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

AUG 3 1 1992

MEMORANDUM FOR: Goutam Bagchi, Chief
Structural and Geosciences Branch
Division of Engineering Technology

FROM: Robert L. Rothman, Chief
Geosciences Section
Structural and Geosciences Branch
Division of Engineering Technology

SUBJECT: TRIP REPORT: AUDIT OF STRUCTURES AND CIVIL ENGINEERING FEATURES, BEAVER VALLEY POWER STATION, UNIT 1.
TAC NO.: M83708

Structural and Geosciences Branch staff (Robert Rothman and John Ma) together with Brookhaven National Laboratory consultants (Joseph Braverman and Richard Morante) performed a structural site audit of Beaver Valley Power Station, Unit 1 during the week of June 15, 1992. The NRR project manager (Albert De Agazio) and a Region I staff member (Joseph Carrasco) accompanied the staff during the audit.

The engineering staff of the licensee (Duquesne Light Company) presented a summary of the plant which included design criteria, containment structure, masonry walls, ground water issues, buried piping storage tanks, civil structural LERs and 10 CFR 50.59 evaluations, and plant safety procedures for natural phenomena. In two days of walkdowns, the audit team examined the Intake Structure, the Category I storage tanks, the Containment, the Cable Vault, the Main Steam Valve House, the Coolant Recovery Structure, the Safeguards Area, the Diesel Generator Building, the Primary Auxiliary Building, the Fuel Building, and the Turbine Building.

A number of questions were raised during the audit. Duquesne Light Company personnel provided responses and documents in an effort to address and resolve many of the questions. At the exit meeting the staff presented a list of observations for the Duquesne Light Company's information. Most of the civil/structural plant features examine are in very good condition.

CONTACT: Robert L. Rothman, ESGB
504-3306

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Enclosure 1 is a detailed trip report with five attachments. The attachments contain the following information:

Attachment 1. Description of Civil/Structural Observations
Attachment 2. Attendance Lists - Entrance and Exit Meetings
Attachment 3. Duquesne Light Company Presentation
Attachment 4. Walkdown Log
Attachment 5. Photographs.

Enclosure 2 contains the SALP Input.

Robert L. Rothman, Chief
Geosciences Section
Structural and Geosciences Branch
Division of Engineering Technology

Enclosure: As stated

cc: W. T. Russell
J. E. Richardson
B. D. Liaw
J Craig
P. T. Kuo
J. A Calvo
J. F. Stolz
A. De Agazio
A. Murphy, RES
J. P. Durr, RGN-I
J. E. Carrasco, RGN-I
L. Rossbach, SRI Beaver Valley

Enclosure 1

BROOKHAVEN NATIONAL LABORATORY
ASSOCIATED UNIVERSITIES, INC.
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Department of Nuclear Energy

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July 24, 1992

Mr. Harold Polk
U.S. Nuclear Regulatory Commission
Mail Stop 12-H26
Washington, DC 20555

Dear Mr. Polk:

Subject: Beaver Valley Power Station Trip Report; Assessment of Structures and Civil Engineering Features at Operating Plants; FIN L-1521, Task Assignment No. 6

Enclosed please find a copy of the trip report for the NRC audit of Beaver Valley Power Station, Unit 1, which was conducted during the week of June 15, 1992.

If you have any questions or comments on this report, please feel free to call me.

Sincerely yours,

Joseph Braverman

Joseph Braverman
Engineering Research and
Applications Division

\kb
Enc.
cc: G. Bagchi (NRC)
R. Rothman (NRC)
J. Ma (NRC)
M. Reich (BNL)
C. Hofmayer (BNL)
P. Bezler (BNL)
R. Morante (BNL)

ENCLOSURE

BEAVER VALLEY POWER STATION UNIT 1

TRIP REPORT

Purpose:	Audit of Structures and Civil Engineering Features
Location:	Beaver Valley Power Station Unit 1 Shippingport, Pennsylvania
Date:	June 15-19, 1992
Personnel:	R. Rothman (NRC), J. Ma (NRC), J. Carrasco (NRC), R. Morante (BNL), J. Braverman (BNL)

Background

The objective of the plant visit was to obtain information about the performance of structures at operating plants and to draw some generic conclusions based on the information obtained from this and other plant visits. To achieve this objective, an assessment of the existing condition and past performance of structures and civil engineering features at Beaver Valley Power Station was performed. Any failures, degradations, maintenance, surveillance, modifications/repairs of safety related structures were of interest. Structures reviewed include buildings, tanks, cable tray and conduit supports, anchorages, underground structures, and the water intake structure.

Inspection Summary

This section of the trip report describes the various audit activities and the structures that were examined during the walkdown. The section following this inspection summary presents the results and major observations noted during the audit. A more complete list and detailed description of the observations are contained in Attachment 1.

June 15, 1992:

At 2:00 p.m., the audit team met with Al DeAgazio, NRC Project Manager, at the plant site. The BNL members of the team were given site-specific safety training, which is required for escorted visitors.

The NRC members of the team completed necessary paperwork for unescorted access to the plant. Badging and dosimetry procedures

were reviewed with the audit team and camera passes were requested for the walkdown.

June 16, 1992:

At 8:00 a.m., there was a brief entrance meeting. This was followed by a formal presentation by Duquesne Light Company (DLCo) personnel. The attendee list is contained in Attachment 2. A copy of the agenda and viewgraphs used in the presentation is included in Attachment 3. The major topics covered include design criteria, containment structure, support anchorages, spent fuel pool/racks, intake structure, masonry walls, ground water issues, buried piping, storage tanks, civil/structural LERs and 10 CFR 50.59 evaluations, and plant safety procedures for natural phenomena.

June 17, 1992:

The walkdown was initiated at 8:00 a.m. The audit team remained together throughout the plant walkdown activities. BNI personnel were escorted by R. Rothman, NRC. DLCo engineering and maintenance personnel were assigned to guide us through the plant and to answers questions as they came up. If questions could not be immediately answered, they were recorded for followup by the plant staff.

The first area visited was the Intake Structure, which is enclosed by a steel frame superstructure over the traveling screens and pump cubicles. The specific areas examined include interior concrete walls, floors, and ceilings; pump cubicles A, B, C, and D; and the exterior concrete walls. There was no immediate access for examining concrete at the water line. Since this required plant maintenance assistance, it was arranged for the following morning.

Next, the team reviewed the exterior of Category I structures and storage tanks, including the Containment; the Cable Vault and Main Steam Valve House; the Coolant Recovery Structure; the Refueling Water Storage Tank; the Safeguards Area; the Diesel Generator Building; the Steam Generator Drain Tank; the Primary Auxiliary Building; the Fuel Building; the Turbine Building; and the concrete enclosure for the Demineralized Water Storage Tank (no access to confined area).

Following completion of the outside inspections, the team inspected the interior of the Primary Auxiliary Building and the Fuel Building on elevations 722'-6", 735'-6", 752'-6", and 768'. Structural components reviewed included concrete floors, walls, and ceilings; building structural steel; conduit/supports; cable tray/supports; pipe supports; equipment supports; support anchorages; seismic gaps between buildings; tanks; masonry walls; and the spent fuel pool and fuel transfer canal.

June 18, 1992:

The walkdown resumed at 8:00 a.m., starting with the interior of the Diesel Generator Building. The concrete walls, floor, and ceiling, the diesel generator supports, attachments to concrete, and general features were examined.

Next, the team returned to the Intake Structure to assess the condition below the operating floor; it is accessible only through normally closed manholes. Mr. Braverman accompanied the DLCo representative into the C Bay pit to check for degradation of concrete and steel.

Following this, the team examined the Control Room, primarily focusing on masonry walls in the vicinity of safety-related electrical cabinets and control panels.

The remainder of the walkdown encompassed the interior of the Service Building, the Cable Vault Structure, and the Safeguards Building. The Service Building inspection included the Switchgear Rooms, the Process Rack Area, and the Air Conditioning Room on elevation 713'- 6", the Cable Mezzanine on elevation 725'- 6"; and elevation 735'.

The Cable Vault Structure inspection included the West Cable Vault, the Auxiliary Feedwater Pump Room, the Main Steam Room, and Motor Control Center Room, and other areas on elevations 722', 735', 751', 756' and 776'. The Safeguards Building inspection included the Hydrogen Recombiner Room, the Recirculation Spray Pump Room, the Charging Line, the Quench Spray Line, the River Water Line, Containment Piping Penetrations, and other areas on elevations 722' and 747'.

Structural components reviewed in these areas include concrete floors, walls, ceiling, and roofs; building structural steel; conduit/supports; cable tray/supports; piping support anchorages; seismic gaps between buildings; equipment supports; tanks; and masonry walls. This concluded the walkdown activities.

During all of the walkdowns, a log was maintained, as shown in Attachment 4, in which the team recorded for each observation the building/area, elevation, location, component/item, aspect reviewed, photograph number, and any comments. Data were recorded for structural components where aging degradation effects were present as well as where they were not. Photographs were taken for selected items to enhance the documentation; these were noted in the log. In addition, measurements were taken when appropriate (such as crack size), to determine the severity of the degradation.

In late afternoon, the audit team reviewed several LER and 10 CFR 50.59 packages related to civil/structural items. These were either selected from a list provided by DLCo during their

presentation or were provided by DLCo in response to specific questions by the audit team.

Throughout the audit, DLCo personnel provided responses and documents in an effort to address and resolve many of the questions and concerns raised by the audit team during the formal presentation session and during the walkdowns. The audit team then reviewed and discussed the observations noted. A list of the more meaningful observations, including those that would be of benefit to DLCo was compiled. This list, which is discussed in the next section of this trip report, was conveyed verbally to DLCo at the exit meeting held the next morning.

Results/Observations

The exit meeting was held at [illegible] a.m. on June 19, 1992. A list of the attendees at this meeting is contained in Attachment 2. During this meeting, R. Rothberg reviewed the purpose of the visit, which was to assess the effects of age-related degradation of civil engineering features, buildings, supports of equipment, anchorages, and to determine what type of maintenance and surveillance activities are necessary, if any. In addition, he summarized the observations noted as a result of the formal presentation given by DLCo and the walkdowns performed by the audit team.

It should be noted that the observations presented to DLCo were for their information and do not represent requirements by the NRC. Any action the licensee may take as a result of these observations is considered voluntary.

While most of the civil/structural plant features examined at Beaver Valley Unit 1 are in very good condition after 16 years of operation, there were some components which did show varying degrees of aging degradation. Some of the observations are discussed below, with a more complete list and detailed description presented in Attachment 1. A few items which were not aging related were also brought to DLCo's attention (e.g., missing or loose concrete anchor bolts; one instance of questionable seismic support for valves in a small bore, safety-related piping run).

An examination of the exterior condition of the containment structure from the ground and from the roof of the adjacent buildings showed no significant signs of concrete degradation. Only minor surface cracking was observed. However, original patches over construction-related holes are deteriorating and falling out, giving the appearance that small chunks of concrete are spalling. Monitoring of this condition and repair of the patches would be beneficial for the long term integrity of the containment.

The Beaver Valley Unit 1 Containment is constructed of reinforced concrete and normally operates at sub-atmospheric pressure (-4 psig). The quench spray and depressurization spray systems are engineered safety features designed to restore sub-atmospheric pressure conditions inside containment following the Design Basis Accident. Because the unit was in operation at the time of the audit, it was not possible to examine inside containment. DLCo presented a summary of results for all integrated and local leak rate tests and for all structural integrity inspections conducted prior to the integrated leak rate tests. A few instances of liner bulging were previously identified; these were subsequently monitored to ensure that the deformation was not growing. Rusted areas and peeled paint in several locations in the interior steel liner were noted in some of the containment inspections performed prior to the ILRTs. Gouges, anchor holes, missing concrete chunks, and some cracks in the exterior concrete surface of the containment were also noted. However, the containment inspection reports concluded that there was no major or gross deterioration of either the outer concrete structure or inside steel liner which would affect its structural integrity.

The last ILRT was conducted in late 1989; these tests are conducted on a 40-month cycle. The current program appears to be sufficient to detect any unusual deterioration which may develop.

For Seismic Category I structures other than Containment, cracks were observed in some reinforced concrete floors, walls, and ceilings. The most notable are cracks in the ceiling of the Diesel Generator Building and the ceiling of the pump cubicles in the Intake Structure. The exterior wall on the South side of the Diesel Generator Building has a region of concrete which has spalled to a depth of 1/2 inch, exposing the steel reinforcement. This reinforcement shows signs of corrosion.

In the Intake Structure in the bay "C" pit, corrosion of the horizontal structural steel supports for the raw water line was observed. This may be due to the water that is trapped in the horizontal structural steel shapes used to support the pipes. The concrete walls in this bay above the water surface appear to be in good condition.

While pipe and equipment supports are generally in good condition, there were a few instances of missing nuts, apparently untorqued anchor bolts, degradation of grout beneath base plates, and one case of a missing anchor bolt.

Corrosion was observed in the raw cooling water piping and steel supports for the condensing unit of the control room air conditioning. In several other areas, corrosion was noted on piping and supports. This appears to be primarily related to condensation.

A structural steel angle section, initially installed under DLCo's IE Bulletin 80-11 program to restrain the bottom edge of a masonry wall, was found to be only loosely held in place. It is important to ensure that all structural modifications to masonry walls are maintained in accordance with the qualification basis established in the 80-11 program. Also, any existing cracks in masonry walls which were not considered in the 80-11 program or any cracks which may develop in the future must be evaluated for their impact on the current qualification basis.

Photographs for some of the key observations are presented in Attachment 5.

Although there is no formal inspection program for structures, DLCo has developed a Plant Inspection Program (NGAP 8.8). The purpose of this procedure is to ensure that deficiencies relating to materials, fire protection, safety hazards, cleanliness, housekeeping, and radiological protection are identified and that corrective action is taken. Under material condition deficiencies, items such as rust, corrosion, loose/unbraced lines/pipes, and leaks are identified. Expansion of this program to cover other aging degradation effects such as concrete cracks, coating failures, and water infiltration would be very beneficial for maintaining the structural performance of the plant.

Another program developed by DLCo is the Settlement Monitoring Program (NEAP 2.20). This procedure provides the requirements to measure the settlement of Unit 1 and Unit 2 structures at selected locations throughout their operating life. This provides sufficient data for an engineering evaluation of the effect of settlement, as it relates to the integrity of the structures. Settlement markers for Unit 1 are surveyed at least annually. This program was initiated in 1971 during construction of the plant. As a result of this program uneven settlement of the Outfall Structure was observed in 1973/1974. The East side settled down while the West side heaved up. DLCo used piles and steel beams to underpin the structure to ensure no further settlement.

DLCo currently performs 10 CFR 50.59 evaluations in accordance with their Administrative Procedure 8.8-10 CFR 50.59 Evaluations, Rev. 0. This procedure defines the responsibilities and requirements for preparation, review, and approval of 10 CFR 50.59 evaluations of proposed changes, tests, or experiments. Because this procedure is relatively new, the 10 CFR 50.59 evaluation packages reviewed were in a different format. However, they did include a safety evaluation, an unreviewed safety question determination, and a Q.A. Category Review.

Conclusion

Considering that the plant has been operating for approximately 16 years, most civil/structural plant features have

performed very well. Some structures/components, however, do show signs of varying levels of aging degradation. The most severe cases relate to concrete cracks in the ceiling of the Diesel Generator Building and the cubicles in the Intake Structure; spalling of concrete and corrosion of reinforcement on the exterior South wall of the Diesel Generator Building; the loose angle support for a masonry wall; deterioration of construction patches on the concrete exterior of Containment; and piping/support corrosion caused primarily by condensation.

DLCo was very responsive to the questions and observations raised by the audit team. In one case, an excessive leak of the service water pumps in the Intake Structure was identified by the audit team. DLCo immediately repaired the pump to stop the water leakage.

The Plant Inspection Program developed by DLCo is a valuable tool to identify material deficiencies such as rust, corrosion, loose/unbraced lines/pipes and leaks, among other items. However, expansion of this program to formalize the inspection of structures for other aging degradation effects such as concrete cracks, coating failures, and water infiltration would be very beneficial for maintaining the structural performance of the plant.

ATTACHMENT 1

BEAVER VALLEY POWER STATION UNIT 1

DESCRIPTION OF CIVIL/STRUCTURAL OBSERVATIONS

Containment

1. Concrete patches over construction related holes are deteriorating and falling out. This gives the appearance that small chunks of concrete are spalling.

2. Based on the Containment Inspection Reports conducted prior to the ILRTs, gouges, anchor holes, missing concrete chunks, and some cracks in the exterior concrete surface were also noted. In addition, rusted areas and peeled paint in several locations in the interior steel liner were identified.

3. A few instances of liner bulging were previously identified. DLCo stated that these were subsequently monitored to ensure that the deformations were not growing.

4. Corrosion of the containment penetration for the component cooling line was observed from the Safeguards Structure at elevation 722 ft.

Intake Structure

1. Concrete cracks in the ceilings of the pump cubicles were identified. Many of the cracks were located near the access panels used for pump maintenance. Crack sizes up to approximately .075 inches were observed.

2. Corrosion of the horizontal structural steel supports for the raw water piping was observed in bay "C" pit (below grade). This may be due to the water that is trapped in the horizontal structural shapes used to support the pipes.

3. In some of the pump cubicles, grout degradation and baseplate corrosion were identified in small diameter piping supports. In addition, conduit supports on the concrete wall had missing washers, untorqued anchors, one missing anchor, gaps with the wall and beam members.

4. Three vertical cracks were observed on the exterior concrete wall on the South side. The cracks were approximately .02 inches wide and 10 feet long.

Diesel Generator Building

1. Long cracks running in the ceiling of both Diesel Generator Rooms were observed. The cracks run the entire width of the room from the East wall to the West wall.

2. The exterior South wall has a region of concrete which has spalled off to a depth of 1/2 inch, exposing the steel reinforcement. The reinforcement shows signs of corrosion.

Primary Auxiliary Building

1. A structural steel angle, initially installed under DLCo's IE Bulletin 80-11 program to restrain the bottom edge of a masonry wall, was found to be only loosely held in place. The masonry wall where this was located is at elevation 722 ft.- 6 in. in the Cable Vault Structure. In addition, a vertical angle did not have an anchor at the top and no washers were present at other anchors where oversized holes were used in the angle.

2. At elevation 722 ft.-6 in. a long, large crack in the concrete ceiling was observed. Signs of rust discoloration were also present.

3. Corrosion was observed in the raw cooling water piping and steel supports for the condensing unit of the control room air conditioning. This was identified at elevation 722 ft.-6 in.

4. At elevation 735 ft.-6 in. grout degradation was observed below the baseplate support to the CCR heat exchanger 1A pressure gauge.

Service Building

1. At elevations 713 ft.-6 in. and 725 ft.-6 in., the concrete ceilings exhibited signs of water infiltration and calcium formation.

2. Degradation of the foundation and corrosion of steel supports were observed in the Switchgear Room, elevation 713 ft.-6 in.

3. Cracks in the masonry wall next to the computer room at elevation 735 ft. of the Control Room were identified.

Cable Vault Structure

1. Cracks were identified in the masonry wall on elevation 735 ft. of the West Cable Vault.

2. Water from the fan coil unit drain line at elevation 735 ft. was corroding the base/steel supports.

3. Corrosion of the structural steel frame supporting the main steam and feedwater piping was observed at elevation 762 ft.-roof level.

Safeguards Structure

1. Corrosion of the sliding support plates for the river water piping was observed at elevation 722 ft.

2. Corrosion of two pipe support base plates was identified on the ceiling above elevation 722 ft.

3. Water infiltration and corrosion of steel angles at the ceiling, adjacent to the exterior containment wall, was observed at elevation 747 ft.

Other Structures

1. Steam Generator Drain Tank - cracks, water infiltration and calcium formation was observed at the West wall.

ATTACHMENT 2

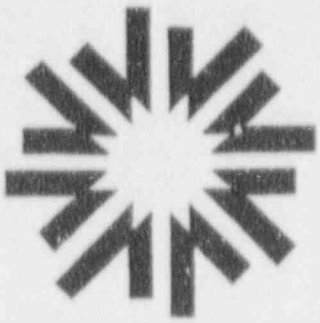
NRC Structural Audit - ENTRANCE MEETING
June 16th 1992

NAME	C/O	PHONE NO.
James F Sepelak	DLC Licensing	412 393 - 5210
Kenneth E Halliday	DLCo NED	5600
Nelson R. Tonet	" Nuclear Safety	5210
Richard J. Morante	NRC/ Brookhaven	516 - 282 - 5860
JOSEPH BRAVERMAN	NRC/BROOKHAVEN NATL.LAB	516 - 282 - 2186
JOHN S. MA	NRC/DET/ES&I3	301 - 504 - 2732
Joseph E. Carrasco	NRC / REG - I	(215) 337 - 5306
ROBERT L ROTHMAN	NRC/DET/ES&I3	(301) 504 - 3306
ALBERT W. DeAGAZIO	NRC/NRR/DRPE	301 - 504 - 1443
Joseph J. Nozar	DLC Nuclear Engineering Dept.	412 - 393 - 5056
W. HWANG	DLC - NUC. ENGRG. DEPT	
EUGENE EBECK	DLC - NUC ENGRG. DEPT.	(412) 393 - 5549
THEODORE SOCKALL	DLCo - Nuc. Engr. Dept	(412) 393 - 5548
FRANK J LIPCHICK	DLC - Nuclear Safety Dept	412 393 - 5285
RALPH HANSEN	DLC - NUCLEAR ENGINEERING DEPT	412 - 393 - 5627
STEVE NASS	DLC / NED	412 393 - 5663
ED COHOLICH	DLC / NUCLEAR SAFETY DEPT.	412 - 393 - 5224
JACK PATTERSON	DLC / TSD	(412) 393 - 4727
Tom Westbrook	DLC/Nuclear Engr. Dept	(412) 393 - 5550
CARMEN MANCINI	DLC/NED	412 - 393 - 5553
Neil Morrison	DLC / NED	(412) 393 - 7927

NRC Structural Audit Exit - June 19, 1992

Name	Co. / Title
Brian F. Sepelak	DLC / Licensing Engr.
RALPH L. HANSEN	DLC / NUCLEAR ENGINEERING
THEODORE SOCKACI	DLC / NUCLEAR ENGINEERING
WILLIAM HWANG	DLC / NUCLEAR ENGINEERING
CARMEN MANCUSO	DLC / NUCLEAR ENGINEERING
KENNETH E. HALLIDAY	DLC / NUCLEAR ENGINEERING
Nelson R. Tonet	DLC / Nuclear Safety
KD GRADA	DLC / QUALITY SERVICES UNIT
George Thomas	DLC / GM - CNSU
Tom Westbrook	DLC / Nuclear Engineering
EUGENE EBECK	DLC / NED
NICK PATTERSON	DLC / TSD
ROBERT RUTHMAN	NRC / DET / ESGS
JOSEPH BRAVERMAN	BNL
Rich Morante	BNL
GLENN RITZ	DLC / NED
JOHN S. MA	NRC / DET / ESGB
FRANK J. LIPCHICK	DLC / Nuclear Safety
JOSEPH E. CARRASCO	NRC / REG - I

ATTACHMENT 3



Duquesne Light Company

Beaver Valley Power Station

Unit 1

NRC AUDIT

June 15, 1992 thru June 19, 1992

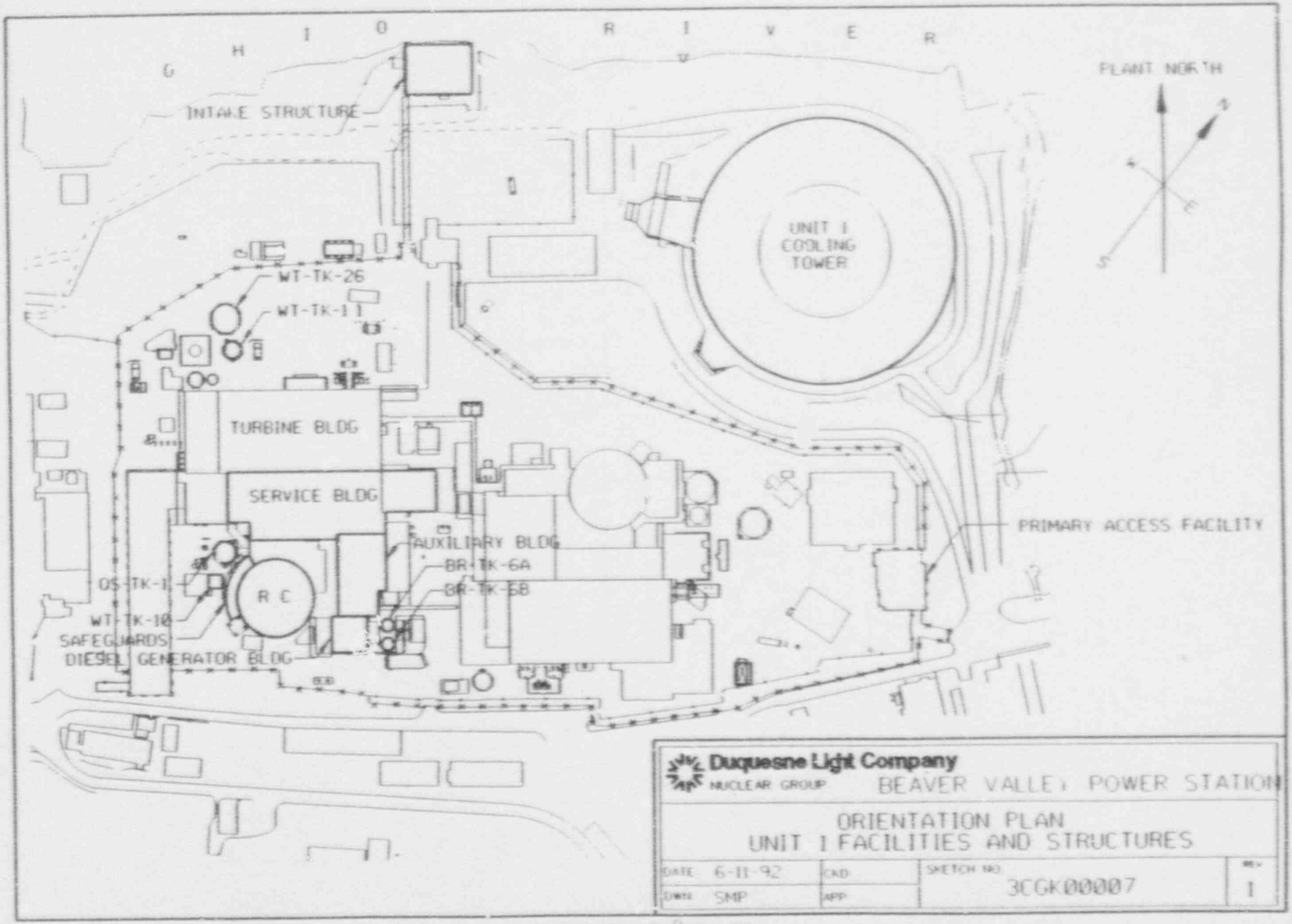
ENGINEERING PRESENTATION AGENDA

Tuesday, June 16 (All Day)

SUBJECT	SPEAKER
Design Criteria Including Seismic, Wind, And Missiles Design Codes and Standards	W. Hwang
Containment Testing and Surveillance	J. Patterson
Support Anchorage Issues	T. Westbrook
Spent Fuel Pool and Spent Fuel Storage Racks	G. Ritz
Intake Structure	C. Mancuso
Masonry Walls	G. Ritz
Corrosion Protection	T. Westbrook
Geology, Foundation Conditions, and Ground Water	T. Westbrook
Flood and Dam Failure	T. Westbrook
Buried Piping Integrity	C. Mancuso
QA Category I Structures Inspection and Surveillance Programs	C. Mancuso
Settlement of Structures and Verticality	E. Ebeck

SUBJECT	SPEAKER
Seismic Instrumentation	J. Nazar
Safety Related Storage Tanks	C. Mancuso
Civil/Structural LERS	C. Mancuso
Past Dispositions of Structural Issues Identified in Past NRC Inspection Reports	B. Sepelak
Civil/Structural 10CFR50.59 Evaluations	T. Sockaci
Plant Safety Procedures - Abnormal Operating Procedures	C. Mancuso
Summary of Planned Activities For Future License Renewal	B. Sepelak
USI A-46 Resolution	G. Ritz
IPEEE Summary	S. Nass

NOTE: AGENDA MAY BE REARRANGED AS REQUIRED.


O H I O R I V E R
INTAKE STRUCTURE
PLANT NORTH
UNIT 1 COOLING TOWER
WT-TK-26
WT-TK-11
TURBINE BLDG
SERVICE BLDG
AUXILIARY BLDG
PRIMARY ACCESS FACILITY
BR-TK-6A
BR-TK-6B
OS-TK-1
R C
WT-TK-10
SAFEGUARDS DIESEL GENERATOR BLDG
Duquesne Light Company
NUCLEAR GROUP
BEAVER VALLEY POWER STATION
ORIENTATION PLAN
UNIT 1 FACILITIES AND STRUCTURES
DATE 6-11-92
CAD
SKETCH NO
3CGK00007
REV
1
DWN SMP
APP
PREPARED ON THE CADD SYSTEM

.GENERAL DESIGN CRITERIA

.Codes and Standards--AISC specifications for steel construction dated 2/12/1969 for older structures and dated 11/1/1978 for newer structures.

ACI building code requirements (ACI 318-63) dated 6/1963 for older structures and ACI 318-77 dated 12/1977 for newer structures.

.Stress criteria for loading combinations of Category I structures other than containment:

D.L.+L.L.	<fa (steel), fc (concrete)
D.L.+L.L.+OBE	<1.33*fa (steel), 1.33*fc (concrete)
D.L.+L.L.+SSE	<0.9*fy (steel), 1.5*fc (concrete)
D.L.+L.L.+W	<1.33*fa (steel), 1.33*fc (concrete)
D.L.+L.L.+TOR	<0.9*fy (steel), 1.667*fc (concrete)
D.L.+L.L.+F1	<0.9*fy (steel), 1.5*fc (concrete)
D.L.+L.L.+F2	<1.33*fa (steel), 1.33*fc (concrete)

.SEISMIC DESIGN CRITERIA

.Site specific ground design spectra–0.06g OBE, 0.125g SSE
.Vertical spectra taken as 2/3 of horizontal
.Soil-Structure interaction in the development of in-structure floor response spectra–Unit 1 spectra submitted on Docket NO. 50-3[illegible]
.Damping values conservative in comparison with REG. GUIDE 1.60
.Method of analysis

1. Static analysis–Simple structures
   .Flexible structures–Static load factor of 1.3 multiplies peak acceleration of in-structure floor response spectra and total weight of structure applied at the center of gravity in horizontal and vertical directions
   .Rigid structures–Rigid range response acceleration mult[illegible]es the total weight of structure applied at the center of gravity in horizontal and vertical directions.

2. Dynamic analysis–Response spectrum method is mostly used. Structure is modelled with sufficient mass points. The normal mode natural frequencies, eigenvectors and participation factors of the undamped structure are calculated. The model accelerations of each mode is obtained by scalling the in-structure floor response spectra of appropriate damping using natural frequency of each mode. Modal forces of each mode are calculated by multiplying the mass with the modal acceleration, eigenvector and participation factor and applied at the mass points of the mathematical model of the structure. The modal responses are combined with the guidelines of REG. GUIDE 1.92.

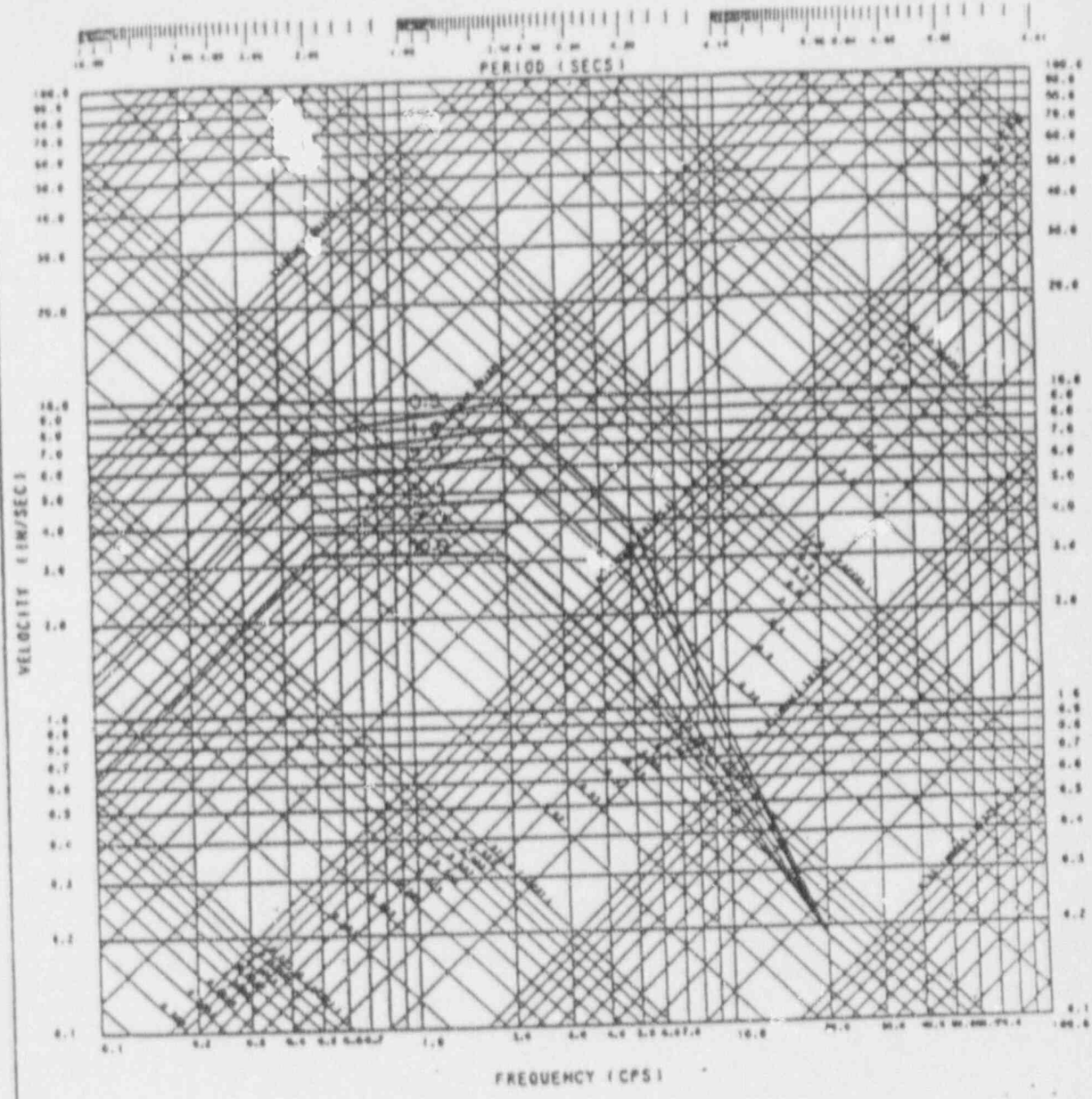


FIGURE 2
RESPONSE SPECTRA 0.06G OBE
BEVER VALLEY POWER STATION-UNIT 1

.WIND DESIGN CRITERIA

.Extreme wind velocity of 130 MPH (Including 1.3 shape factor) 100 yr. interval wind storm per ASCE paper 3269.

.Tornado wind velocity of total 360 MPH--300 MPH rotational and 60 MPH translational.

.Differential pressure of 3.0 psi in 3.0 seconds.

.Wind loads calculated per ASCE paper 3269.

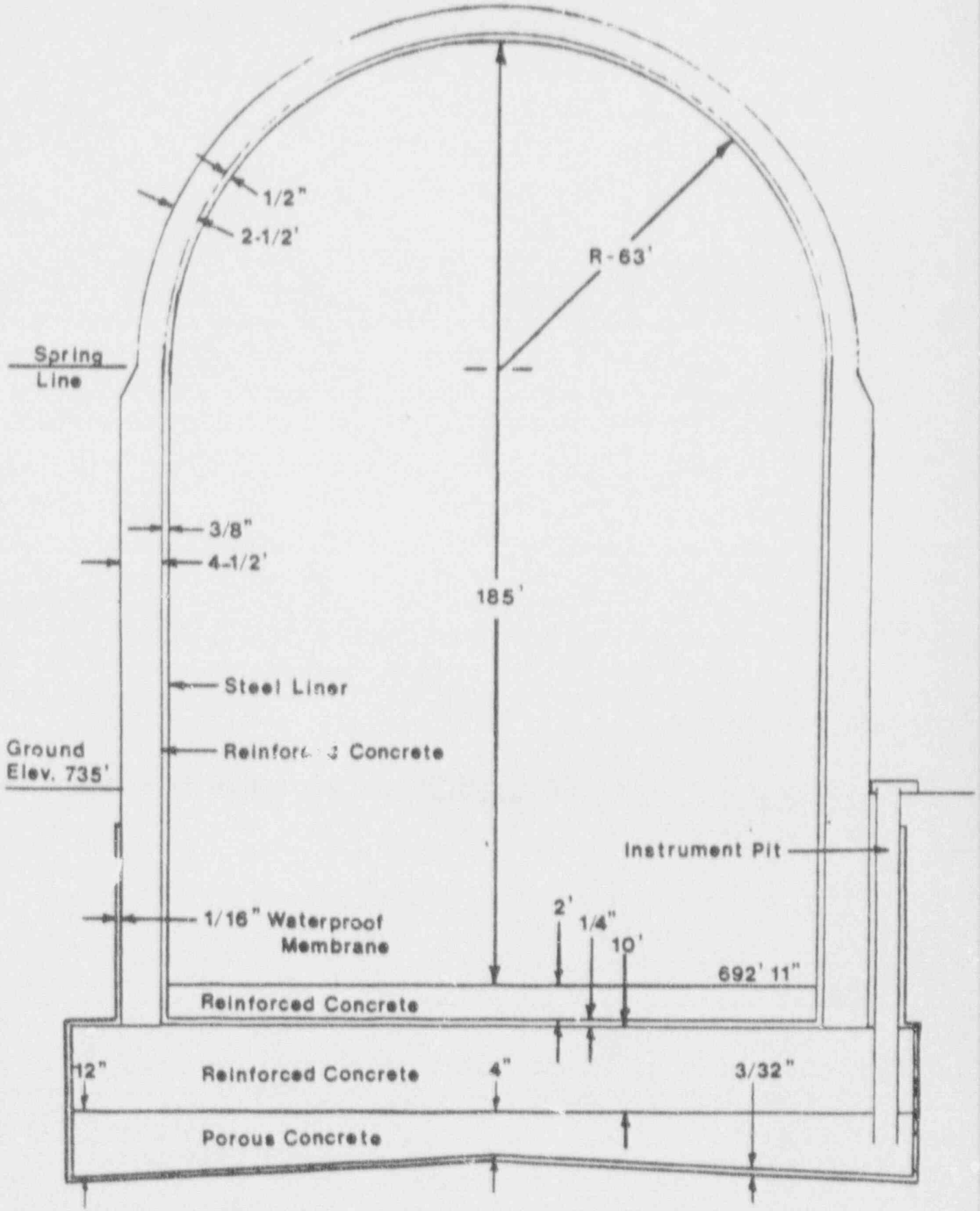
.FLOOD DESIGN CRITERIA

.Location: near Ohio River (normal pool: El. 664.5 ft)

.Probable maximum flood up to elevation 730 ft-0 in. : The flood load due to the buoyancy and hydrostatic pressure associated with this flood level is designated as F1

.Standard project flood up to elevation 705.0 ft : The flood load due to the buoyancy and hydrostatic pressure associated with this flood level is designated as F2

CONTAINMENT STRUCTURE
BVPS UNIT 1



CONTAINMENT PENETRATIONS

TOTAL PIPING PENETRATIONS 112

PENETRATIONS TESTED WITH AIR 54

PENETRATIONS TESTED WITH WATER 14

PENETRATIONS NOT SUBJECT TO LEAK RATE TESTING 21

SPARE PENETRATIONS 23

TOTAL ELECTRICAL PENETRATIONS 109

PERSONNEL AIRLOCK

EQUIPMENT HATCH

EMERGENCY AIRLOCK

CONTAINMENT INTEGRATED LEAK RATE TEST HISTORY FOR BVPS UNIT #1

NOVEMBER 3 THRU 23, 1978 FIRST ILRT

NOVEMBER 3, 1978	TEST COMMENCED.
NOVEMBER 4, 1978	TEST PRESSURE OBTAINED.
NOVEMBER 5, 1978	LEAKAGE DETECTED AT CONTAINMENT VACUUM AIR EJECTOR PENETRATION AND TEMPERATURE FLUCTUATION CAUSED BY THE DATA ACQUISITION EQUIPMENT.
NOVEMBER 19, 1978	REPRESSURIZATION OF CONTAINMENT COMPLETED FOLLOWING REPAIR OF THE CONTAINMENT VACUUM AIR EJECTOR PENETRATION AND THE DATA ACQUISITION EQUIPMENT.
NOVEMBER 21, 1978	24 HOUR DATA ACQUISITION COMPLETED AND LEAKAGE IS WITHIN ACCEPTABLE LIMITS (0.0406% / DAY).
NOVEMBER 23, 1978	SUPERIMPOSED LEAKAGE VERIFICATION TEST SUCCESSFULLY COMPLETED AND CONTAINMENT DEPRESSURIZED TO ATMOSPHERIC PRESSURE.

CONTAINMENT INTEGRATED LEAK RATE TEST HISTORY FOR BVPS UNIT #1

JULY 30 THRU AUGUST 3, 1986 THIRD ILRT

JULY 30, 1986	TEST COMMENCED.
JULY 30, 1986	TEST PRESSURE OBTAINED.
JULY 31, 1986	TEMPERATURE FLUCTURATION DUE TO CHANGES IN THE CHILLED WATER TEMPERATURE TO THE CONTAINMENT AIR RECIRCULATION FANS.
AUGUST 1, 1986	CONTAINMENT AIR RECIRCULATION FANS ISOLATED.
AUGUST 2, 1986	CONTAINMENT AIR TEMPERATURE STABILIZED AND DATA ACQUISITION RESTARTED.
AUGUST 2, 1986	DATA ACQUISITION COMPLETED (BN-TOP-1 METHOD) AND LEAKAGE IS WITHIN ACCEPTABLE LIMITS (0.0143 % / DAY).
AUGUST 3, 1986	SUPERIMPOSED LEAKAGE VERIFICATION TEST SUCCESSFULLY COMPLETED AND CONTAINMENT DEPRESSURIZED TO ATMOSPHERIC PRESSURE.

CONTAINMENT LOCAL LEAK RATE TEST HISTORY FOR BVPS UNIT #1

AUGUST 7, 1975 PREOPERATIONAL LLRT 903.11 SCF/D

FEBRUARY 28, 1977 NORMAL SURVEILLANCE 2628.62 SCF/D

NOVEMBER 18, 1978 NORMAL SURVEILLANCE 1712.13 SCF/D

SEPTEMBER 12, 1980 FIRST REFUELING OUTAGE 3722.98 SCF/D

MAY 25, 1982 SECOND REFUELING OUTAGE 3400.53 SCF/D

SEPTEMBER 13, 1983 THIRD REFUELING OUTAGE 2458.96 SCF/D

DECEMBER 15, 1984 FOURTH REFUELING OUTAGE 2007.35 SCF/D

AUGUST 8, 1986 FIFTH REFUELING OUTAGE 1548.28 SCF/D

FEBRUARY 8, 1988 SIXTH REFUELING OUTAGE 929.31 SCF/D

DECEMBER 8, 1989 SEVENTH REFUELING OUTAGE 1052.67 SCF/D

APRIL 15, 199' EIGHTH REFUELING OUTAGE 871.73 SCF/D

ACCEPTANCE CRITERIA 3929 SCF/D OR 0.6 La

VERIFICATION OF STRUCTURAL INTEGRITY OF THE CONTAINMENT LINER AND CONCRETE STRUCTURE FOR BVPS UNIT #1

NOVEMBER 1978 CONTAINMENT INSPECTION PRIOR TO THE FIRST ILRT

RESULTS: THE INSPECTION OF THE REACTOR CONTAINMENT STRUCTURE REVEALED NO MAJOR OR GROSS DETERIORATION OF EITHER THE OUTER CONCRETE STRUCTURE OF INSIDE STEEL LINER WHICH WOULD AFFECT ITS STRUCTURAL INTEGRITY.

ABNORMALITIES:

1. NUMEROUS SURFACE BLEMISHES AND GOUGES IN THE EXTERIOR CONCRETE SURFACE.
2. BULGES AND WARPAGE IN THE INTERIOR STEEL LINER.
3. PAINT PEELED OFF OF SEVERAL LOCATIONS IN THE INTERIOR STEEL LINER.

VERIFICATION OF STRUCTURAL INTEGRITY OF THE CONTAINMENT LINER AND CONCRETE STRUCTURE FOR BVPS UNIT

JULY 1986 CONTAINMENT INSPECTION PRIOR TO THE THIRD ILRT

RESULTS: THE INSPECTION OF THE REACTOR CONTAINMENT STRUCTURE REVEALED NO MAJOR OR GROSS DETERIORATION OF EITHER THE OUTER CONCRETE STRUCTURE OR INSIDE STEEL LINER WHICH WOULD AFFECT ITS STRUCTURAL INTEGRITY.

ABNORMALITIES:

1. TWO ADDITIONAL GOUGES NOTED IN THE EXTERIOR CONCRETE SURFACE.
2. PAINT PEELED OFF OF LOCATIONS IN THE INTERIOR STEEL LINER.

SUPPORT ANCHORAGES

- Design Criteria & Practice
- IEB 79-02 Resolution
- Other Issues

SUPPORT ANCHORAGES

- Design Criteria & Practice (con't)

  - A safety factor of 4 is used for design

  - For Hilti bolts, a paraoblic shear-tension interaction formula is used. A straight line interaction is used for Maxibolts

  - Site Standard covers installation and inspection requirements for expansion anchors

SUPPORT ANCHORAGES

- 79-02 Resolution
  - A sampling program was performed for anchors associated with the 28 systems in 79-02 scope
  - Majority of anchors were shell-type
  - Repairs or modifications performed for deficient anchors
  - Supports attached to block walls were removed or modified
  - Final Report issued July 7, 1980

SUPPORT ANCHORAGES

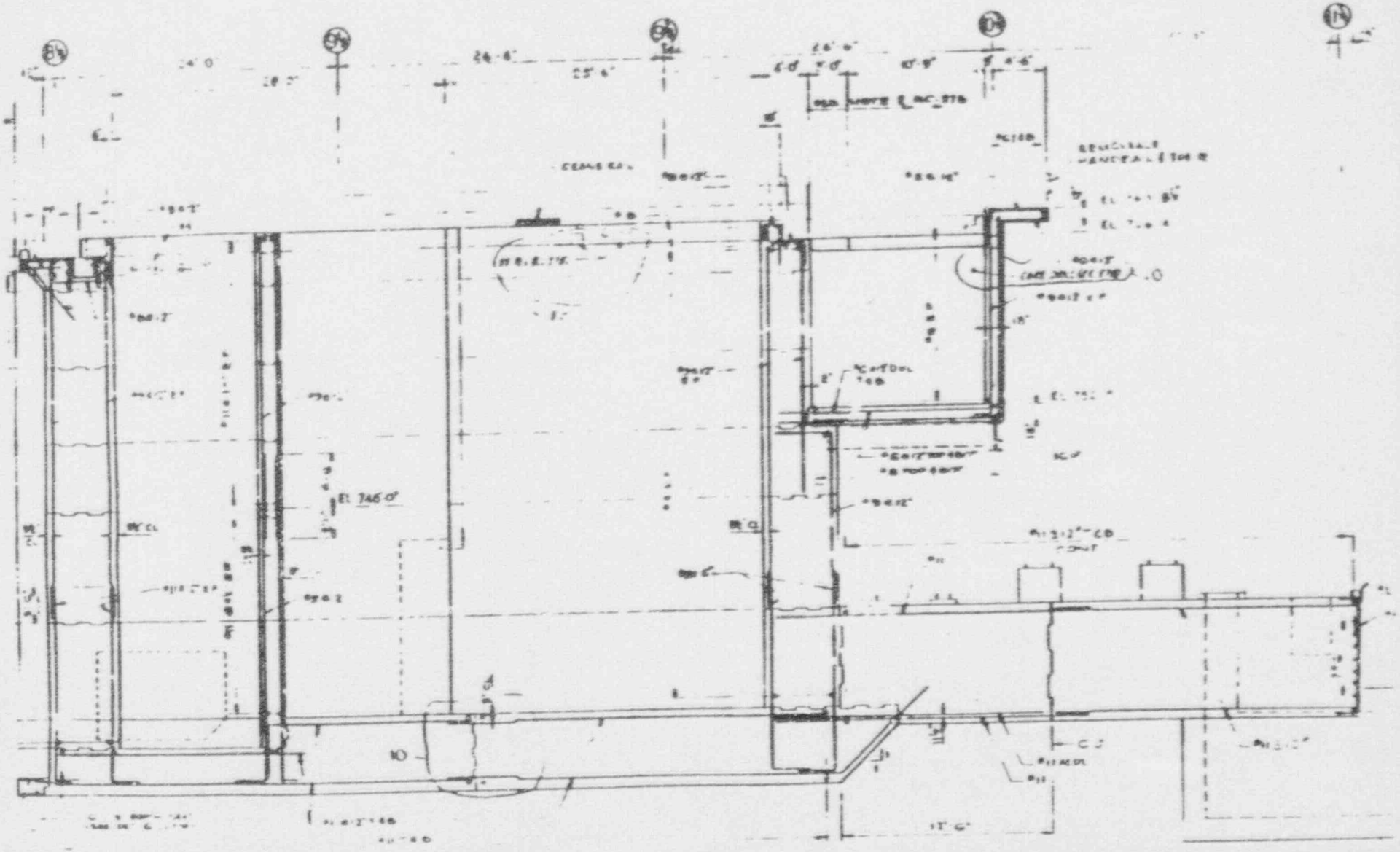
- Other Issues (con't)
  - IEN 86-94
    - Reviewed all baseplates in 79-02 scope
    - Small number used 1/2" Ø Kwik Bolts
    - Reduced allowables did not affect design margin (F.S. >4)
    - Onsite tests matched Hilti's original ultimate values
    - Revised allowable loads

SUPPORT ANCHORAGES

- Other Issues (con't)
  - IEN 88-25 (con't)
    - Onsite shear testing of HKB-II verified edge distance of 12 anchor diameters
  - Hilti Part 21 (Jan. 1991) on reduced capabilities for 1" and 3/4" anchors
    - Site specific tests met or exceeded Hilti's ultimate loads

SPENT FUEL POOL & STORAGE RACKS

- Structure
- Design Features
- Rack Changes



SECT 1-1

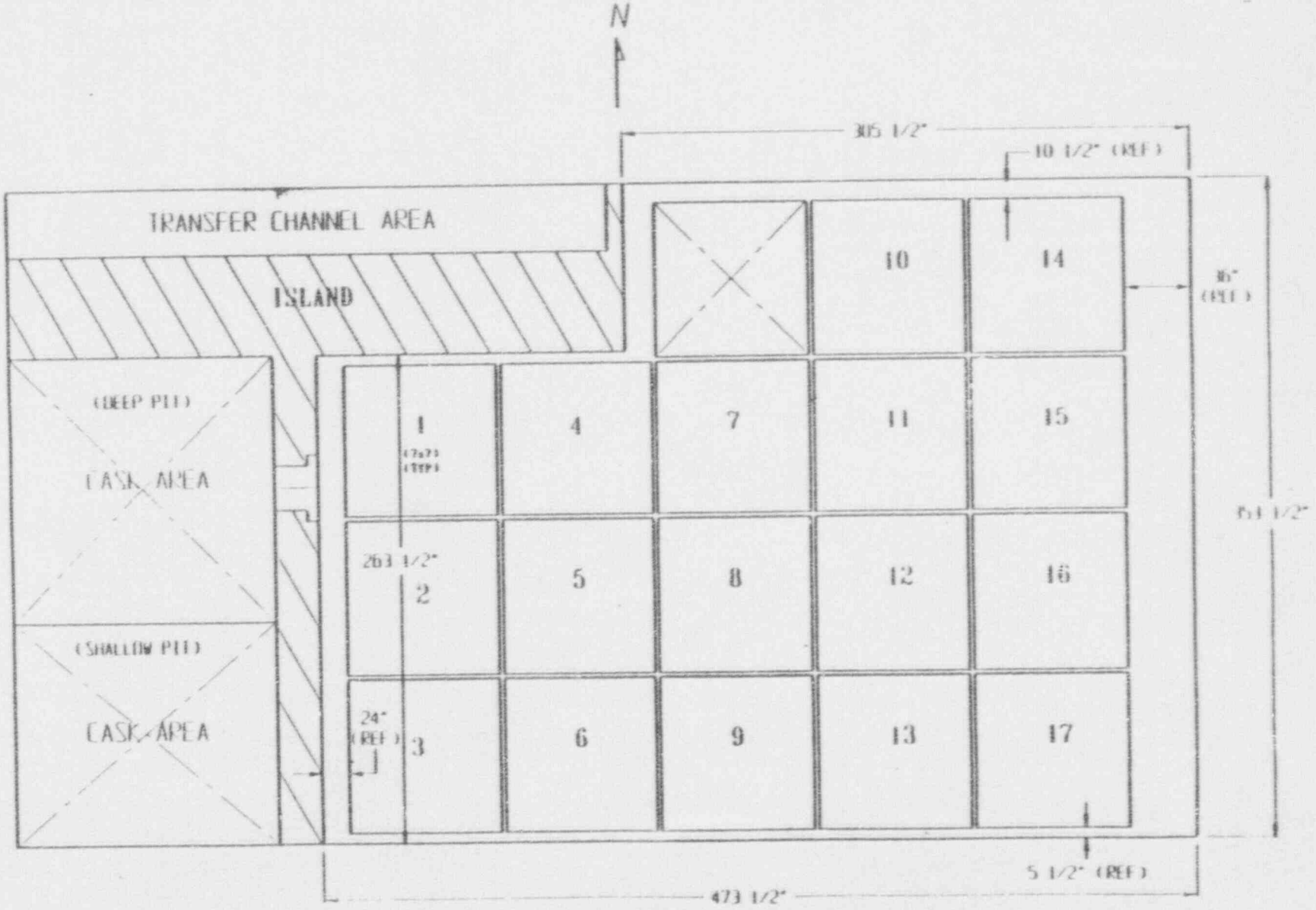


FIG. 2.1 1: BEAVER VALLEY UNIT 1 EXISTING RACKS ARRANGEMENT

Table 2.2.3

COMMON MODULE DATA

Storage cell inside dimension: dimension (nominal):	8.75 inch
Storage cell neight (above the baseplate):	166 inch
Baseplate thickness:	0.75 inch
Support leg height:	5-1/4 inch (nominal)
Support leg type:	Remotely adjustable legs with lateral gussets.
Number of support legs:	4 (minimum)
Remote lifting and handling provision:	Yes
Poison material:	Boral
Poison length:	144 inch
Poison width:	7.5 inch
Cell Pitch:	10.82 inch (Region I) 9.05 inch (Region II)

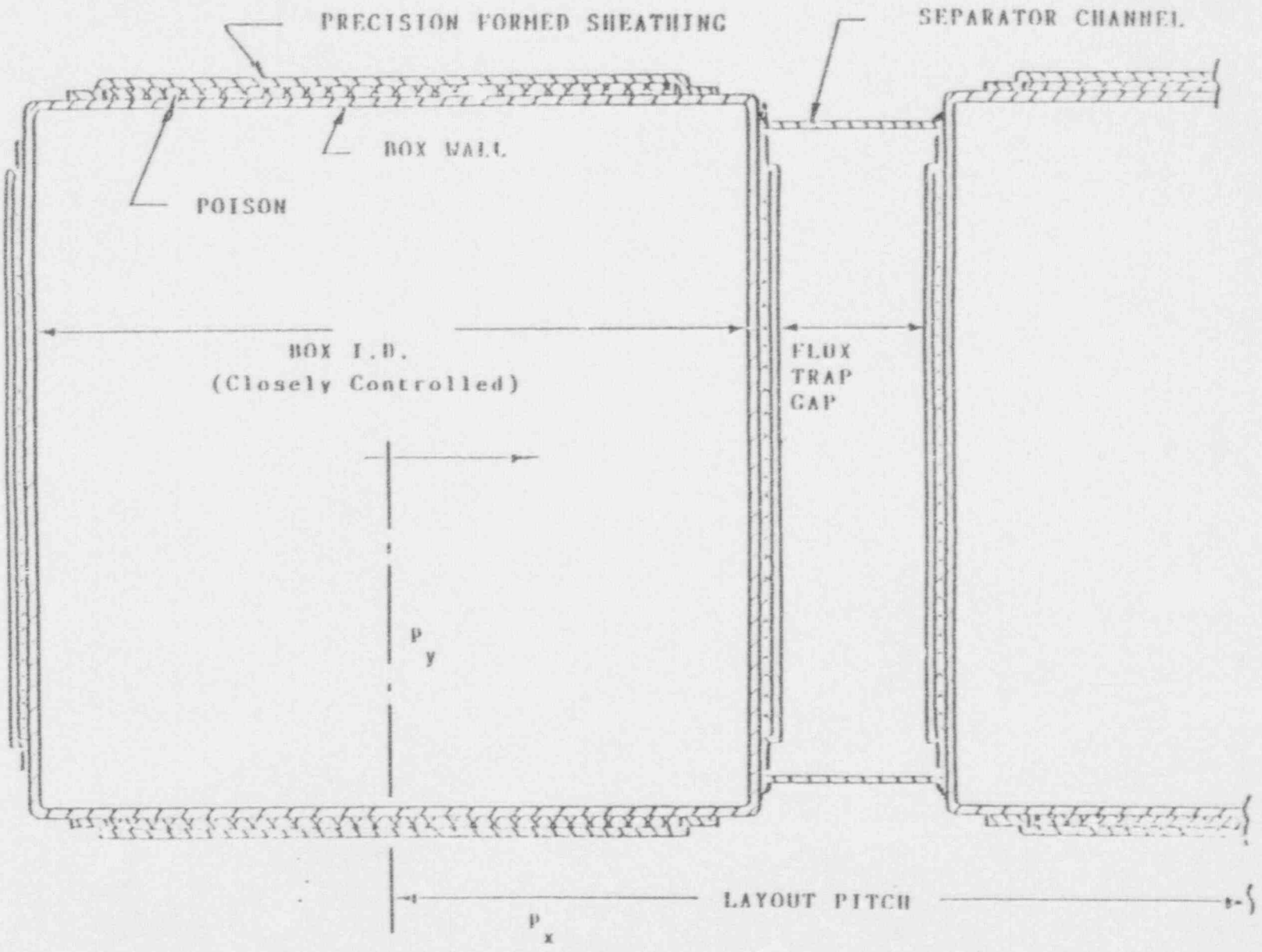


FIGURE 3.2.4 ASSEMBLING OF REGION I BOXES

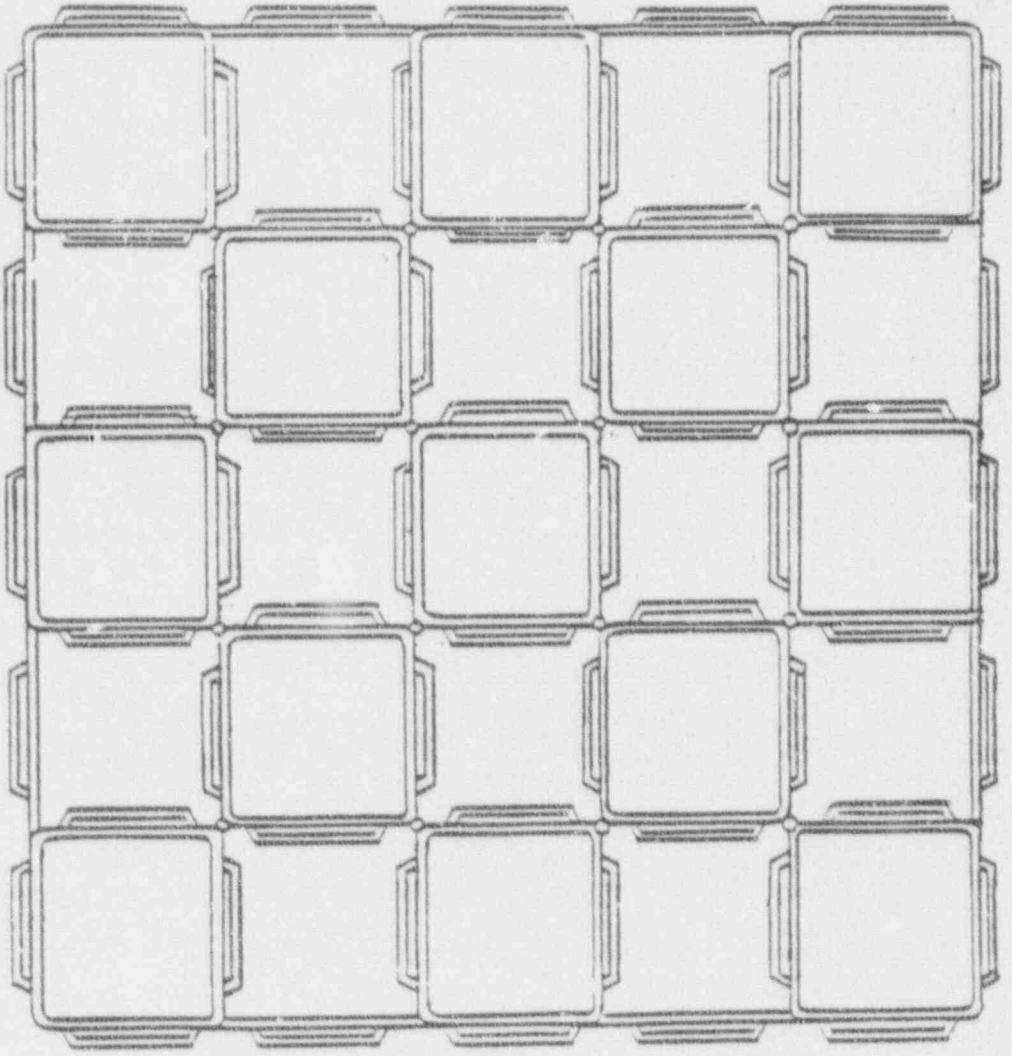


FIGURE 3.3.2

ARRAY OF REGION II CELLS

(NON-FLUX TRAP CONSTRUCTION)

RERACKING EFFECTS

Racks:	Original	Current	Proposed
Fuel Assemblies:			
Enrichment		3.3%	5.0%
No. per Rack	16 = 4x4	49 = 7x7	80-168 = Varied
Total	272	832	1625
Wt.	380K	1222K	2,384K
SFP/Building:			
Water Temp (Full Core Offload)	(125°F)	149°F	153.4°F
Total Bldg. Wt.	15,181K	15,367K	16,287K
Soil Pressure	11.41 ksf	12.7 ksf	8.4 ksf
Structural Modification	Design	No	No

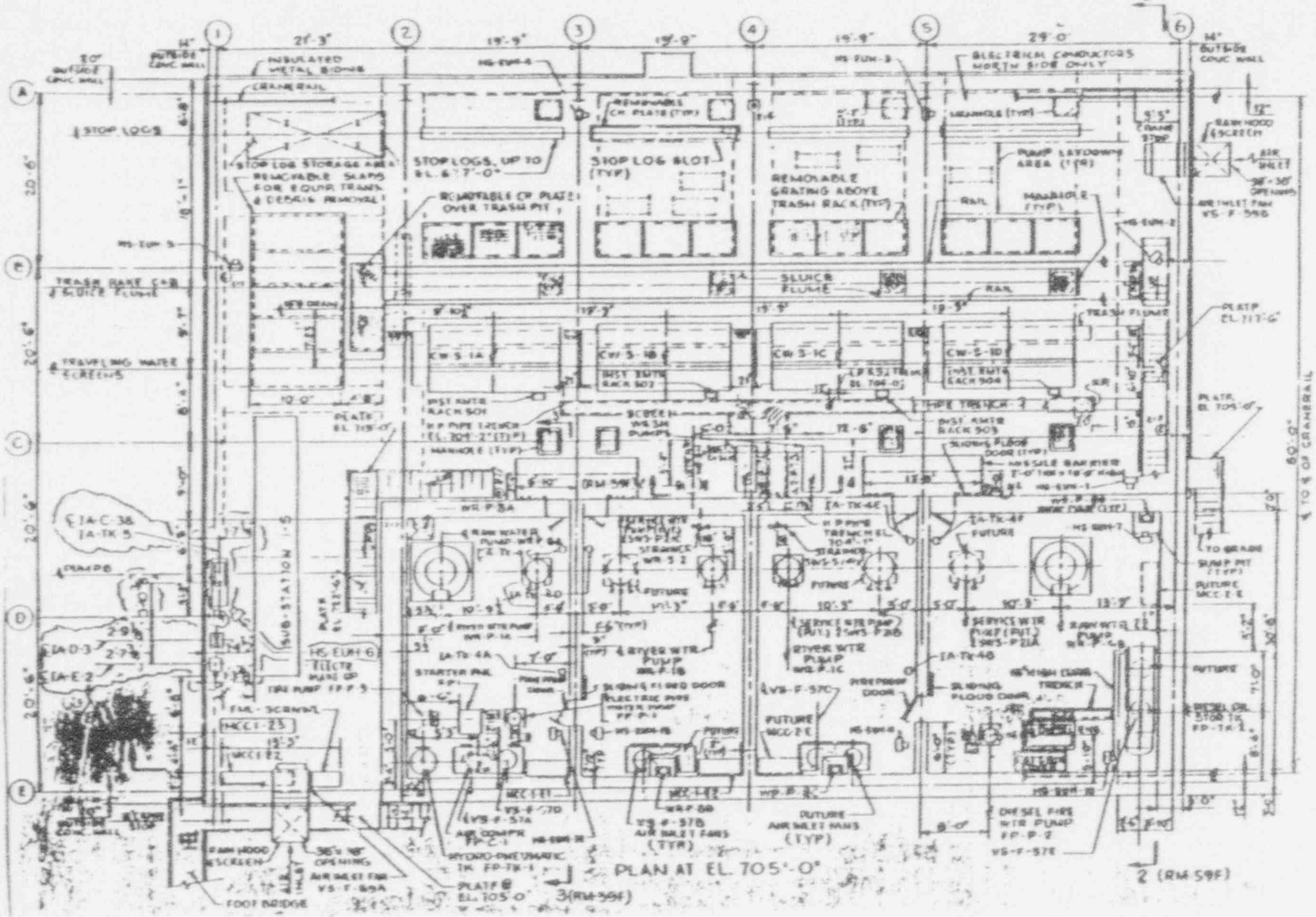
INTAKE STRUCTURE

Overview

- Common Structure
- Key Equipment
- Layout

Surveillance

- Operating Surveillance Test
- Frequency
- Inspection of Bays during drain down


PLAN AT EL. 705'-0"
2 (RM-59F)
3 (RM-59F)
STOP LOGS, UP TO EL. 677'-0"
STOP LOG SLOT (TYP)
REMOVABLE GRATING ABOVE TRASH RACK (TYP)
PUMP LAYDOWN AREA (TYP)
ELECTRICAL CONDUCTORS NORTH SIDE ONLY
INSULATED METAL SIDING
CRANE RAIL
STOP LOG STORAGE AREA REMOVABLE SLABS FOR EQUIP TRANS & DEBRIS REMOVAL
REMOVABLE CP PLATE OVER TRASH PIT
SLUICE FLUME
TRASH FLUME
TRAVELING WATER SCREENS
SUB-STATION 1-5
SCREEN WASH PUMPS
PIPE TRENCH
FUTURE
RIVER WTR PUMP
SERVICE WTR PUMP
DIESEL FIRE WTR PUMP
FIREPROOF DOOR
FOOT BRIDGE
$60'-0"$
℄ TO ℄ OF CRANERAIL

INTAKE STRUCTURE

Observations

- No Degradation
- Water In-Leakage During Drain Down

CONCRETE BLOCK WALLS
IB 80-11 / IN 87-67

IEB 80-11:

- Resulted in 108 Walls Considered; 105 Governed by 80-11 Criteria & Reviewed; PAB (65), CV (9), FB (2), SB (29)
- 4 Were 79-02 Walls With >2 1/2 in. Dia. Piping
- 15 Did Not Meet Our Acceptance Criteria - No TS Equip
- 11 Modified - Equip Removed, Walls Braced/ Stiffened with Structural Tube Steel (DCP-424)
- Walls were Field Inspected & Sketched by DLC; Analyzed by S&W (Procedures BV-1-8011-01 thru 05)

CONCRETE BLOCK WALLS
IB 80-11 / IN 87-67

In 87-67:

- Our Review Concluded IEB 80-11 Effort was Acceptable (EM 30624):
  - Materials were Controlled Per Spec BVS-346 and Field Q/C, Samples of Documentation Furnished to NRC as Attachments to Reports
  - Procedures were in Effect - Walkdown / Inspection, Evaluation Criteria, Detailed Analysis Methods
  - Simple, Defendable Edge Assumptions Used (ie, No Ties to Structure Assumed which Require Opening Wall to Confirm)

CONCRETE BLOCK WALLS
IB 80-11 / IN 87-67

- Bldg-Induced Strains and Thermal Included; No Wind, Tornado, Missile, Pipe Whip / Jet Impingement Walls

- Professional Photographs Taken of All Walls

- NRC TER Approving DLC Report Received 7/16/82

CONCRETE BLOCK WALLS
IB 80-11 / IN 87-67

- Performed Wall Inspections and Identified Any Additional/Deleted Equipment, Damage, Cracks, Deviations from Drawing (73 Walls)

- Evaluated Changes Using 80-11 Criteria; Most Actual Changes were so Minor (eg, Fire Extinguisher, Small Conduit/Tubing, Chipped Block, Small Corings) That 25 psf or Judgement Controlled. However, One Wall had Courses Removed, Another (without equipment on it) had Steel Framing Substituted for Bottom Courses Under a DCP (480)

- All Walls were Still Adequate, No Modifications Made

- Next Inspection would Occur 1999 per NGAP 8.12, Although Option Exists to Inspect in 1993

CORROSION PROTECTION

- Protective Coatings
  - Interior Structures
  - Exterior Exposure
  - Below Ground
- Waterproof Membranes

CORROSION PROTECTION

Protective Coatings

- Exterior Exposure
  - Most commonly used systems are alkyds or urethane topcoat over various primers
- Below Ground/Immersion
  - Coal Tar Epoxies Specified
- Linings not used
  - Majority of tanks are stainless steel
- Coatings have performed well in service

Waterproof Membranes

GEOLOGY/FOUNDATION CONDITIONS

- Subsurface Conditions
- Foundation Conditions
- Groundwater Conditions

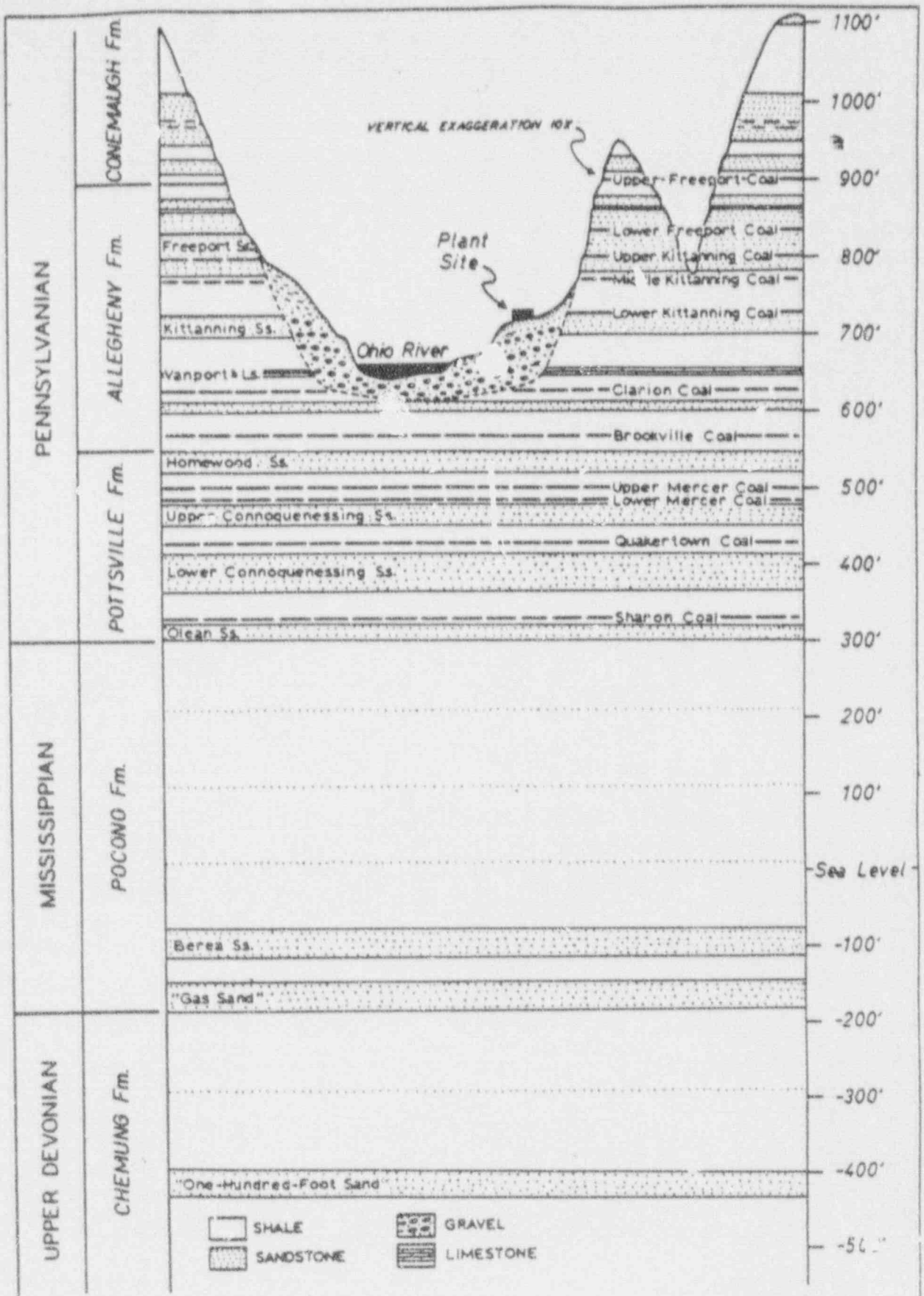


FIGURE 1 — GENERALIZED STRATIGRAPHIC SECTION IN PLANT AREA

REV. 0 (1/82)

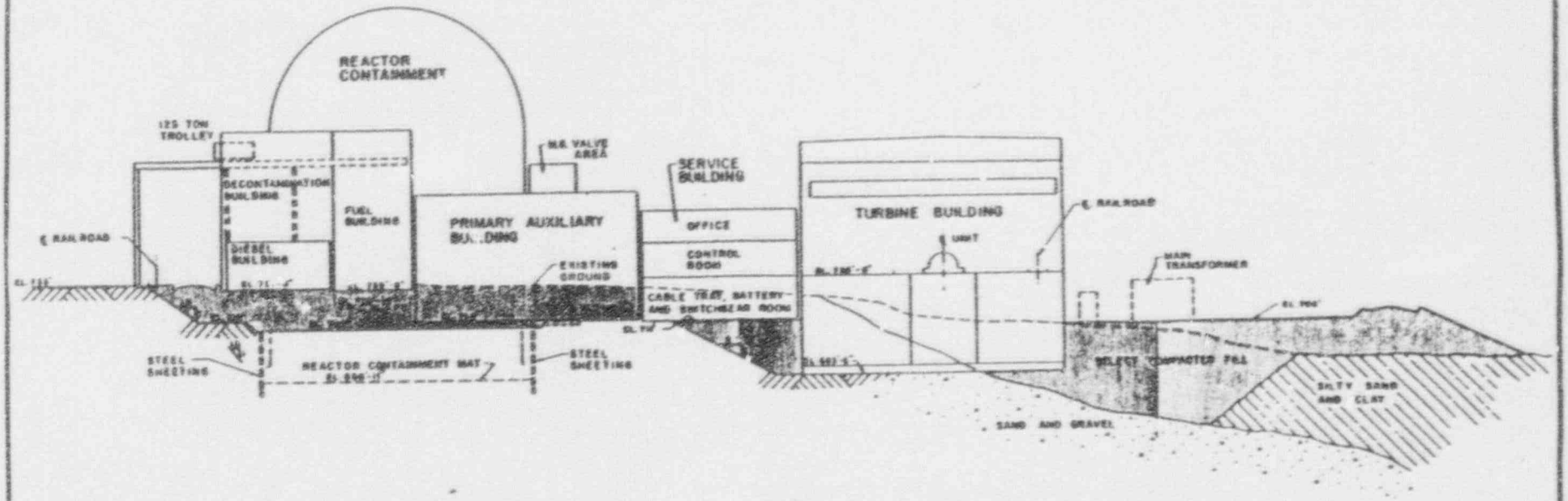


FIGURE 2.7-1
TYPICAL SECTION SHOWING EXCAVATION AND COMPACTED FILL
BEAVER VALLEY POWER STATION UNIT NO. 1
UPDATED FINAL SAFETY ANALYSIS REPORT

FLOODS AND DAM FAILURE

- Highest Historical Flood

March 1936	703.1 ft.	Prior to flood control reservoirs
December 1942	692.9 ft.	Flood control
June 1972	692.7 ft.	Flood control (current)

- Plant is shut down when river level reaches 695 feet.

FLOODS AND DAM FAILURE

- Flood Protection (con't)
  - All construction joints were provided with water stops/pipes were cast in walls
  - Other penetrations are sealed
  - Protective actions - (AOP)

FLOODS AND DAM FAILURE

- Floods
- Flood Protection
- Dam Failure
- EDSFI Audit

FLOODS AND DAM FAILURE

- Dam Failure (con't)

  - Failure of critical dam in conjunction with the SPF raised the peak river level at the site to 725.2 feet - less critical than the PMF

  - Dams were designed for local probable maximum storm runoff and will not fail from overtopping

FLOODS AND DAM FAILURE

- Floods
- Flood Protection
- Dam Failure
- EDSFI Audit

FLOODS AND DAM FAILURE

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  - Failure of critical dam in conjunction with the SPF raised the peak river level at the site to 725.2 feet - less critical than the PMF

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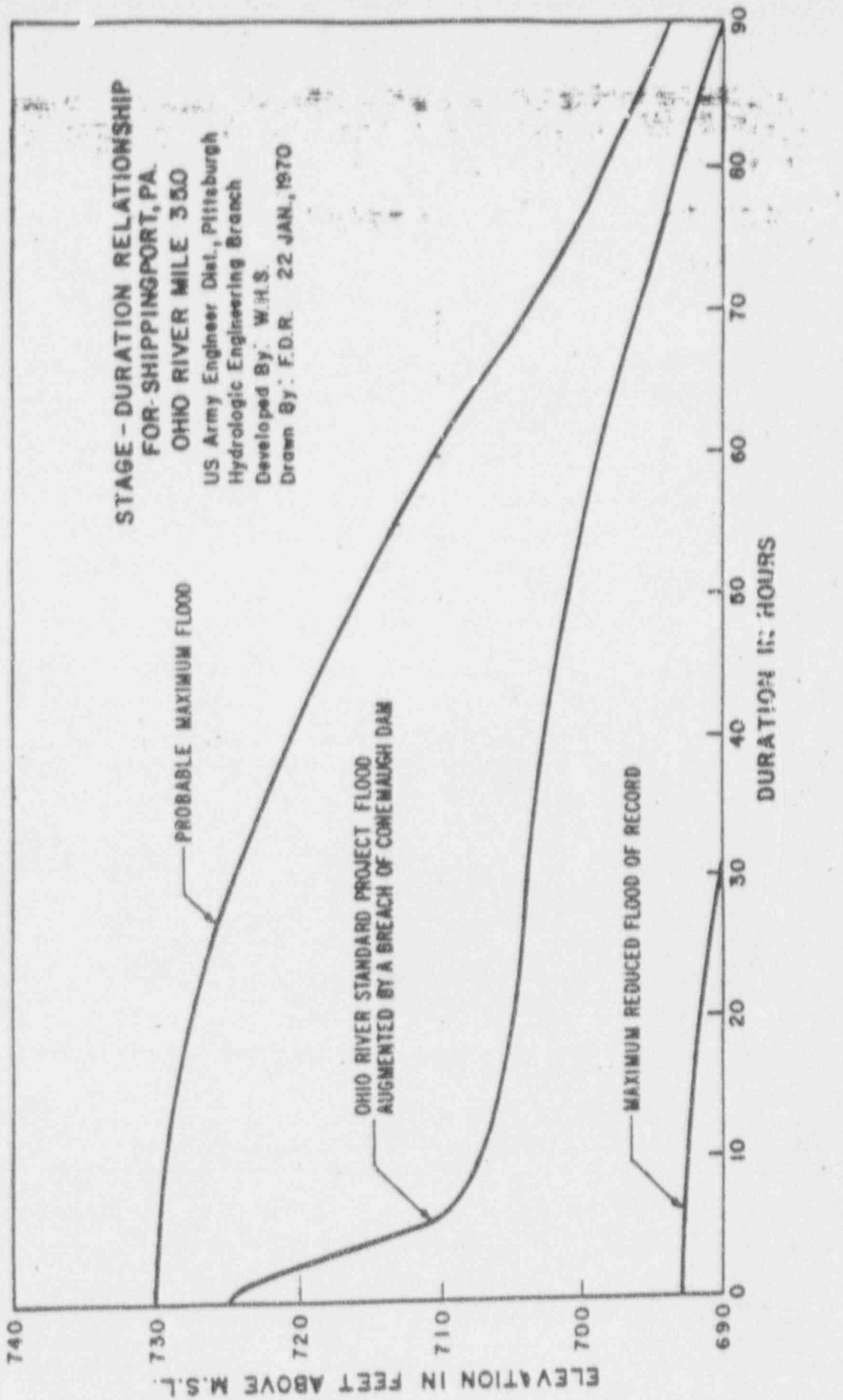

STAGE-DURATION RELATIONSHIP
FOR SHIPPINGPORT, PA.
OHIO RIVER MILE 35.0
US Army Engineer Dist., Pittsburgh
Hydrologic Engineering Branch
Developed By: W.H.S.
Drawn By: F.D.R. 22 JAN., 1970
PROBABLE MAXIMUM FLOOD
OHIO RIVER STANDARD PROJECT FLOOD
AUGMENTED BY A BREACH OF CONEMAUGH DAM
MAXIMUM REDUCED FLOOD OF RECORD
ELEVATION IN FEET ABOVE M.S.L.
740
730
720
710
700
690
0
10
20
30
40
50
60
70
80
90
DURATION IN HOURS

Plate 5

BURIED PIPE

Circulation Water

- Non-Safety Related
- 4 - 108" Lines
- Pre-Cast Reinforced Concrete
- Internal Inspection
- Visual
- Sounding Techniques

BURIED PIPE

Diesel Fuel Oil

- Safety Related
- ASTM A106 Grade B Carbon Steel
- Operational Surveillance Tests
- Operates at Atmospheric Pressure

QA CATEGORY I STRUCTURES
Inspection & Surveillance Programs

Quality Services Inspection Procedures

- Examination Requirements
- Acceptance Standards
- Personnel and Equipment Qualifications

QA CATEGORY I STRUCTURES
Inspection & Surveillance Programs

Boric Acid Inspection

- During Cold Shutdown
- Boric Acid Accumulation on Structural Steel
- Examination of Component after Boric Acid Removal

SEISMIC INSTRUMENTATION

Unit #1

- Strong Motion Recording Accelerograph
- Peak Shock Annunciator and Recorder
- Non-Annunciating Peak Shock Recorders
- Peak Recording Accelerometers to be Mounted on Equipment

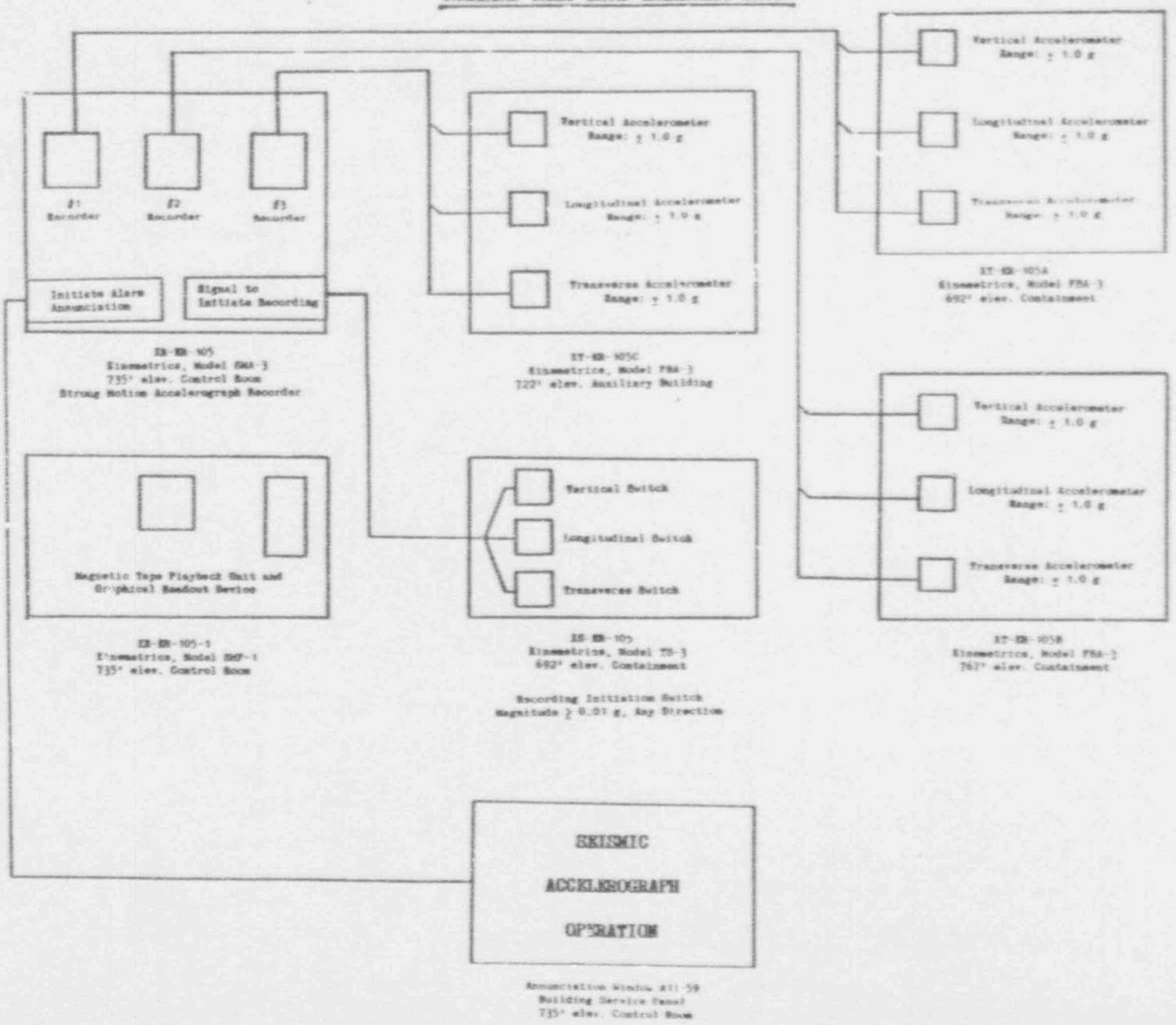
Unit #2

- Strong Motion Recording Accelerograph
- Peak Shock Annunciator and Recorder

Sheet #3

BEAVER VALLEY POWER STATION

EISMOMETRIC STRONG MOTION ACCELEROGRAPH SYSTEM



IB-EB-105
Kinemetrics, Model SMA-3
735' elev. Control Room
Strong Motion Accelerograph Recorder

IB-EB-105-1
Kinemetrics, Model SMP-1
735' elev. Control Room

IS-EB-105
Kinemetrics, Model TS-3
692' elev. Containment

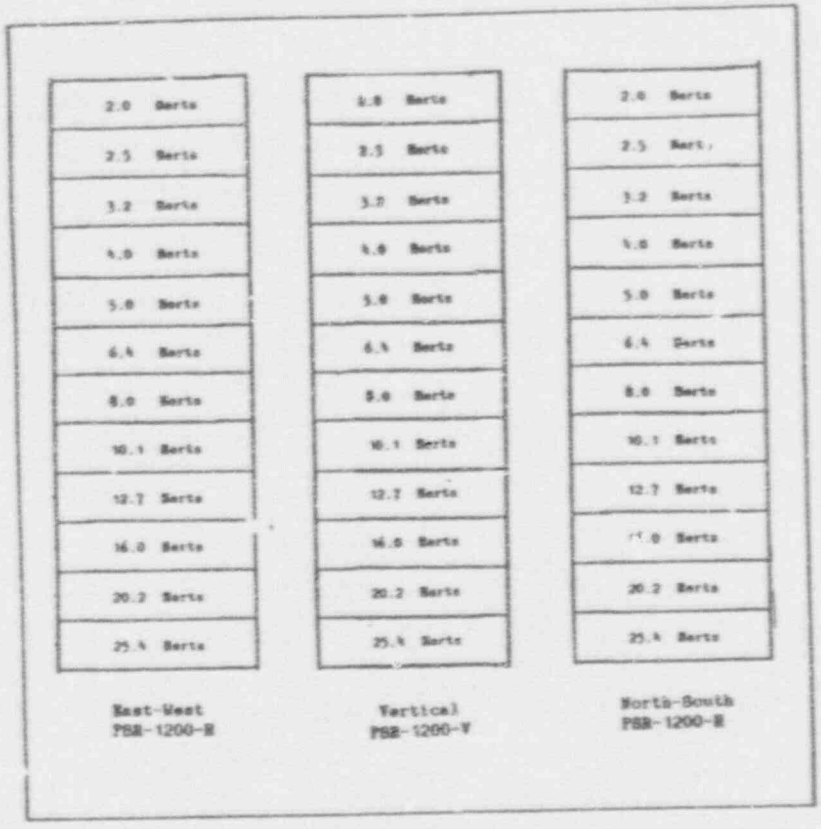
Recording Initiation Switch
Magnitude ≥ 0.01 g, Any Direction

IT-EB-105A
Kinemetrics, Model FBA-3
692' elev. Containment

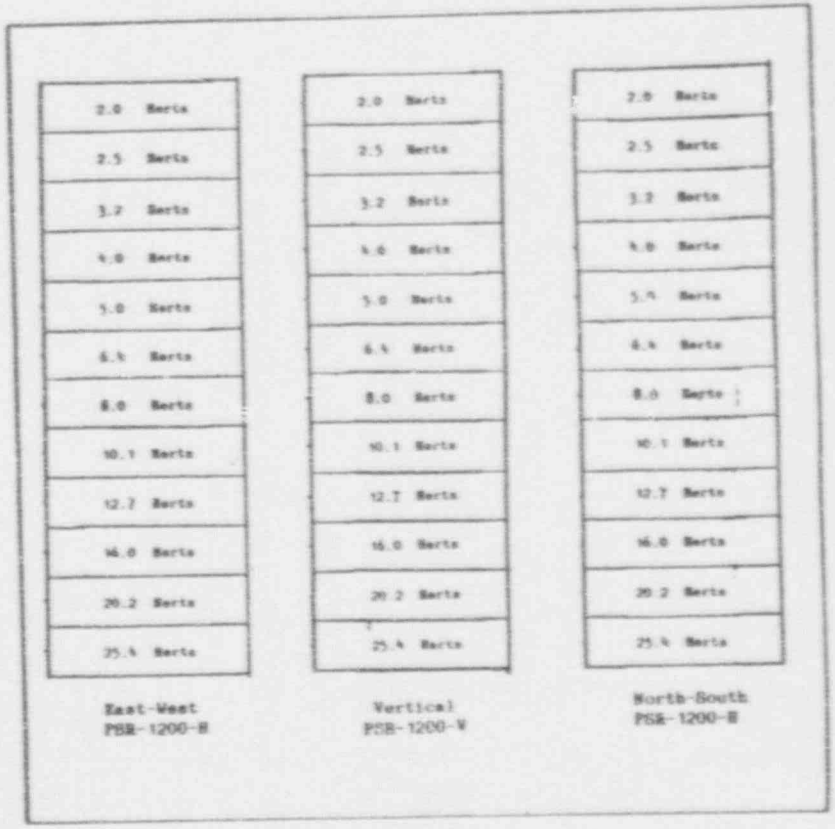
IT-EB-105C
Kinemetrics, Model FBA-3
722' elev. Auxiliary Building

IT-EB-105B
Kinemetrics, Model FBA-3
767' elev. Containment

Annunciation Window A11-59
Building Service Panel
735' elev. Control Room



XR-ER-100
Engdahl, Model PSR-1200-H
and Model PSR-1200-V Recorders
735' elev. Control Room

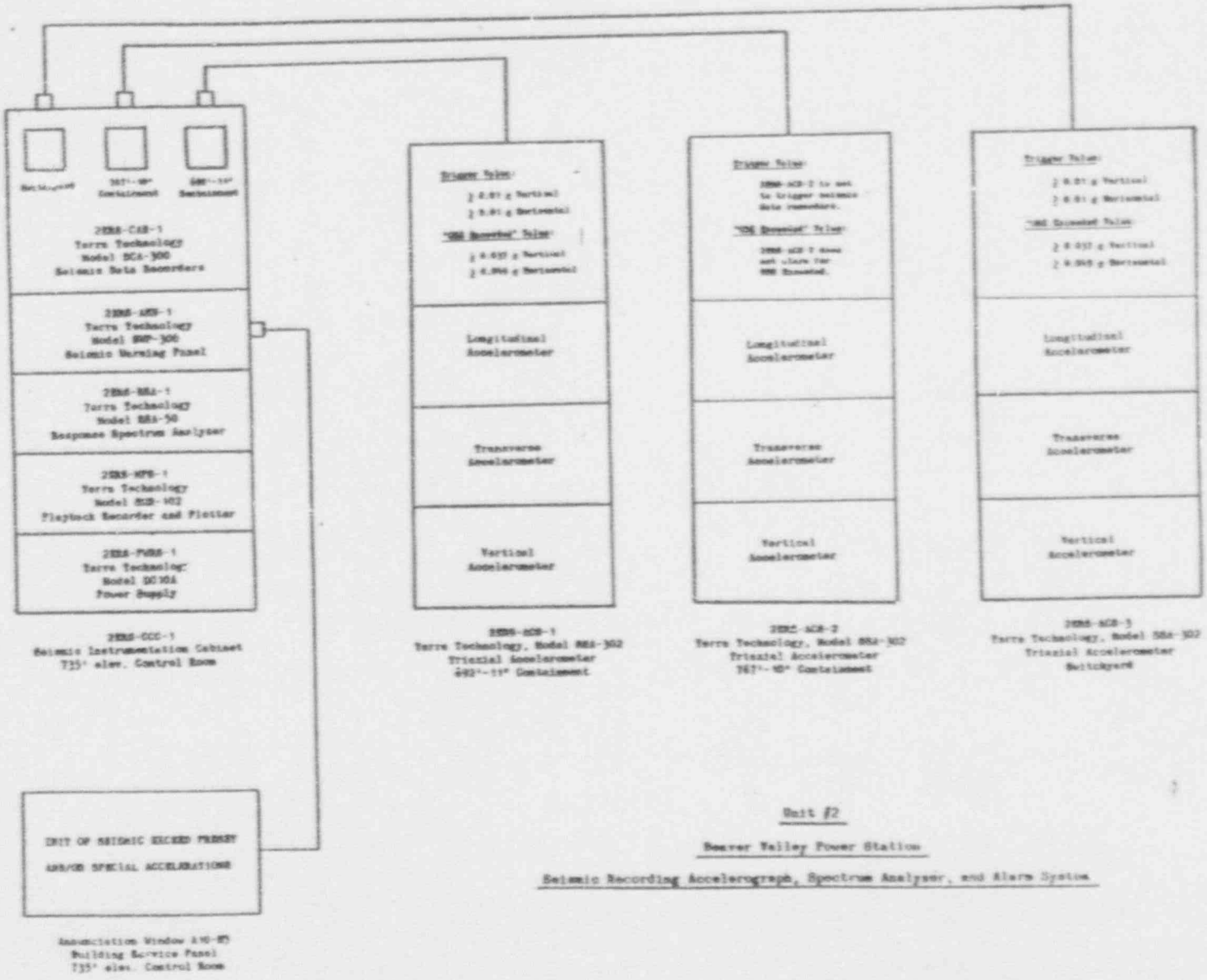


XR-ER-102
Engdahl, Model PSR-1200-H
and Model PSR-1200-V Recorders
768' elev. Auxiliary Building

Unit #1

Beaver Valley Power Station

Engdahl Peak Shock Recorders



Unit #2

Beaver Valley Power Station

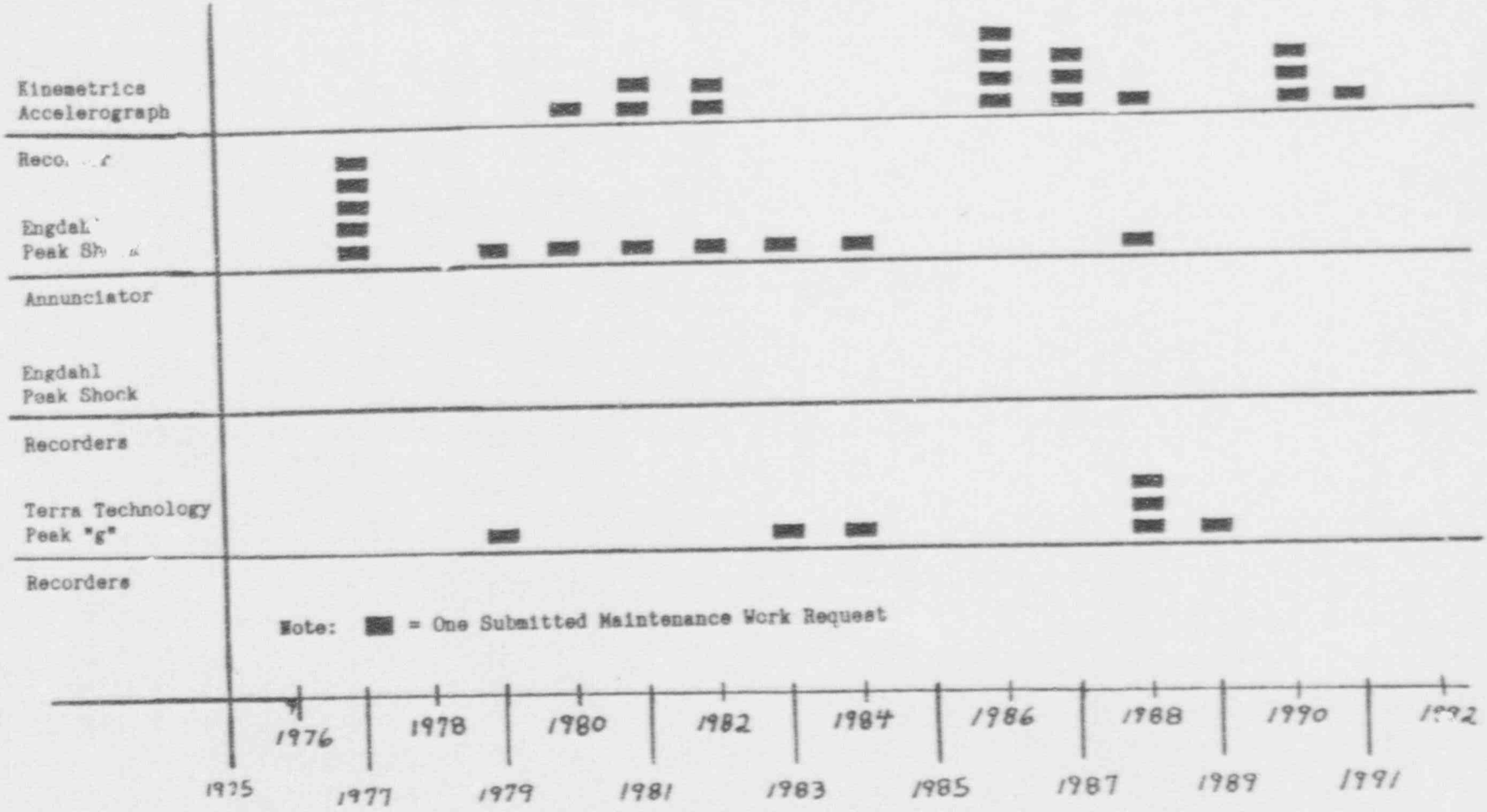
Seismic Recording Accelerograph, Spectrum Analyzer, and Alarm System

Unit #1

Beaver Valley Power Station

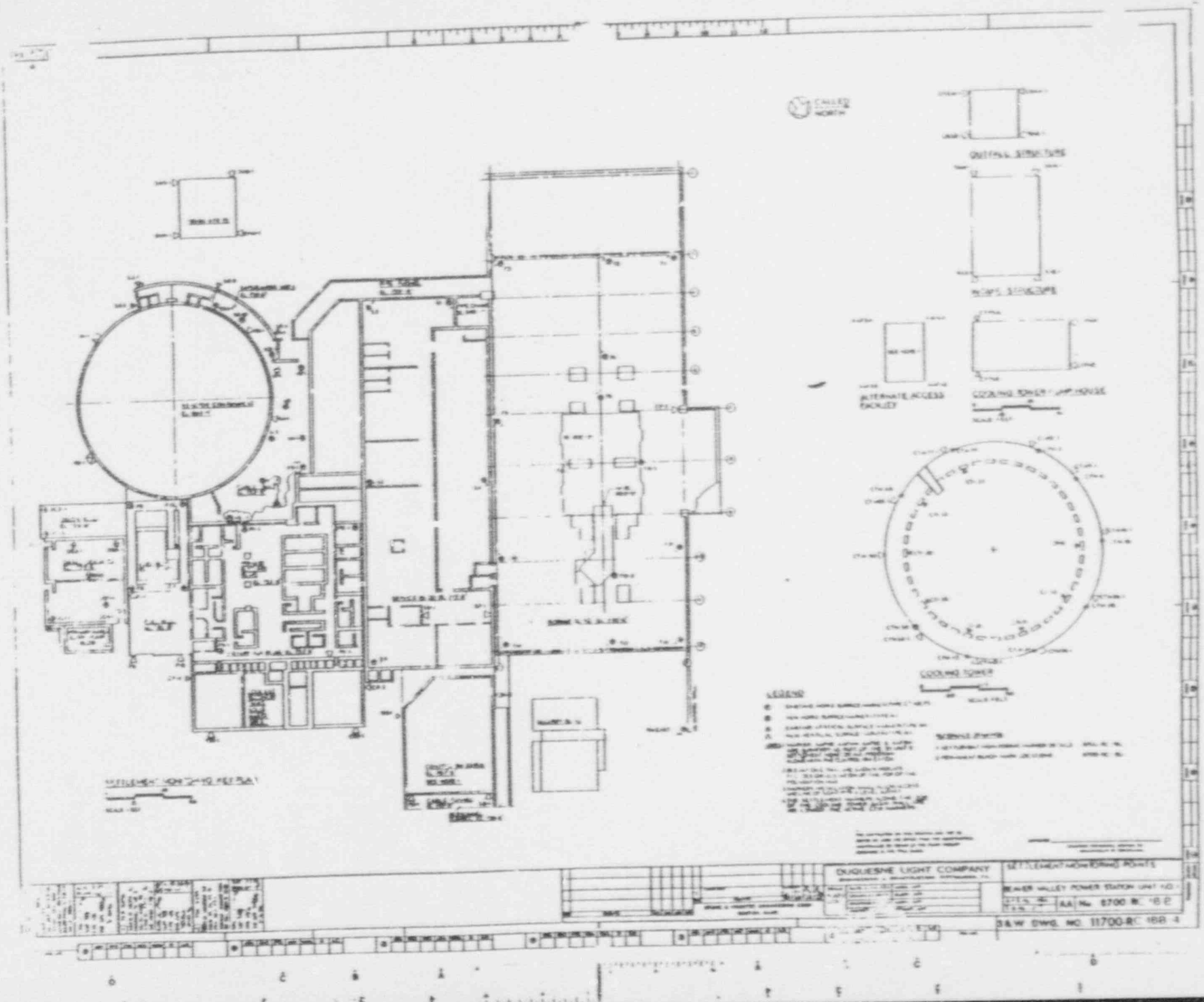
Seismic Monitoring Equipment

Maintenance Work Request Temporal Distribution

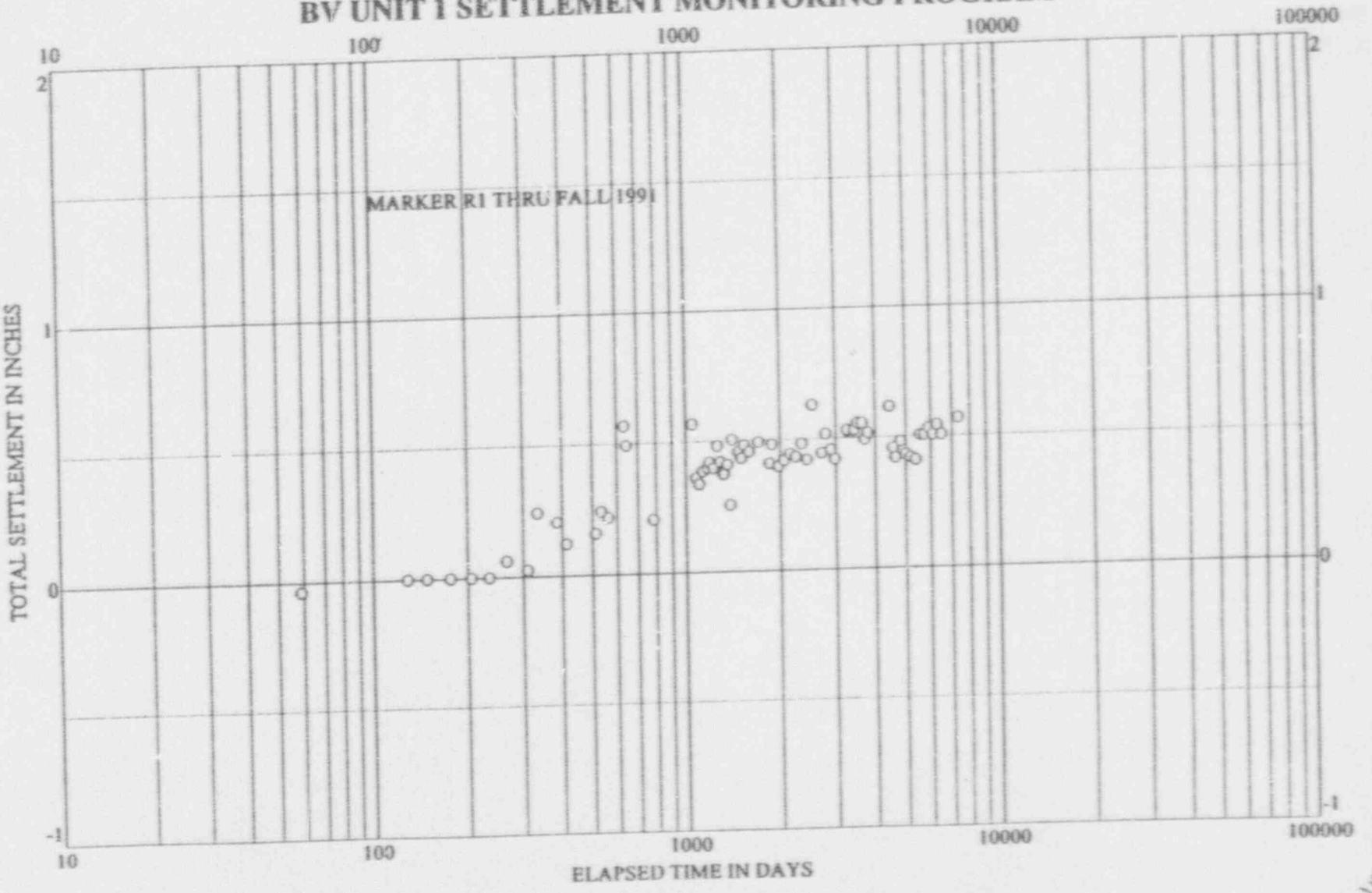


SETTLEMENT OF STRUCTURES

- Overview
  - Settlement Monitoring Program
  - Unanticipated settlements and engineering dispositions
  - Status of Unit 1 settlement program as of 12/1991
  - Separation of structures and verticality

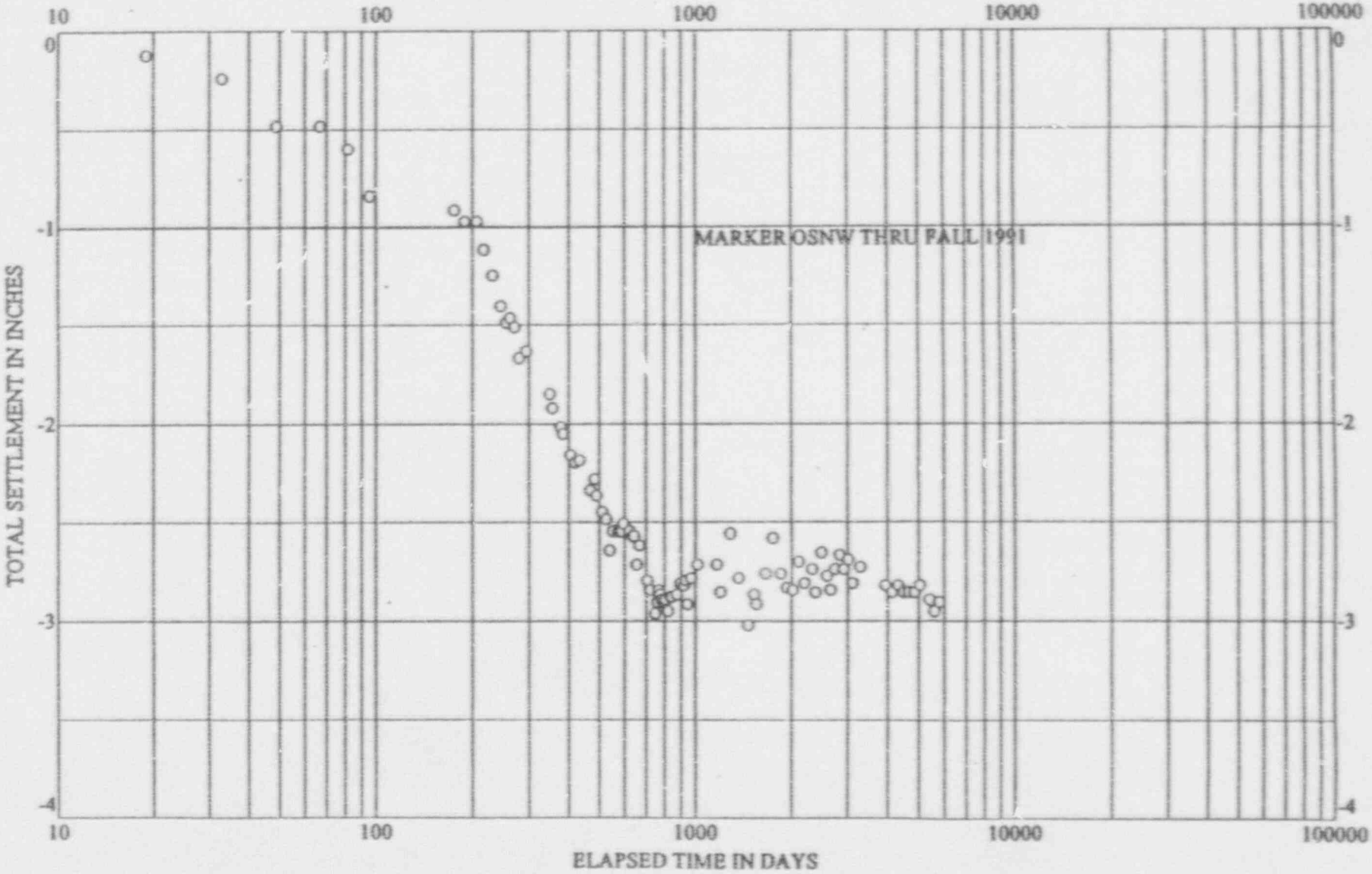

DUQUESNE LIGHT COMPANY
BEAVER VALLEY POWER STATION UNIT NO.
AA No. 8700 R. 18 E
S & W DWG. NO. 11700-RC-168-4

BV UNIT 1 SETTLEMENT MONITORING PROGRAM



UNANTICIPATED SETTLEMENTS AND ENGINEERING DISPOSITION

- Outfall Structure 1973/1974
- Settlement markers indicated:
  East Side Settlernent ↓
  West Side Heave ↑
- Solution: Entirely underpin the structure to ensure no further settlement
- Four (4) HP Piles driven to refusal and two (2) wide flange steel beams to fully support the structure
- No interruption of operation at outfall structure.


BV UNIT 1 SETTLEMENT MONITORING PROGRAM
10
100
1000
10000
100000
0
-1
-2
-3
-4
MARKER OSNW THRU FALL 1991
TOTAL SETTLEMENT IN INCHES
ELAPSED TIME IN DAYS

SEPARATION OF STRUCTURES AND VERTICALITY

- Stone and Webster Structural Design Criteria (BVM-52) for Shakespaces is four (4) inches.
- Shakespace Location Plan 08700-RC-18A.
- Relative displacement profiles are part of Structural Design Criteria.
- Four (4) inches of free space is greater than the max building displacement by a factor of 2.

SAFETY RELATED STORAGE TANKS

- ASME XI Program
- Tank Leakage & Corrosion
- Settlement
- Tank Appurtenances
- Foundation

LICENSEE EVENT REPORTS
BVPS # 1

- LER 1-76-053 Shock Annunciator Inoperable
- LER 1-77-101 Peak Shock Recorder O.O.S.
- LER 1-78-028 Failure of Seismic Monitor Recorder
- LER 1-78-040 Misaligned Reed Switches on Peak Shock Annunciator

LICENSEE EVENT REPORTS
BVPS # 1

- LER 1-80-037 Flawed Weld in Containment Liner
- LER 1-81-082 Possible Floor Overload in PAB
- LER 1-82-013 Containment Liner Bulge and Missing Liner Test Channel Plug
- LER 1-82-017 Void in Containment Wall Near Equipment Hatch

PAST NRC INSPECTION STRUCTURAL ISSUES

- Search of database identified the following items:

  - IFI 80-12-01
  - UNR 81-20-06
  - UNR 80-27-30
  - UNR 82-08-03
  - UNR 83-21-02
  - UNR 82-11-03
  - UNR 87-11-02

PAST NRC INSPECTION STRUCTURAL ISSUES

INSPECTOR FOLLOW ITEM 80-12-01

NRC to review DLC Actions Concerning Construction Deficiencies in Safety-Related Tanks

- Item reviewed in depth in Inspection 80-17

- Item closed in Inspection 80-25

PAST NRC INSPECTION STRUCTURAL ISSUES

UNRESOLVED ITEM 81-20-06

Review Unit 2 Structural Design Deficiencies for Applicability to Unit 1 (CON'T)

- Item reviewed in Inspection 81-25
- Item reviewed and closed in Inspection 83-19

ITEMS RELATED TO BULLETIN 79-14

UNRESOLVED ITEM 82-08-03

Seismic Design Deficiencies

- QA Audit verified adherence to IEB 79-14
- Sample of work packages independently verified
- Actions reviewed in Inspections 82-10 and 83-19
- Item closed in Inspection 85-06

PAST NRC INSPECTION STRUCTURAL ISSUES

UNRESOLVED ITEM 82-11-03

Review Acceptability of Containment Liner Bulges (LER 32-13)

- Inspection program of containment liner bulges initiated (BVT 1.3-1.47.6)

- Item reviewed and closed in Inspection 83-25

PAST NRC INSPECTION STRUCTURAL ISSUES

UNRESOLVED ITEM 83-21-01

Provide Summary Report to NRC regarding Anchor Bolt Stiffness (Ref: IEB 79-02)

- Summary Report Submitted 9/84
- Item reviewed and closed in Inspection 85-17

PAST NRC INSPECTION STRUCTURAL ISSUES

DEVIATION 86-06-03

EDG Fuel Oil Day Tanks Support Craddles were not built to Industry Codes applicable to Seismic Structures

- DCP 739 replaced supports for fuel oil day tanks
- Item reviewed and closed in Inspection 86-11

10 CFR 50.59 EVA[illegible]IONS

Design Change Package No.	Subject	Evaluation Summary
161	BV-1 Cooling Twr Roadway Slope Protection	QA Category III (OSC Mtg. 81-80, 7/2/80)
210	BV-1 Emerg. Airlock Installation	EAL, Blank Flange Conn, Missile Shield and Concrete Access Platform are QA Category I, Seismic. Rest is QA Cat. III, Seismic
216	BV-1 New Rx Cavity Seal	QA Category III (OSC Mtg. 7/25/78)

10 CFR 50.59 EVALUATIONS

Design Change Package No.	Subject	Evaluation Summary
397	Upgrade Peak Shock Recorder	QA Category III, Seismic
424	Concrete Block Modifications for IEB 80-11	QA Category I
480	Concrete Block Wall Modification to Allow Removal of LW-E-4	QA Category I
481	Concrete Block Wall Modification to Allow Removal of LW-E-1	QA Category III, Seismic

10 CFR 50.59 EVALUATIONS

Design Change Package No.	Subject	Evaluation Summary
706	Refueling Pool Cofferdam	QA Category II, Seismic
723	Replacement of Containment Concrete Floor Plugs with Grating	QA Category III, Non-Seismic
735	Replace Defective Metal Inserts in Missile Shields and Floor Plugs	QA Category III, Seismic
739	Replace EDG Day Tank Supports	QA Category I, Seismic

10 CFR 50.59 PROGRAM

- All Design Changes Evaluated
- All Other Changes Screened
- Documentation and Training Improved
- Meets NSAC - 125 Guidelines
- NGAPs 8.10, 8.18

AOP - Abnormal Operating Procedure

Acts of Nature

- Tornado
- Flood
- Earthquake
- Dam Failure

AOP - Abnormal Operating Procedure

Tornado

- Secure Loose Equipment
- Secure Gas Cylinders
- Cease Certain Operations
- Tornado Proof Structure

AOP - Abnormal Operating Procedure

Earthquake

- Magnitude of Seismic Event
- Operational Basis Earthquake
- Design Basis Earthquake
- Plant Inspection

FUTURE LICENSE RENEWAL

- No Plans at the present time

A-46 RESOLUTION/ SQUG

Current Commitments:

- Complete 9R - Spring/Summer 1993 (Under Review for SSER)
- Use A-46 in Entirety w/o Exceptions
- Combine with IPEEE to Extent Possible

Status:

- SSEL & Relay Personnel Trained by SQUG
- Preliminary SSEL (Less Relays) Established & OPS Reviewed; Minimum List Developed to Facilitate In-House Performance
- Tentatively Scheduled Four Personnel for 1992 SQUG Walkdown Training (September & November)
- Reviewing Completion Relative to 3 Yr NRC Allowed Time Frame, Outage Schedule And IPEEE Scope of Work

IPEEE EVENTS

- Fire
- External Flood
- Seismic
- High Winds
- Transportation

SEISMIC EVALUATIONS

- Key Components from Risk Assessment
- Fragility Curves
- Convolute with both Hazard Curves
- EPRI curves as base case
- LLNL curves as sensitivity study

WALKDOWN LOG

BEAVER VALLEY-UNIT 1 TEAM: N/A DATE: 6/17/92 Page 1 of 7

BLDG/AREA	ELEV.	LOC.	COMPONENT/ITEM	ASPECT REVIEWED	PHOTO #	COMMENTS
Intake Structure	Main Level, 705'	Inside Steel Superstructure	Traveling Screens; Floor Coating	General Condition; good, with minor degradation of coating	A-1 *	All components outside pump cubicles are non-safety
"	730'	On top of pump cubicles	Concrete Floor	Cracks up to 0.075" wide, running diagonally from corners of access hatch	A-2	Other cracks noted
"	705'	Pump Cubicle D	Pumps, Piping, Supports, Conduit, Concrete, Anchors	General Condition: O.K.		
"	705'	Pump Cubicle C	"	General Condition: O.K.; some corrosion evident on exposed piping - surface rust	A-3	Piping for Unit 2 Service Water Pump. Photo looking South
"	705'	"	"	Piping and Supports generally well maintained	A-4	Photo looking north.
"	705'	Pump Cubicle B	"	General Condition: O.K., with some grout degradation + baseplate corrosion	A-5	Small Dia. Piping for Unit 1 River Water Pump
"	705'	"	"	Conduit Support on wall with missing washers, untorqued anchors, gaps, bent members	A-6	Power to River Water Pump
"	705'	Pump Cubicle A	"	General Condition: OK; vertical crack on south wall, ~ 0.03" wide		
"	705'	"	"	Crack on floor, ~ 0.04" wide and ~10' long; conduit support missing one baseplate anchor	A-7	West side of cubicle
"	705'	Outside, on grating	Exterior Concrete Walls	General Condition: Good, but 3 vertical cracks ~10' long by ~0.02" wide	A-8	Cracks on South Wall
Containment Exterior	767'	From adjacent roof of cable vault	Exterior Surface of Concrete Wall	General Condition: O.K., with some minor cracking observed	A-9	Looking south at roof level
"	767'	"	"	"	A-10	Looking south + up from roof level
"	≈780'	Adjacent Roof near duct	Exterior Surface of Concrete Dome	General Condition: Good	A-11	Looking south + up from roof level

* Photo did not come out

ATTACHMENT 4

WALKDOWN LOG

BEAVER VALLEY-UNIT 1 TEAM: N/A DATE: 6/17/92 Page 2 of 7

BLDG/AREA	ELEV.	LOC.	COMPONENT/ITEM	ASPECT REVIEWED	PHOTO #	COMMENTS
Containment Exterior	767'	Adjacent Roof of Cable Vault	Exterior Concrete Wall Surface	small cracks observed	A-12	Looking south
"	762'	East Side of Cable Vault, on roof	"	cracks up to 0.03" wide observed	A-13	Looking South-east and up
Refueling Water Storage Tank	762'	"	Refueling Water Storage Tank	Concrete Missile Shield (lower part) and Insulation (upper part) completely cover tank. How is it inspected?	A-14	Looking West, from roof
	762'	"	Main Steam, Feedwater Piping and Supports	General Information	A-15	Looking South
	762'	"	"	Corrosion on top surface of bracing plate for support.	A-16	
	762'	"	"	Corrosion between double angles (TT) support members	A-17	Photo does not show condition
Coolant Recovery Struct.	735'	Grade	Settlement Marker CR-3	General Information	A-18	
Containment Exterior	735'	East Side of Equip. Hatch	Exterior Surface of Concrete Wall	Missing "chunks" of concrete, up to 3" x 2" x 2" deep; Pattern observed.	A-19	Looks like deterioration of construction patches
"	735'	"	"	Shake space at Equipment Hatch, to adjacent structure	A-20	
Diesel Generator Bldg	Grade	South Side	Exterior Concrete Surface	Missing Concrete, exposing rebar ~ ½" from surface; thin cover	A-21	Looking North
Steam Generator Drain Tank	Grade	West Wall	Concrete Enclosure for Tank LW-TK-7B	Water Damage to Concrete	A-22	Looking NE
Platform Structure	Grade	Adjacent to Equip Hatch	Concrete Surface	Vertical Cracks, ~ 0.01" wide, minor	A-23	Looking East
Turbine Building	735'	Turbine Bay	General Layout	Info only; located shake space betw Turbine and Service Bldgs	A-24*	Non-safety

* Photo did not come out

WALKDOWN LOG

BEAVER VALLEY-UNIT 1 TEAM: N/A DATE: 6/17/92

BLDG/AREA	ELEV.	LOC.	COMPONENT/ITEM	ASPECT REVIEWED	PHOTO #	COMMENTS
Refueling Water Storage Tank	Grade	Lower Part	Concrete Missile Shield Exterior	Concrete and Foundation look OK		
Demineralized Water Storage Tank	Grade	Concrete Enclosure	Exterior Concrete Surface	Concrete looks OK; Tank inside the enclosure; Confined Area		No access to tank
Primary Auxiliary Bldg	722'-6"	West Wall, adjoining Cable Vault	Masonry Wall	Loose floor angle support; vertical angle support missing anchor at top	B-1	Masonry Wall part of 80-11
"	722'-6"	"	"	Deterioration above Fire Door A 22-3; cracks in concrete	B-2	
"	722'-6"	"	Ceiling	Concrete Crack ~ 20' long, with rust discoloration	B-3	
"	722'-6"	Control Rm Air Conditioning	Raw Water Piping	Significant Corrosion on pipes	B-4	Most Likely Due to Condensation
"	735'-6"	At CCR Heat Exchanger 1A	Support Base Plate for Discharge Press. Gage	Missing Grout below support baseplate	B-5	
"	752'-6"	Boron Test Tanks	Tank BR-TK-2B	Permanent Deformation / Buckle at bottom of tank; occurred	B-6	Tanks not safety-related;
"	752'-6"	"	"	before plant operation; DLCo not concerned.	B-7	normally empty. "
"	752'-6"	"	" / Also Tank BR-TK-2A	Permanent Deformation - ½" inward, at nozzle	B-8	"
"	768'	Adjacent to 1VS-ACFL-10 HVAC filter	Chilled Water Piping and Support on Floor	Significant Corrosion of Pipe Support and Piping	B-9	Not safety-related piping
"	722'-6"	Near West wall adjoining Cable Vault	Pipe Support Condition	Missing Nut on U-bolt Support for 3" diameter pipe; ≈ 9' above floor		
"	752'-6"	Freight Elevator Door	Concrete Wall	Minor Wall Cracks observed		

WALKDOWN LOG

BEAVER VALLEY-UNIT 1 TEAM: N/A DATE: 6/17/92 Page 4 of 7

BLDG/AREA	ELEV.	LOC.	COMPONENT/ITEM	ASPECT REVIEWED	PHOTO #	COMMENTS
Primary Auxiliary Bldg	≈763'	SLCRS HEPA Filter	Masonry Wall Enclosure	80-11 Modification to Masonry Wall; Question about Safety Class and	Missile Protection Requirements	
Coolant Recovery Tank	768'	/	/	General Condition of Tank - looked O.K.		
Fuel Bldg	768'	Fuel Pool	Steel Superstructure and Panels Covering Fuel Pool	Question about Missile Protection of Fuel Pool		
"	735'-6"	Fuel Pool Heat Exchangers	/	General Support Condition - looks O.K.		
"	735'-6"	West Wall	Lateral Support for Fuel Pool Piping	Gap in Base Plate		

WALKDOWN LOG

BEAVER VALLEY-UNIT 1 TEAM: N/A DATE: 6/18/92

BLDG/AREA	ELEV.	LOC.	COMPONENT/ITEM	ASPECT REVIEWED	PHOTO #	COMMENTS
Diesel Gen. Bldg	Operating Level	#1 D.G. Room	General Condition of Concrete, D.G. Supports, etc.	≈40' long cracks running E-W in concrete ceiling; extend wall-to-wall	B-10	
"	"	#2 D.G. Room	"	same as above observed in #2 D.G. Room also		
"	"	#2 D.G. Room	Piping/Valves for D.G. Fuel Oil Transfer Pump	Relatively large valves on small bore pipe; no extra support; very flexible.	B-11	Observation; not degraded condition
Intake Structure	Below Operating Level	Pit for Pump Bay "C"	General Condition of Steel and Concrete	Steel Frame Pipe supports for Raw Cooling Water Line has considerable corrosion; water collects on horizontal member.	B-12	
"	"	"	"	(same as above)	B-13	
"	"	"	"	Concrete walls and ing in good condition	B-14	Poor photo quality; Best possible
"	Outside	Looking at South Wall	General View	Elevation Markers; perspective of Ohio River in background	B-15	
Control Room	735'	Behind Control Display	Peak Shock Annunciator, Recorder, and Fl...ck	General Information - mounting, configuration	B-16* B-17* B-18*	Photos over-exposed
"	"	Near Computer Room; Door 535-3	Masonry Walls/ 80-11 Fixes	Presence of Cracks in Masonry Walls; Crack at Hung Ceiling Level on South Wall	B-19	DLCo identified crack in last inspection
Service Bldg	735'	General	Walls, Floor, Ceiling, Equipment, etc.	General Condition - O.K.		El. ≥ 735' not safety-related
"	713'-6"	General	Normal Switchgear; Cable Trays; Floor, Walls	General Condition - O.K.; some minor floor cracks, no water.		Mixture of non-safety and safety
"	"	"	Ceiling	Calcium Stain - possible water infiltration	B-20	
"	"	Process Rack Area	HVAC; Cable Trays; Emergency Shutdown Panel; etc.	General Condition - O.K.		

* Photo did not come out

WALKDOWN LOG

BEAVER VALLEY-UNIT 1 TEAM: N/A DATE: 6/18/92

BLDG/AREA	ELEV.	LOC.	COMPONENT/ITEM	ASPECT REVIEWED	PHOTO #	COMMENTS
Service Bldg	713'-6"	Air Conditioning Room	Control Room Air Cond. Condenser Units	Degradation of support base	B-21	
"	"	"	"	Corrosion of Steel Support Members	B-22	
"	725'-6"	Cable Tray Mezzanine	Cable Trays, Conduits, Gen'l	General Condition - OK; small cracks in floor		
"	"	"	Waste Line and Ceiling Above	Sign of Water Infiltration, Calcium Deposit on Ceiling just above Waste Line	B-23 B-24	Potential Leakage from Waste Line may cause problem here
"	713'-6"	Control Rod Room	Cable Trays; Conduits; Electric Equip.; Walls, Floors, etc.	General Condition - OK		
"	"	Orange & Purple Switchgear Rms	"	General Condition - OK		Masonry Wall with nomods in Battery Rm #4
Cable Vault Structure	735'	West Cable Vault	Electrical Penetrations to Containment	General Condion - OK	C-1	
"	"	"	Masonry Wall - East end	Cracks observed	C-2	
"	"	AFW pump rooms; Quench Spray Pump Rm	General	General Condition - OK		
"	735'	Safeguards Area Cooling Unit	Fan Coil Unit	Corrosion of bottom of unit, base support, and lines	C-3	Drain dump partly on floor; misses drain hole; goes to Rad Waste
Safeguards Structure	≈745'	General				
"	"	Containment Wall	Concrete Condition	Horizontal "Crack" observed; Probably a Construction Joint	C-4	
"	722'	River Water Line	Pipe Support	Corrosion on sliding Plates	C-5	

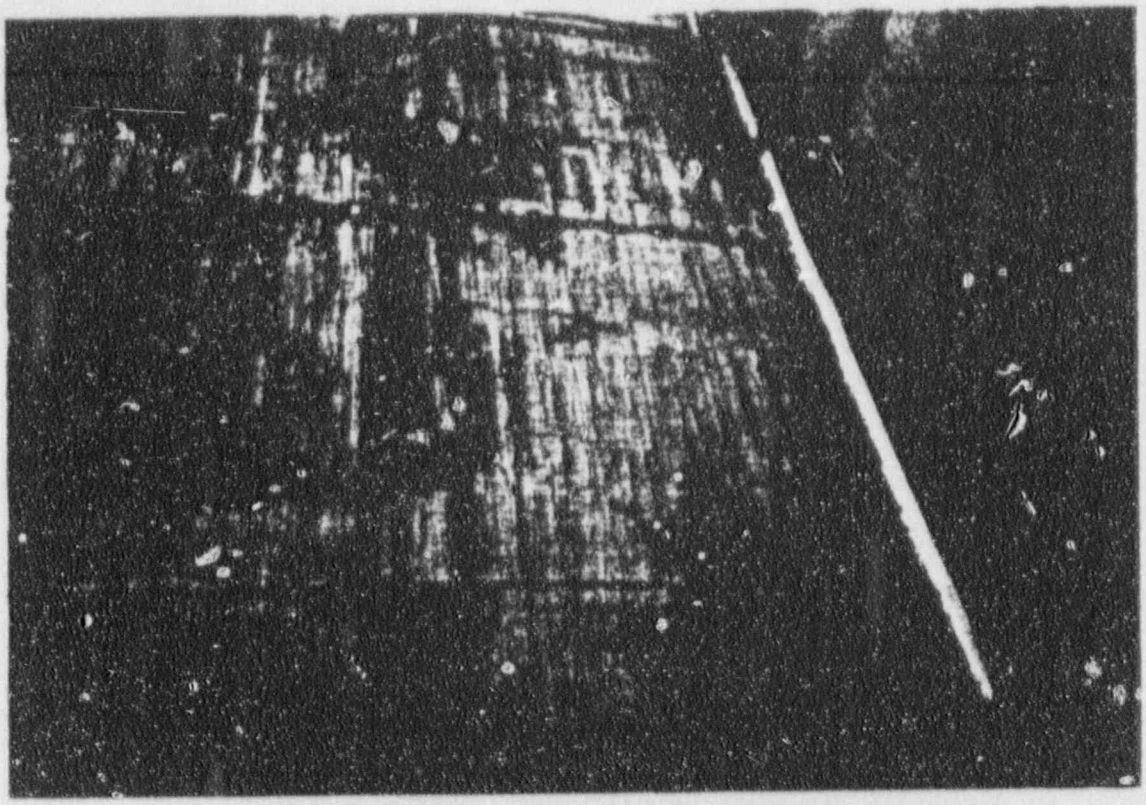
WALKDOWN LOG

BEAVER VALLEY-UNIT 1 TEAM: N/A DATE: 6/18/92

BLDG/AREA	ELEV.	LOC.	COMPONENT/ITEM	ASPECT REVIEWED	PHOTO #	COMMENTS
Safeguards Structure	722'	Near #QS-9-2 pipeline	Riser Support Clamp on Pipe	Condensation (?) dripping from clamp; clamp corroded.	C-6	
"	"	"	Embedded Steel Plate in Ceiling	Corrosion observed on 2 supports attached to embedded steel plate	C-7	
"	"	Component Cooling Line	Piping Penetration #1	Large Diameter Penetration to Containment (at left in photo) shows significant corrosion	C-8	
Cable Vault Structure	735'	Fan Coil Unit 1VS-AC-8	CO_2 Door Release Line; ≈ 1" Dia.	Attached to both Cable Vault Wall and Containment		Differential Motion would be problem if safety-related
"	722'	Abutment to Containment	Shake Space betw. Cat I Structures	Special Structural Steel Section Installed as Modification; may not provide the design-required 4" space		Modification made to meet App. R
"	735'	General	MCC's and Electrical Penetrations	General Condition - OK		
"	756'	MCC Room	Walls, Floor, Ceiling, Equipment	"		
"	777'-6"	Main Steam Room	Main Steam Isolation Valves	Info. only	C-9	
"	751'	"	Main Feedwater Pipe Whip Restraints	"	C-10 C-11	
Safeguards Structure	747'	Recirc Spray Pump Room	Ceiling	Corroding Steel Angle Section is sign of possible water infiltration from roof	C-12	{Note: C-13 N/A}
Unit 1 Cooling Tower	Grade	/	/	Info Only	C-14	
Unit 2 Containment	Grade	/	/	"	C-15	
Switchyard	Grade	/	Seismic Free Field Instrument	"	C-16 C-17 C-18	

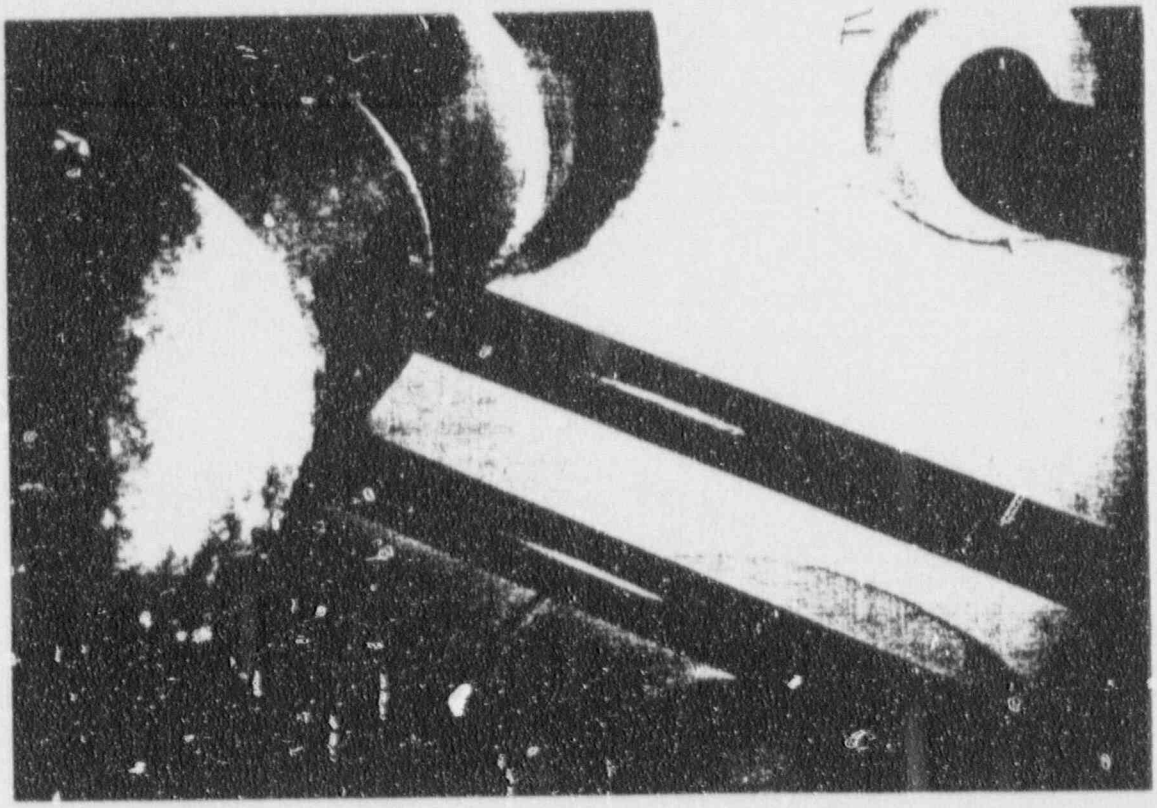
ATTACHMENT 5

Outside Containment Wall - Concrete Crack Pattern (A-10 & A-12)*

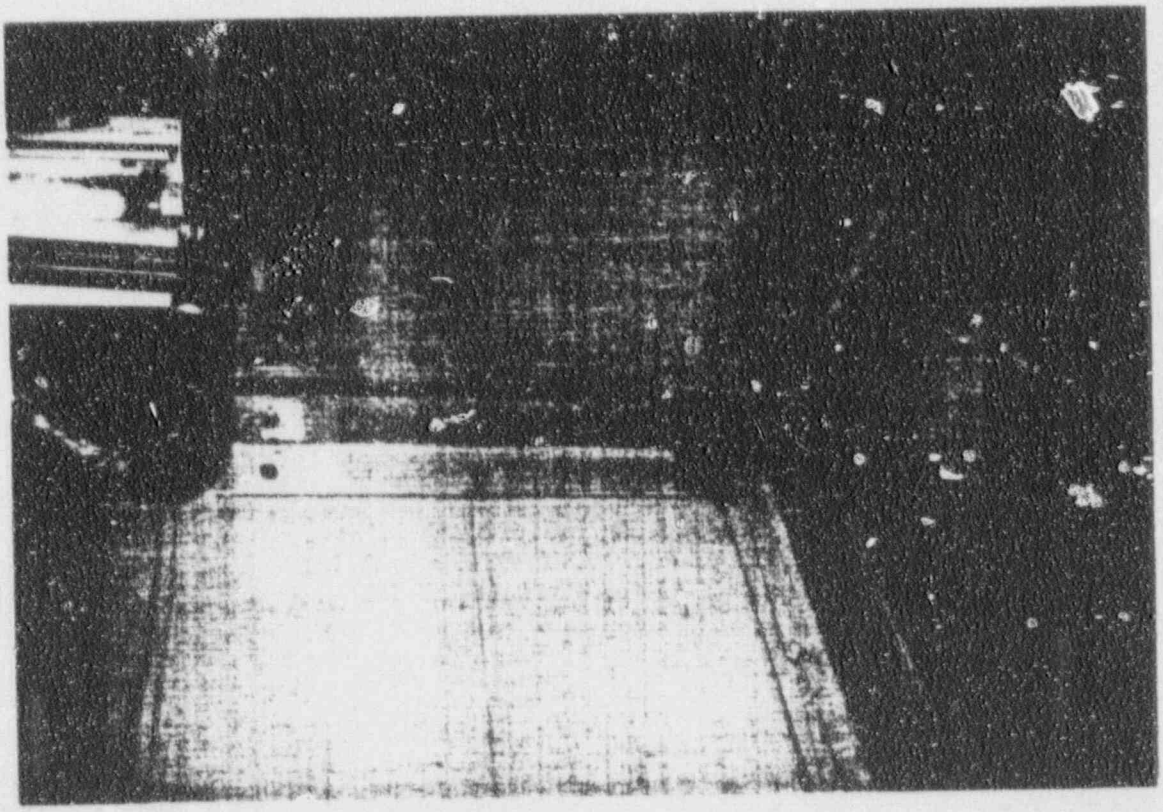


*Designations in parentheses refer to the photograph numbers in the walkdown log (Attachment 4)

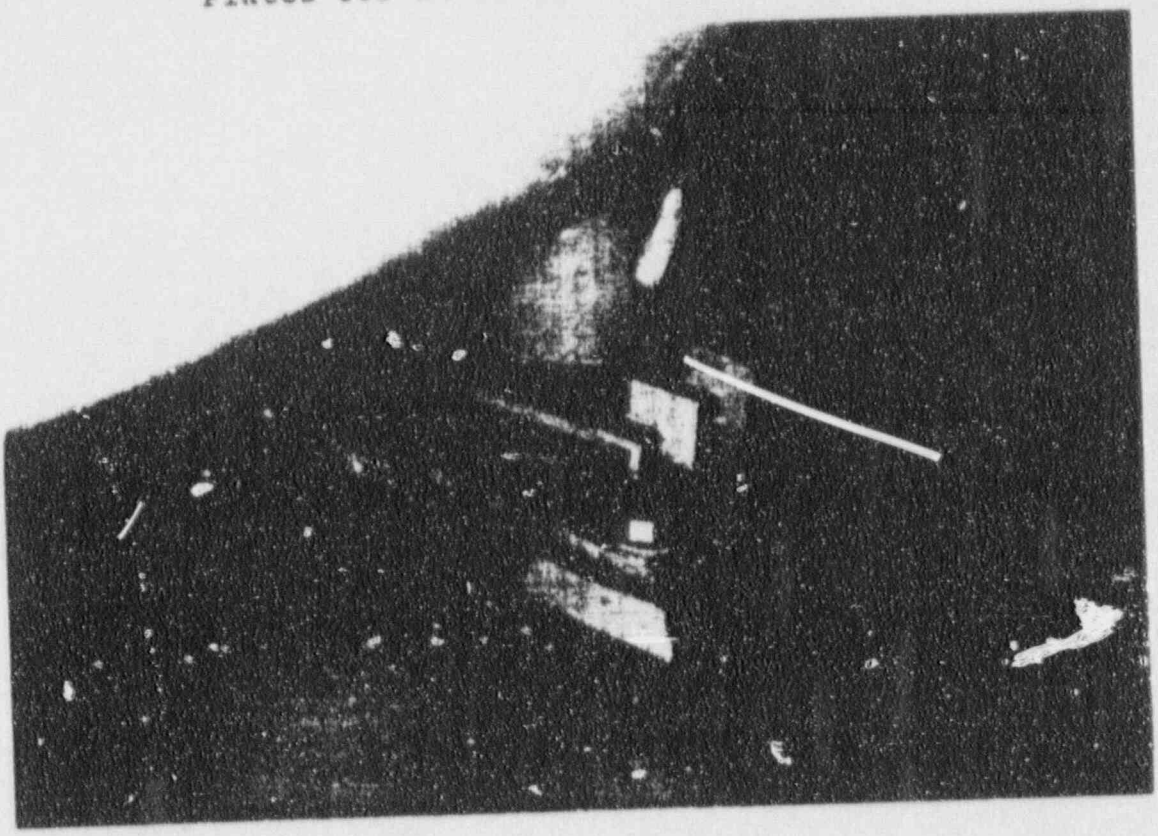
Containment-Corrosion of Containment Penetration
for Component Cooling Line (C-8)



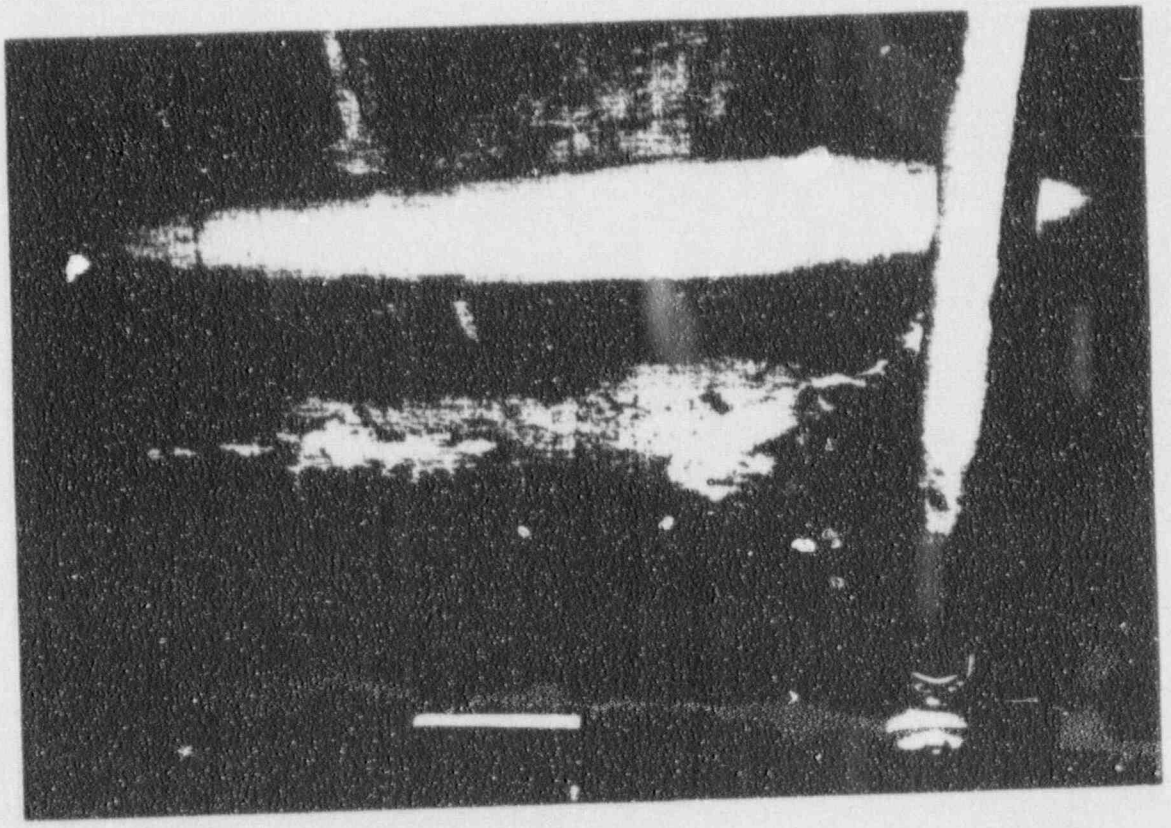
Safeguards Structure - Water Infiltration
and Corrosion of Steel Angles (C-12)



Safeguards Stiucture-Corrosion of Sliding Support Plates for River Water Piping (C-5)

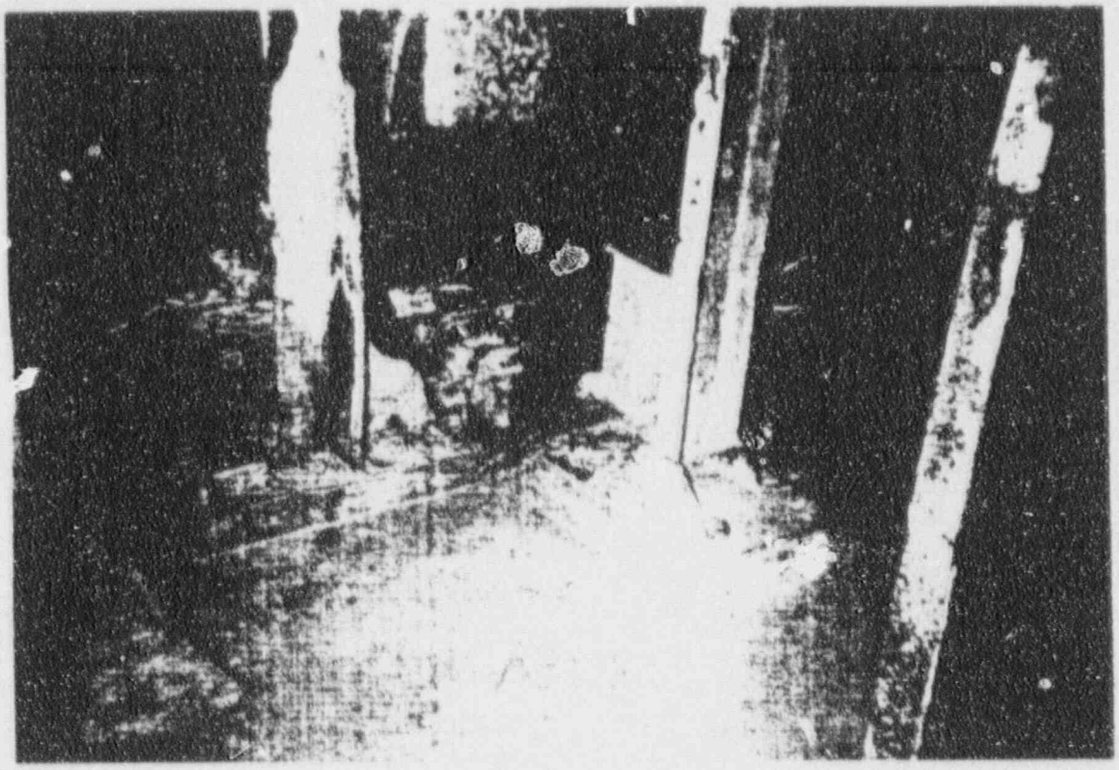


Service Building - Water Infiltration and Calcium Formation (B-23)

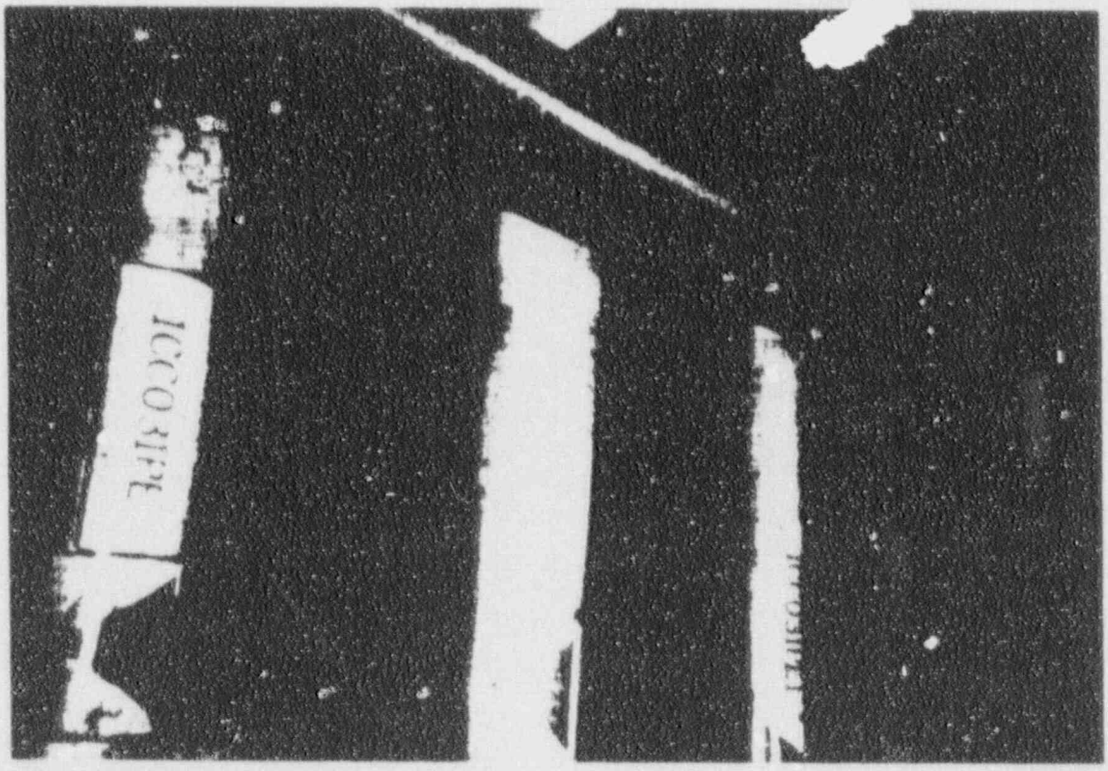


Service Building - Control Room Condenser Unit

Degradation of Base/Foundation and Corrosion of Steel Supports (B-21)



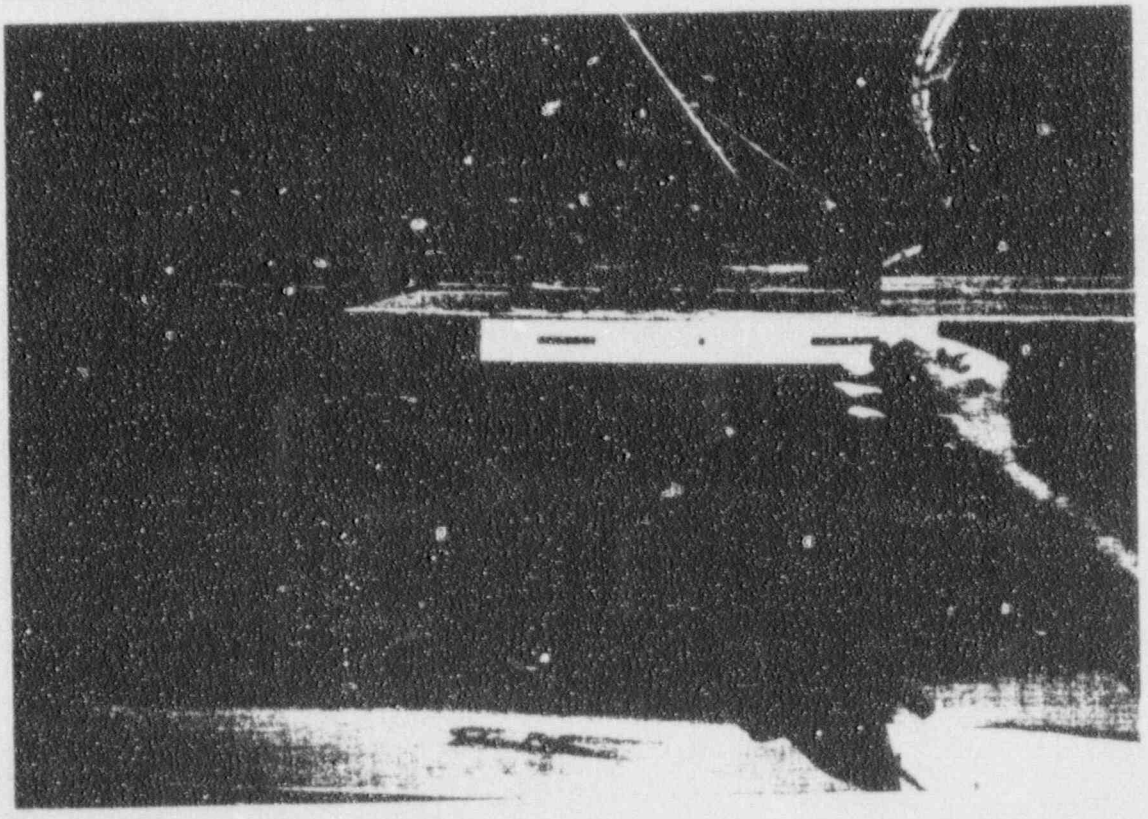
Metal Corrosion of Frame Support (B-22)



Cable Vault Structure

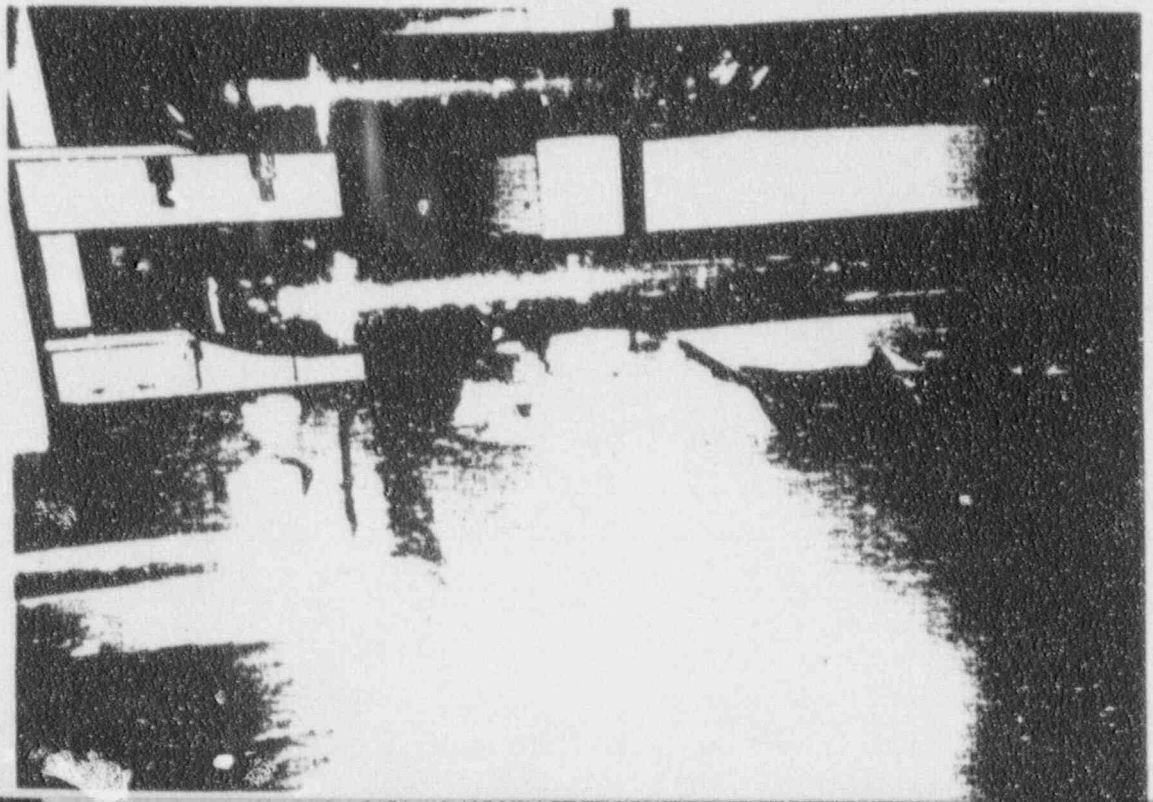
Corrosion of Base/Steel Supports of the Fan Coil Unit (C-3)

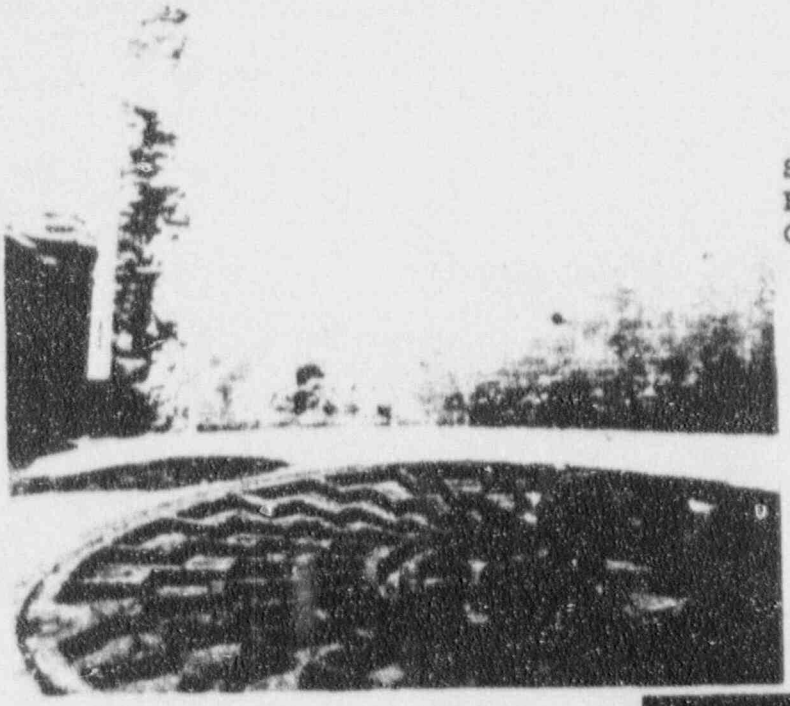
Corrosion of Structural Steel for Main Steam/Feedwater Piping (A-16)



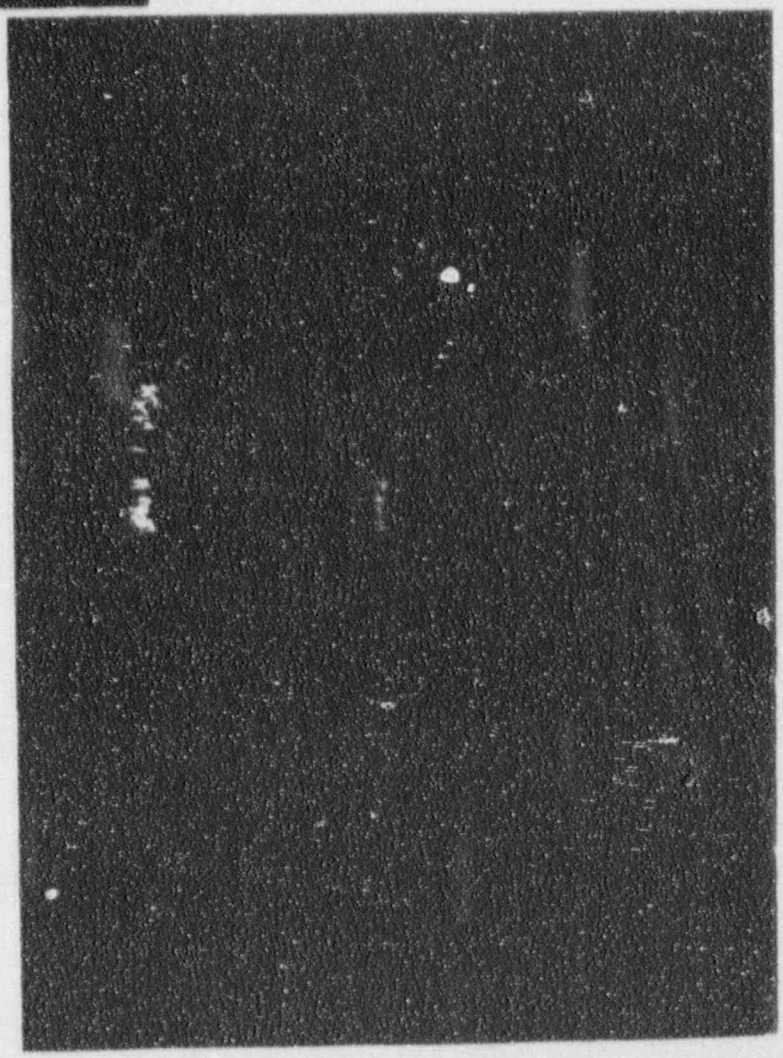
Concrete Crack and Rust Discoloration at Ceiling (B-3)

Missing/Degradation of Grout Below Baseplate (B-5)





South Wall of Diesel Generator Building - Concrete Spall and Corrosion of Reinforcement (A-21



Steam Generator Drain Tank - Cracks, Water Infiltration and Calcium Formation (A-22)

Enclosure 2

SALP INPUT

Facility: Beaver Valley Power Station Unit 1
Licensee: Duquesne Light Company

Summary of Activities

The Structural and Geosciences Branch staff has been performing structural audits of six selected nuclear power plants. The selection criteria are: Operating License issued prior to 1976, regional distribution, and containment structure type. Beaver Valley Unit 1 was the fifth plant visited under this program. The objective of the audit was to assess the condition of structures and civil engineering features at the plant. The structural audit was performed during the week of June 15, 1992.

Narrative Discussion of Licensee Performance

As requested prior to the site audit, the licensee prepared a presentation on the structural and civil engineering features of the plant. The presentation was logical, in suitable depth, and well presented. The reposes to staff concerns and questions were satisfactory and technically sound. The licensee's staff was extremely cooperative in guiding the audit team where it wanted to go during the walkdowns.

Author: Robert L. Rothman
Date: August 27, 1992