°C = 423°K
1800 "	135°C = 408°K

1) Activation Energy (A)

Arrhenius formula $\text{Log}_n \frac{X_1}{X_2} = \frac{A}{K}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$

$$A = \frac{K \text{ Log}_n\left(\frac{X_1}{X_2}\right)}{\left[\frac{1}{T_1} - \frac{1}{T_2}\right]}$$

$$A = 8.617 \times 10^{-5} \frac{\text{Log}_n\left(\frac{1800}{370}\right)}{\left[\frac{1}{408°} - \frac{1}{423}\right]} = 1.568 \text{ eV}$$

2) Life @ 160°F = 71°C = 343°K

$$X_1 = 370\, e^{\frac{1.568}{8.617 \times 10^{-5}}\left[\frac{1}{343} - \frac{1}{423}\right]} = 8,426,069 \text{ Hours}$$

Life > 40 years

IMPELL CORPORATION

TELECOPY FORM

COMPANY	AMERICAN ELECTRIC POWER
ATTENTION	MR. JOSE PRIA
SUBJECT	Thermal Aging of NORYL
TELECOPY NO.	(614) 223-1823
VERIFICATION NO.	
FROM	A. BISWAS
DATE	5/14/86
JOB NO.	1630-005-1661
NO. OF PAGES FOLLOWING	8

DO YOU WANT THIS TELECOPY RETURNED? ✓ Yes ____ No

225 BROAD HOLLOW ROAD • MELVILLE, NEW YORK 11747 • (516) 420-3200

TO.
MR. JOSE PRIA.

PER OUR TELECON ENCLOSED PLEASE FIND THE THERMAL AGING DATA (UL TEST) FOR NORYL GFN3.

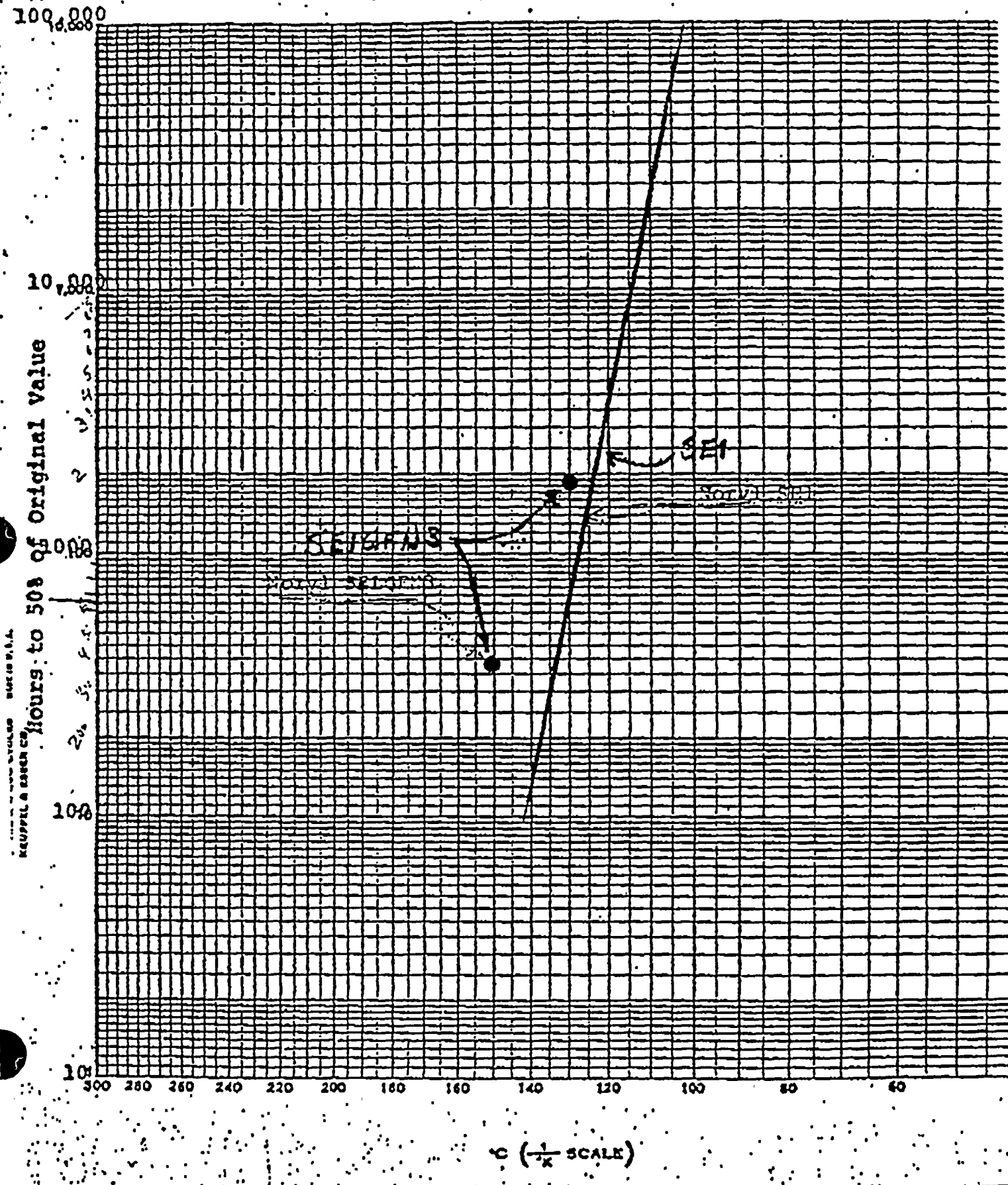
THANKS

A BISWAS 5/14/86
IMPELL

U.L. Thermal Aging Program

Comparison of Noryl SE1GFN3 with Noryl SE1

Tensile Impact Strength at 1/8" Thickness



Thermal Aging - Noryl SE1GFN3-780
Tensile Impact Strength (ASTM D1822)
1/16" "S" Type Specimens

Hours	120°C	140°C
0	18	18
336		13
504	9	7
672	18	12
840	16	15
1008		16
1196	26	18
1344		9
1512	18	13
1680		12
1848		3
2184	13	

Thermal Aging - Noryl SE1GFN3-780
Tensile Impact Strength (ASTM D1822)
1/8" "S" Type Specimens

Hours	110°C	120°C	130°C	140°C	150°C
0	32	32	32	32	32
168				29	25
336					19
504	23	24	18	11	12
672	24	23	17	15	13
840	25	22	17	13	13
1008			17	15	13
1176	19	18	14	14	13
1344			13	14	12
1512	23	15	21	15	11
1680			22	10	17
1848	28	21	17	7	
2184	15	19	15		

Thermal Aging - Noryl SE1GFN3-780
Tensile Strength (ASTM D638)
1/8" Specimens

Hours	110°C	120°C	130°C	140°C	150°C
0	16,500	16,500	16,500	16,500	16,500
168				15,400	14,700
336					14,300
504	16,900	16,900	16,300	14,200	13,900
1008	15,400	15,600	13,100	13,600	11,300
1176				12,600	11,700
1680	15,700	13,600	12,500	11,700	11,800
2016				11,900	10,600
2352	14,800	12,500	11,500	11,900	11,400

Thermal Aging - Noryl SE1GFN3-780
Tensile Strength (ASTM D638)
1/16" Specimens

Hours	120°C	140°C
0	14,800	14,800
168		14,100
504	18,300	15,300
1008	18,700	14,700
2016	13,600	10,800
2352	12,700	11,100

Thermal Aging - Noryl SE1GFN3-780

Tensile Strength (ASTM D638)

1/32" Specimens

Hours	120°C	140°C
0	16,600	16,600
672	15,800	11,800
1176	12,100	10,200

Thermal Aging - Noryl SE1GFN3-780
Dimensional Stability (ASTM D1042)
Percent Change on 8 1/2" Tensile Bars

Hours	110°C	120°C	130°C	140°C	150°C
504	0.03	0.29	0.68	1.53	1.69
1008	0.00	0.25	0.68	1.61	1.74
1680	0.01	0.32	0.74	1.66	1.80
2352	0.03	0.33	0.71	1.66	1.85

A-24-84
LAP

ATTACHMENT # 2

Marathon Terminal Blocks
Test Report # 45603-1
Wyle Job # 45603

From Page XII-24 Par. 3.4.1

$$\text{Log}_n(\text{Life}) = 14101.11669\left(\frac{1}{T}\right) - 24.3612852$$

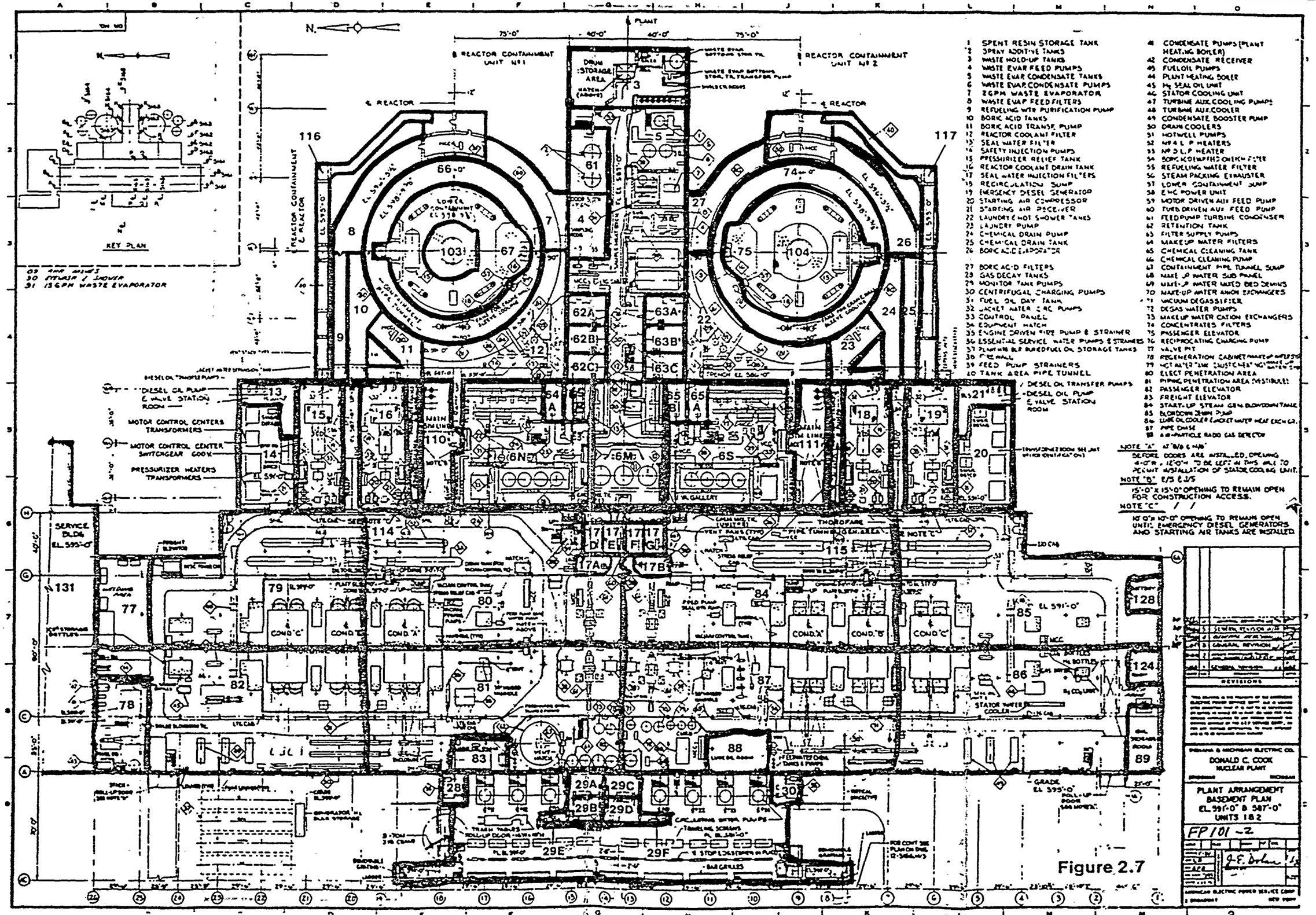
$\frac{A}{K} = 14101.11669$ A = Activation Energy
K = 8.617×10^{-5}

$A = 8.617 \times 10^{-5} \times 14101.11669 =$ 1.215 eV
(Typical Thermophenolics)

Life @ 160°F = 344°K

$$\text{Log}_n(\text{Life}) = \frac{14101.11669}{344} - 24.3612882 = 16.6316$$

Life = 16,668,5970 Hrs = 1900 Years



1 SPENT RESIN STORAGE TANK
2 SPRAY ADDITIVE TANKS
3 WASTE HOLD-UP TANKS
4 WASTE EVAP FEED PUMPS
5 WASTE EVAP CONDENSATE TANKS
6 WASTE EVAP CONDENSATE PUMPS
7 25GPM WASTE EVAPORATOR
8 WASTE EVAP FEED FILTERS
9 REFUELING WTR PURIFICATION PUMP
10 BORIC ACID TANKS
11 BORIC ACID TRANSF PUMP
12 REACTOR COOLANT FILTER
13 SEAL WATER FILTER
14 SAFETY INJECTION PUMPS
15 PRESSURIZER RELIEF TANK
16 REACTOR COOLANT DRAIN TANK
17 SEAL WATER INJECTION FILTERS
18 RECIRCULATION SUMP
19 EMERGENCY DIESEL GENERATOR
20 STARTING AIR COMPRESSOR
21 STARTING AIR RECEIVER
22 LAUNDRY & HOT SHOWER TANKS
23 LAUNDRY PUMP
24 CHEMICAL DRAIN PUMP
25 CHEMICAL DRAIN TANK
26 BORIC ACID EVAPORATOR
27 BORIC ACID FILTERS
28 GAS DECAY TANKS
29 MONITOR TANK PUMPS
30 CENTRIFUGAL CHARGING PUMPS
31 FUEL OIL DAY TANK
32 JACKET WATER CIRC PUMPS
33 CONTROL PANEL
34 EQUIPMENT HATCH
35 ENGINE DRIVEN FIRE PUMP & STRAINER
36 ESSENTIAL SERVICE WATER PUMPS & STRAINERS
37 PLANT HTG BLR FUEL OIL STORAGE TANKS
38 FIRE WALL
39 FEED PUMP STRAINERS
40 TANK AREA PIPE TUNNEL
41 DIESEL OIL TRANSFER PUMPS
42 DIESEL OIL PUMP & VALVE STATION ROOM
43 TRANSFORMER ROOM SPRINKLER (WATER CONTINUATION)
44 CONDENSATE PUMPS (PLANT HEATING BOILER)
45 CONDENSATE RECEIVER
46 FUEL OIL PUMPS
47 PLANT HEATING BOILER
48 H2 SEAL OIL UNIT
49 STATOR COOLING UNIT
50 TURBINE AUX COOLING PUMPS
51 TURBINE AUX COOLER
52 CONDENSATE BOOSTER PUMP
53 DRAIN COOLERS
54 HOTWELL PUMPS
55 NO 4 L P HEATERS
56 NO 3 & L P HEATER
57 BORIC ACID MIXING TANK & FILTER
58 REFUELING WATER FILTER
59 STEAM PACKING EXHAUSTER
60 LOWER CONTAINMENT SUMP
61 EMC POWER UNIT
62 MOTOR DRIVEN AUX FEED PUMP
63 TURB DRIVEN AUX FEED PUMP
64 FEEDPUMP TURBINE CONDENSER
65 RETENTION TANK
66 FILTER SUPPLY PUMPS
67 MAKE-UP WATER FILTERS
68 CHEMICAL CLEANING TANK
69 CHEMICAL CLEANING PUMP
70 CONTAINMENT PIPE TUNNEL SUMP
71 MAKE UP WATER SUB PANEL
72 MAKE-UP WATER MIXED BED DEMINS
73 MAKE-UP WATER ANION EXCHANGERS
74 VACUUM DEGASSIFIER
75 DEGAS WATER PUMPS
76 MAKE UP WATER CATION EXCHANGERS
77 CONCENTRATES FILTERS
78 PASSENGER ELEVATOR
79 RECIPROCATING CHARGING PUMP
80 VALVE PIT
81 REGENERATION CABINET
82 PASSENGER ELEVATOR
83 FREIGHT ELEVATOR
84 START-UP STEAM GEN BLOWDOWN TANK
85 BLOWDOWN SAMPLE PUMP
86 LUBE OIL COOLER (JACKET WATER HEAT EXCH'R)
87 PIPE CHASE
88 AIR-PARTICLE RADIO GAS DETECTOR

NOTE "A" AT 8'0" & 14'0" BEFORE DOORS ARE INSTALLED, OPENING 4'-0" W x 12'-0" H TO BE LEFT IN THIS WALL TO PERMIT INSTALLATION OF STATOR COOLING UNIT.

NOTE "B" E/3 & J/5
15'-0" X 15'-0" OPENING TO REMAIN OPEN FOR CONSTRUCTION ACCESS.

NOTE "C" / /
10'-0" X 10'-0" OPENING TO REMAIN OPEN UNTIL EMERGENCY DIESEL GENERATORS AND STARTING AIR TANKS ARE INSTALLED.

Figure 2.7

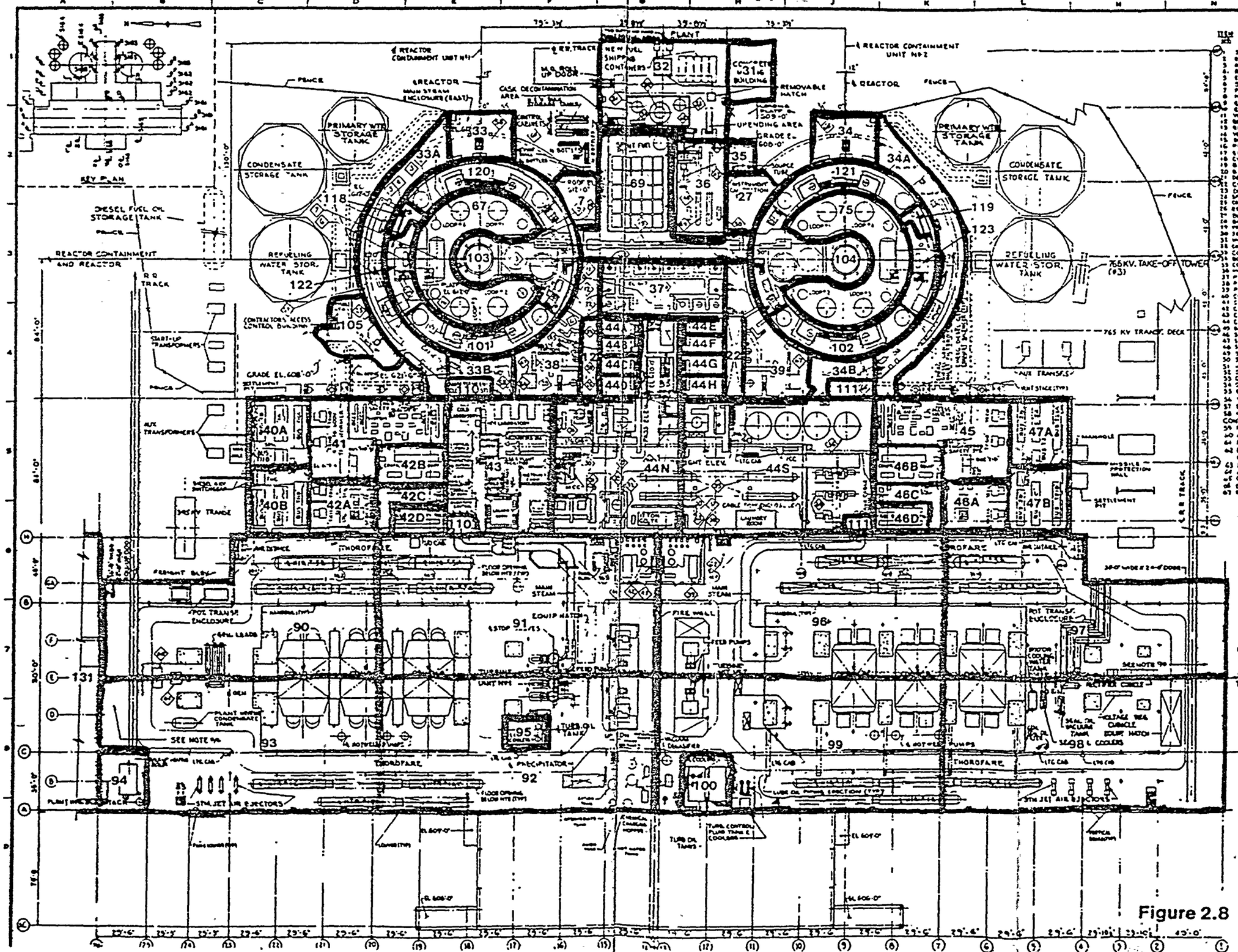
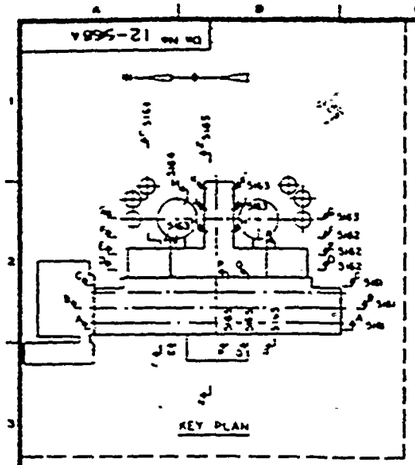
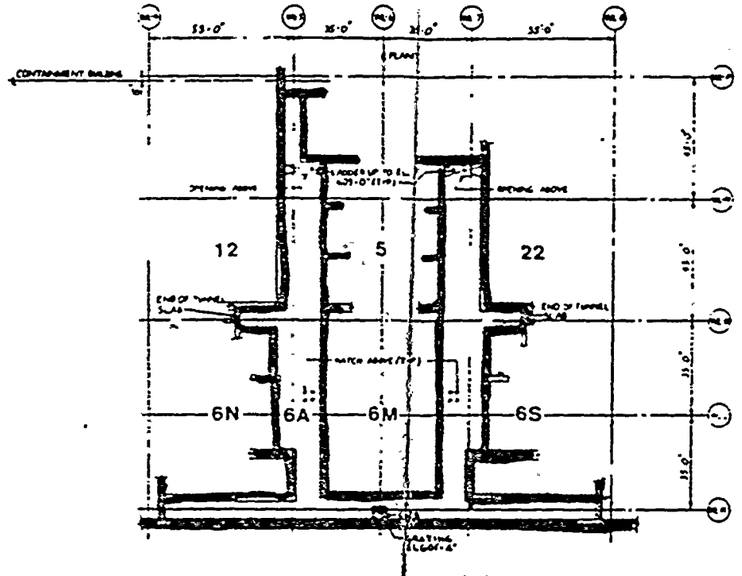
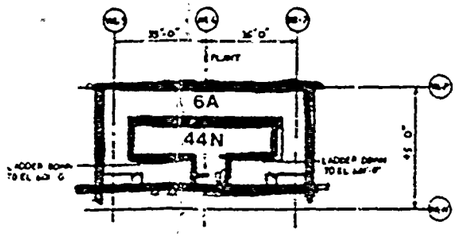


Figure 2.8

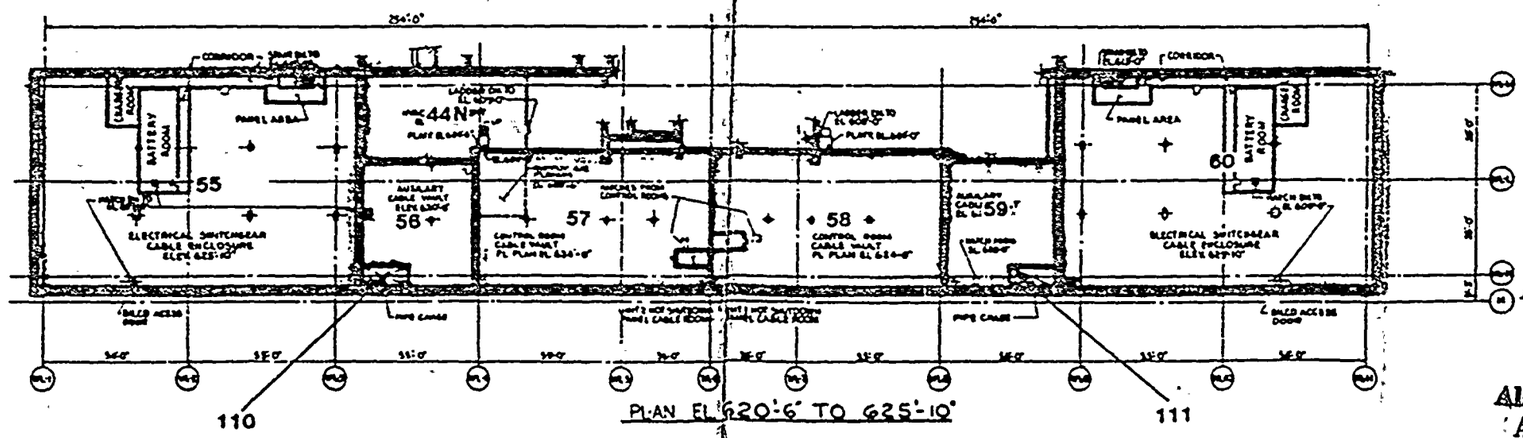




PIPE TUNNEL PLAN EL 601'-0"



PART PLAN EL 609'-0"



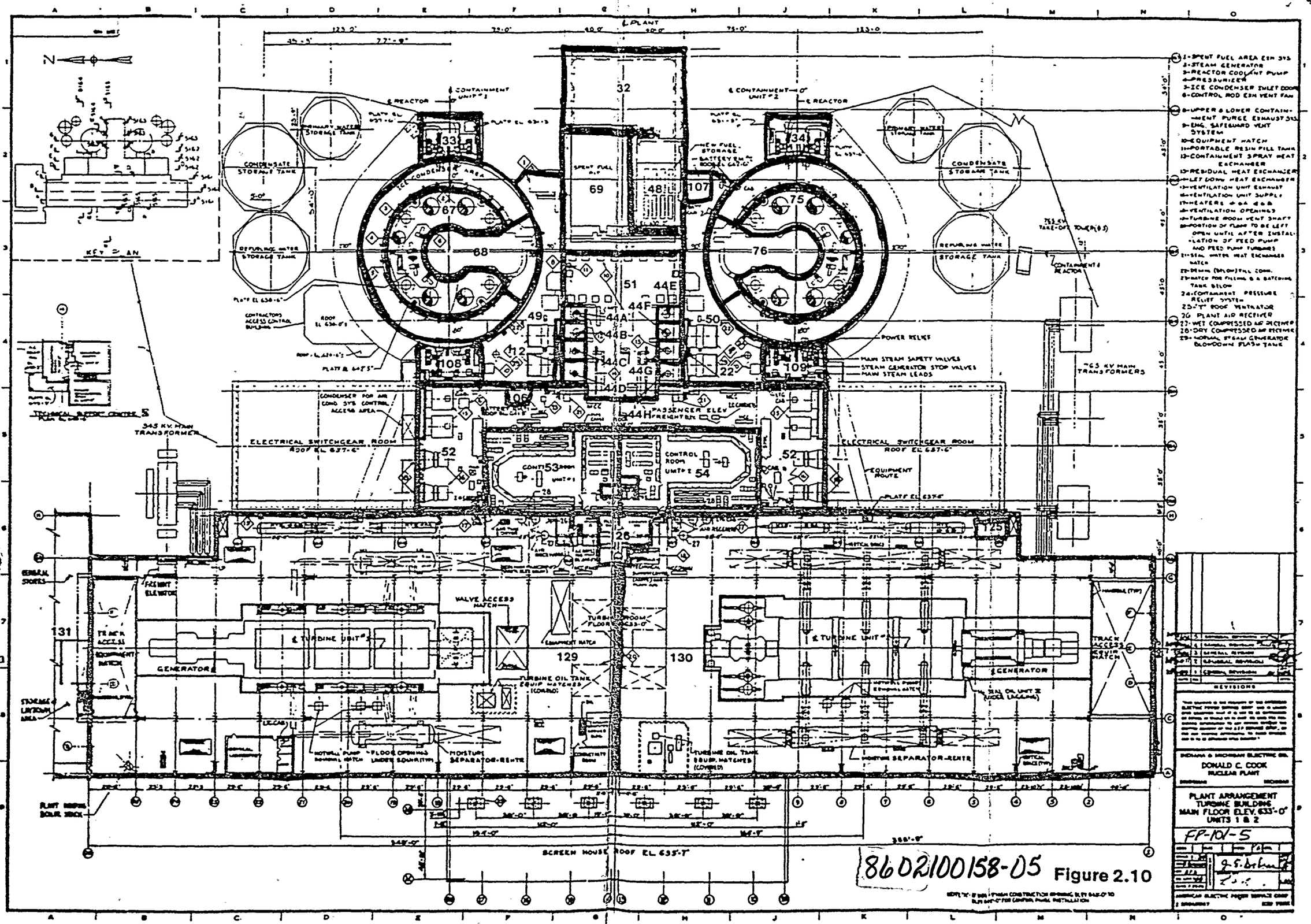
PLAN EL 620'-6" TO 625'-10"

Figure 2.9

DONALD C. COOK NUCLEAR PLANT

PART PLANT ARRANGEMENT PLAN EL 601'-0" & 609'-0" & 620'-6" TO 625'-10"
UNIT 1&2

FP 101-4



8602100158-05 Figure 2.10

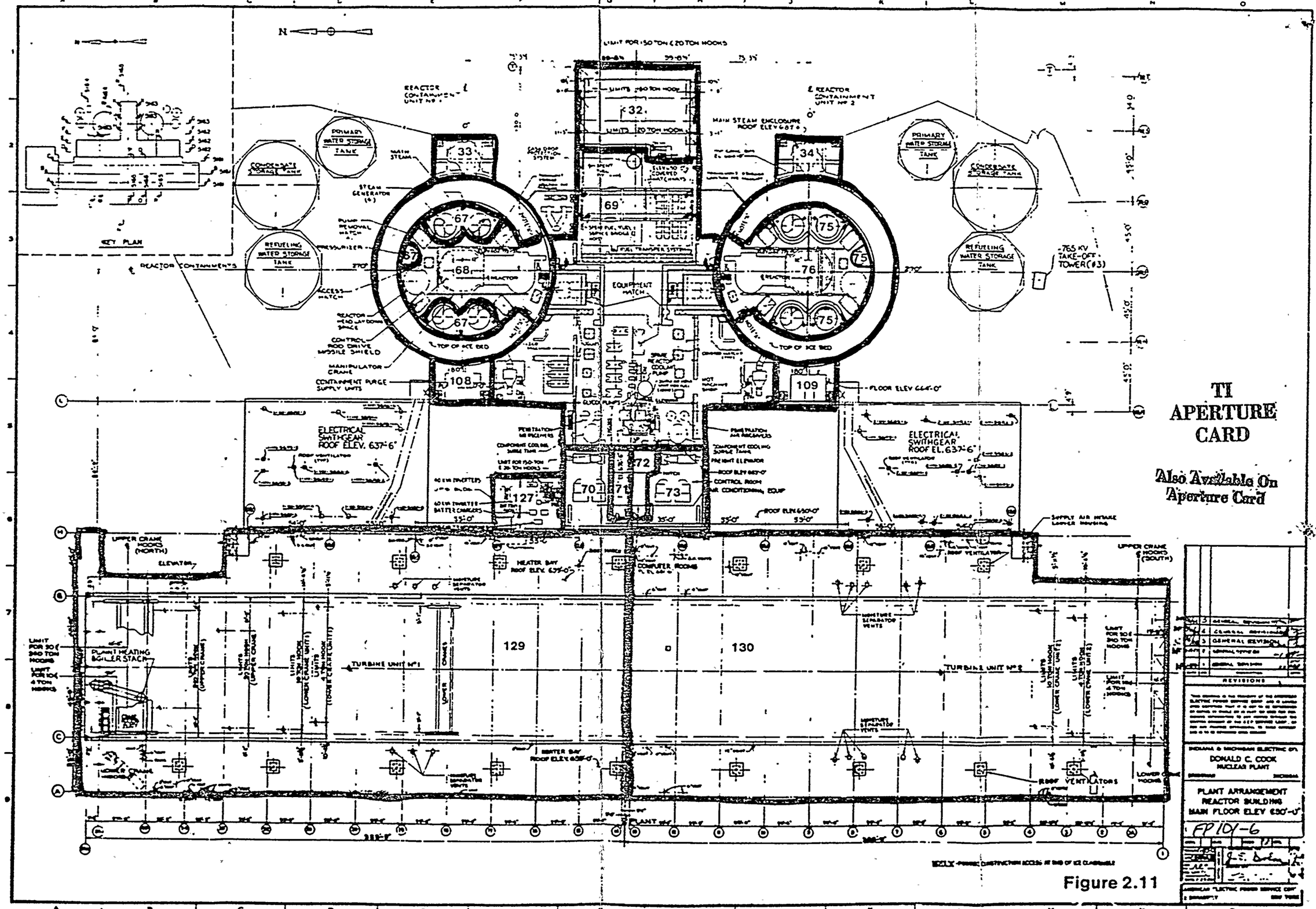


Figure 2.11