50-334F

Duquesne Light

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December 11, 1978

Director of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
Attention: A. Schwencer, Chief
Branch No. 1
Division of Operating Reactors
Washington, D. C. 20555

Reference: Beaver Valley Power Station, Unit No. 1
Docket No. 50-334
Additional Information on Fire Protection Program

Gentlemen:

Enclosed are three (3) signed originals and thirty-seven (37) copies of additional information on the Fire Protection Program for the Beaver Valley Power Station. This additional information supplements our September 29, 1978 response and completes the information requested in your July 18, 1978 letter.

This information has been prepared by our Archetect-Engineer and it is our intent to comply with all included recommendations.

Very truly yours,

E. J. Woolever

E. J. Woolever
Vice President

Attachment

7812140109

FOR ENCLOSURES TO DOCUMENTS,
REQUEST BEHIND THE FILE MATERIAL

F

(CORPORATE SEAL)

Attest:

H. W. Staas
Secretary

COMMONWEALTH OF PENNSYLVANIA)
) SS:
COUNTY OF ALLEGHENY)

On this 11th day of December, 1978, before me, DONALD W. SHANNON, a Notary Public in and for said Commonwealth and County, personally appeared E. J. Woolever, who being duly sworn, deposed, and said that (1) he is Vice President of Duquesne Light, (2) he is duly authorized to execute and file the foregoing Submittal on behalf of said Company, and (3) the statements set forth in the Submittal are true and correct to the best of his knowledge, information and belief.

DONALD W. SHANNON, Notary Public
Pittsburgh, Allegheny Co., Pa.
My Commission Expires
June 7, 1979

FIRE PROTECTION PROGRAM REVIEW

for

Beaver Valley Power Station - Unit 1
Duquesne Light Company

November 1978

by

Duquesne Light Company
Pittsburgh, Pennsylvania

and

Stone & Webster Engineering Corporation
Boston, Massachusetts

BVPS Unit 1

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QUESTION A.1-1

Combined Fire and Security Emergency

Describe the responsibilities of key plant personnel in the event of a combined fire and security emergency.

RESPONSE

In the event of a combined fire and security emergency, there are no shared personnel or equipment between the fire brigade and the security team. Each group is responsible for actions directly related to the particular emergency that may arise. During back shifts, weekends, and holidays, the shift supervisor has overall responsibilities for both groups in the event of a combined fire and security emergency.

Question A.1-2: Personnel

State who in upper management has been assigned the responsibility for the overall fire protection program.

State who has been delegated the authority for formulation and assurance of program implementation. State his experience.

State the experience and qualifications of the fire protection engineer or consultant.

Response A.1-2: Mr. G. W. Moore, Duquesne Light Company - General Superintendent of Power Stations, is responsible for the overall fire protection program.

Mr. J. A. Werling, Beaver Valley Power Station Superintendent, is authorized for formulation and assurance of program implementation. His experience and qualifications are as follows:

J. A. Werling - BS in Chemistry. Mr. Werling has over twenty years of nuclear power stations experience including eighteen years in responsible supervisory positions directing operations. Certified by the Naval Reactors branch of the NRC for nine years. He held held the position of Station Operating Supervisor, responsible for directing all activities associated with the operation of the Shippingport Atomic Power Station for six years. He has been associated with the Beaver Valley Project for four years engaging in design review, quality assurance activities, licensing activities, station staffing and training, and the preparation of the station operating manuals. He received a Senior Operator License in October, 1975. Total nuclear experience: twenty years.

L. E. Wagner - BS in Industrial Management. Mr. Wagner is the Duquesne Light Company's Power Stations Department Safety Engineer whose qualifications include responsibilities for all activities associated with fire protection and safety for all DLC power generating stations including BVPS for the past 6 years. He attended Duquesne University where he obtained his BS in Industrial Management. He is an active member of the following associations:
(1) American Industrial Fire Protection Association,
(2) National Fire Protection Association,
(3) American Society of Safety Engineers,
(4) American Industrial Hygeinist Association, and
(5) Society of Fire Protection Engineers

QUESTION A.2-1

Equipment Required for Safe Shutdown

The information provided in the Fire Protection Program Review is not sufficiently detailed. Specifically, the Fire Protection Program Review and the fire hazard analysis cover major components such as pumps, heat exchangers and motor control centers needed for shutdown but do not cover such essential items as cable runs, valves, controls and other auxiliary equipment needed for the proper functioning of these major components. The information does not indicate whether there are any fire areas in the plant containing equipment that performs a function required for safe shutdown that cannot be performed by equipment located in another fire area. For each fire area, provide a list of the equipment (including cable runs, valves, panels, breakers, etc) located in the area that can be used to perform functions required for safe shutdown. For each item on the list, indicate whether its function can be performed by equipment located in another fire area and identify the area. In preparing the list for each fire area, the following functions should be considered to be required for safe shutdown:

1. Placing the reactor in a subcritical condition and maintaining the reactor subcritical indefinitely.

2. Bringing the reactor to hot shutdown conditions and maintaining it at hot shutdown for an extended period of time (i.e., longer than 72 hours) using only normal sources of cooling water.

3. Maintaining the reactor coolant system inventory indefinitely using only normal sources of makeup water.

4. Bringing the reactor to cold shutdown conditions within 72 hours.

If all the redundant equipment available to perform any of the above functions (assuming a loss of offsite electrical power) is located in a single fire area, identify the specific separation that exists and any combustible material between the redundant equipment.

RESPONSE

The results of the fire protection analysis are provided in the attached report.

FIRE HAZARD ANALYSIS

INTRODUCTION

A fire hazards analysis has been conducted to determine whether there are any fire areas in the plant containing equipment that performs a function required for a safe shutdown that cannot be performed by equipment in another fire area. This analysis is more detailed than previous fire protection reviews in that it includes an area-by-area investigation of pumps, valves, power supplies, cable runs, panels, breakers, controls, ventilation and cooling support systems that are required for a safe shutdown. The following functions, coincident with an assumed loss of offsite power were considered in the analysis:

1. Placing the reactor in a subcritical condition and maintaining the reactor subcritical indefinitely

2. Bringing the reactor to hot shutdown conditions and maintaining it at hot shutdown for an extended period of time (i.e. longer than 72 hours) using only normal sources of cooling water

3. Maintaining the reactor coolant system inventory indefinitely using only normal sources of makeup water

4. Subsequently bringing the reactor to cold shutdown conditions

The analysis defines the systems required to perform these functions and the redundancy existing within each system. For example, if only parts of a system are needed for a safe shutdown function these components alone, and their associated cables, and support systems, are evaluated in detail. In order to directly analyze the effects of a fire in any of 30 fire areas the physical location of the safe shutdown components, and more importantly the associated cables had to be determined. This undertaking typically involved either three or six cables for a MOV (depending on whether or not auxiliary shutdown panel operation is possible), six cables for 4 kV pump motors, and 381 cables for the Class 1E distribution system. Some of a total of approximately 1,000 safe-shutdown cables are found in each of 30 fire areas and therefore a total of 30,000 combinations of safe shutdown related locations and fire areas had to be investigated. A detailed discussion of this investigation is provided in the first section of this response.

RESULTS

The analysis demonstrates that a loss of one or more shutdown functions is possible as a result of a postulated fire in each of the following fire areas: CR-1, CR-2, CR-3, CR-4, CS-1, CV-2, CV-3, PA-1F, PA-1H, PT-1A, and RC-1. The most severe

consequences of a fire are associated with the complete loss of the 1E distribution system and concurrent loss of offsite power.

The following equipment and components may be jeopardized by a single fire:

1. Auxiliary Feedwater Pumps and Motor Operated Valves, Fire area PT-1A

2. Motor Operated Valves, CH 115B & D (charging pump suction) Fire area PA-1H

3. Component Cooling Water Pumps, Fire area PA-1F

4. Control Room Heating Ventilation and Air Conditioning Equipment, Fire area CR-2

5. Residual Heat Removal Pumps, Fire area RC-1

6. Safe Shutdown Instrumentation, Fire area RC-1

7. Safe Shutdown Instrumentation, Fire area CR-4

A discussion of the component physical location and separation and the consequences of a given fire is provided on a system-by-system basis.

Primary and backup fire protection detection and suppression systems are provided to limit the effects of fires. The analysis assumed complete loss of an entire fire area. In some cases additional detection and suppression capability is recommended where redundant or alternate functions may not be available.

1. PT-1A Add detection and suppression systems for the auxiliary feedwater system

2. PA-1F Add detection and suppression systems for the component cooling water pumps

3. RC-1 Add detection and suppression system for the RHR pumps

4. CS-1 Add detection to meet NFPA72D coverage recommendation to the cable spreading area

5. CV-3 Add fire detection and suppression to the cable vault

In other areas, the existing detection and suppression systems are considered adequate based on the system-by-system cable location analysis and the available manual and automatic actions which may be taken to provide safe shutdown functions. For example, the control room is continuously manned and human detection supplements the installed detection system and a rapid

response can be expected without the addition of more suppression systems.

METHOD OF ANALYSIS

This analysis may be divided into two general parts. The first part of the analysis defines the safe shutdown functions, the degree of redundancy required and the system diversity available for safe shutdown. The second part determines the cables and components required for operation of the system and compares them with all cables in a given fire area to demonstrate whether or not redundant and diverse functions are vulnerable to a fire. Within vulnerable fire areas, the location and functional relationship of cables is identified in order to evaluate existing separation, fire detection and suppression. Manual operations and recommendations are based on the NRC "defense in depth" concept and they are presented in each system summary table. The five areas referenced in this report are the same as those listed in the initial Fire Hazards Analysis of the Beaver Valley Unit Power Station. In one case, a fire area was subdivided into subareas to simplify the inspection of that fire area. The fire area is PA-1, the auxiliary building. The building was sectioned at the center and new designations applied to each section floor by floor. The top level was divided into PA-1A and PA-1B, the third level into PA-1C and PA-1D, the second level into PA-1E and PA-1F and the bottom level was divided into PA-1G and PA-1H.

Figure 1 summarizes the components, system diversity, and functions required for safe shutdown. A brief description of each function follows. There are four primary functions to be maintained for a safe shutdown. They are as follows:

1. Negative reactivity insertion
2. Reactor coolant system volume control
3. Reactor coolant pressure control
4. Decay heat removal

In order that the above functions can be implemented, the secondary safe shutdown functions must also be available. The secondary safe shutdown functions provide the necessary support for the primary safe shutdown function. The secondary safe shutdown functions are as follows:

1. Motive power
2. Auxiliary cooling

The basis of the analysis of those functions used to achieve safe shutdown are:

1. Fire in a single fire area
2. No coincident occurrence of natural phenomenon
3. Loss of offsite power
4. Only fire-induced failures are to be considered

Negative reactivity insertion is provided by the control rods for hot shutdown and by the Boron Injection system for the additional

negative reactivity needed for cold shutdown. The Reactor Protection system includes a means of initiating fail safe control rod insertion. This ensures the availability of this function for achieving and maintaining hot shutdown.

The reactor coolant system volume control function is required for safe shutdown. The make-up function is provided by the safety injection system. The letdown function is achieved through either natural shrinkage of the reactor coolant system during cooldown, or the use of the pressurizer powered relief valve, or manual operation of the letdown valve.

Reactor coolant pressure control function is accomplished by use of the pressurizer heaters and the pressurizer spray valves.

Since fire-induced failures are the only type of failures considered, no breech of the reactor coolant system or of any other system is considered to occur at the same time. Systems and components which are exclusively used for LOCA or steam line break mitigation are not required for safe shutdown and they are not included in the analysis (Quench Spray, Recirculation Spray, Low Head Safety Injection, etc). Systems or components which provide a safe shutdown function as well as an accident mitigation function are included in the analysis (Charging/High Head Safety Injection system, Auxiliary Feedwater systems, etc). The decay heat removal function is accomplished through the use of the auxiliary feedwater system for hot shutdown and the residual heat removal system for cold shutdown.

The secondary safe shutdown functions include electric power, ventilation and cooling water systems. Motive power is provided by the IE Electrical Distribution system. Cooling of safety related structures and components is provided by the following systems:

1. Control room HVAC
2. D/G ventilation system
3. Emergency switchgear ventilation system
4. Intake Structure ventilation system
5. River water system
6. Component cooling water system

Instrumentation used to monitor reactor system volume and heat removal from the steam generator are as follows:

1. Pressurizer level monitors
2. Pressurizer pressure monitor
3. Steam generator level monitors
4. Steam generator pressure monitors

A list of components used for safe shutdown is given in Table 1.

The second part of this analysis lists all safety related cables associated with the components required for safe shutdown. This

step is accomplished by reviewing electrical one-line diagrams, electrical elementary drawings, wiring diagrams, and logic diagrams.

Through the use of the machine location drawings and the electrical tray and conduit location drawings; all trays, conduits and components used for safe shutdown in each fire area are listed. The electrical raceway information system identifies all cables in a given fire area.

Through the use of the electrical raceway information system, the analysis now determines if any of the cables associated with a safe shutdown component are routed through a given fire area. If so, the analysis lists all safe shutdown components which have cables routed through a given fire. This procedure is repeated for each fire area for each system. The sort (cable/component by fire area) forms the basis of the evaluation of the impact of a potential fire.

The sorts and a flow diagram for each system and for each fire area is then used to determine if a fire will potentially reduce a system availability to a level below that required to assure minimum safe shutdown capability. In areas where the analysis indicates the potential loss of a shutdown function, a detailed review of the cable sort and flow diagram is performed.

Rather than performing a fault tree analysis or failure modes and effects analysis to determine the actual effect produced by the loss of a cable, it is conservatively assumed that the loss of any safety related cable directly associated with a component will result in the loss of that component. If a loss of function results from this assumption, the failure mode of the associated component is re-examined to see if there would be an actual loss of function. For example, if a motor operated valve was normally open and designed to fail open upon the loss of power, a fire affecting the power cable along would not cause the valve to close even though the analysis would indicate a component failure. In addition, even if the valve were to reposition as a result of a fire, actual loss of the function would not result provided the valve is accessible, since all MOV's can be locally operated. (See Appendix A for further details). The analysis thus identifies the minimum safe shutdown function available in the event of a fire.

The system summary table lists only those fire areas which would jeopardize a safe shutdown function. It indicates the associated failure mode/degree and indicates whether or not manual and/or automatic control is available to the plant operators.

Each problem area is evaluated with respect to the potential consequences of a fire and the results of that analysis are presented on a system basis with a corresponding summary table. If the redundant and diverse methods for safe shutdown are jeopardized due to a fire in the listed fire area, then the

physical location and separation of the components or electrical cables and the manual and automatic alternatives were examined. The analysis identified three possible failure modes/degrees.

1. The potential loss of redundant components necessary for a safe shutdown function

2. The potential loss of primary (control room) or secondary (auxiliary shutdown panel) control of redundant components

3. The potential loss of control and/or power cables to redundant component

The recommended position is included in the system-by-system analysis tables. Where less than 20 ft of separation* is available, or where there is less than a 1/2 hour rated barrier*, additional fire protection is recommended.

Fire areas that do not contain system components/cables or where redundant or diverse functions were not jeopardized were excluded from the tables.

* Recommendation based on NRC field audit, 11/78.

SPECIAL DESIGN FEATURES

Essentially all devices needed for safe shutdown have two control points, one is the control room, and the other is the auxiliary shutdown panel located in CR-4. Control from both stations is simultaneously prohibited by the use of a transfer device. The actual transfer device is located in the appropriate emergency switchgear room. The transfer device control point is the auxiliary shutdown panel located in CR-4.

Since the actual transfer devices are located in fire areas ES-1 and ES-2 a fire in CR-1, CR-4 or CS-1 will not effect manual operation of these devices locally. Each circuit, the control room side, and the auxiliary shutdown panel side are separately fused so that failures in one path can be cleared by operation of the transfer device. This transfer device makes each system control path independent of the other.

All motor operated valves are designed for local manual control and this analysis takes credit for this feature provided the valve is not located in the fire area which caused its failure.

Loss of offsite power causes loss of the station air system since the air compressor is operated from a nonsafety electrical bus. Air operated valves in the letdown path from the reactor coolant system normally fail closed. In the event that the normal letdown path is used, several air operated valves would be manually opened by operator action.

TABLE 1

ACTIVE COMPONENTS REQUIRED FOR SAFE SHUTDOWN

HVAC Components

Emergency Switchgear

VS-F-16A	VS-D-55A
VS-F-16B	VS-D-55B
VS-D-16A	VS-F-55A
VS-D-16B	VS-F-55B

Diesel Generator

VS-D-2A	VS-D-2C
VS-D-2B	VS-D-2D
VS-F-22A	VS-D-22-1B
VS-D-22-1A	VS-F-22B

Control Room

VS-D-40-1A	VS-F-40A
VS-D-40-1B	VS-F-40B
VS-D-40-1C	VS-AC-1A
VS-D-40-1D	VS-AC-1B

Intake Structure

VS-F-57A
VS-F-57B
VS-F-57C

RHR Components

RH-P-1A	MOV-RH-700	MOV-RH-720B
RH-P-1B	MOV-RH-701	MOV-RH-783
FCV-RH-605	MOV-RH-720A	

Diesel Generator Fuel Oil System

EE-P-1A
EE-P-1B
EE-P-1C
EE-P-1D

Component Cooling Water System

CC-E-1A	MOV-CC-112A2
CC-E-1B	MOV-CC-112B2
CC-E-1C	MOV-CC-112A3
CC-P-1A	MOV-CC-112B3
CC-P-1B	
CC-P-1C	

Chemical and Volume Control System

MOV-CH-310	CH-P-1A
MOV-CH-289	CH-P-1B
MOV-SI-836	CH-P-1C
MOV-SI-869A	MOV-CH-115B
FCV-CH-122	MOV-CH-115D

Auxiliary Feedwater System

MOV-151A	FW-P-3A
MOV-151B	FW-P-3B
MOV-151C	FW-P-3C
MOV-151D	
MOV-151E	
MOV-151F	

Riverwater System

CH-P-1A	VSE-14A	MOV-RW-113A	MOV-RW-116B
CH-P-1B	VSE-14B	MOV-RW-113B	MOV-RW-102A1
CH-P-1C	WR-P-1A	MOV-RW-113C	MOV-RW-102A2
VS-P-3A	WR-P-1B	MOV-RW-113D	MOV-RW-102-B1
VS-P-3B	WR-P-1C	WR-P-9A	MOV-RW-102-B2
VSE-4A	EE-E-1A	WR-P-9B	MOV-RW-102-C1
VSE-4B	EE-E-1B	MOV-RW-116A	MOV-RW-102-C2

Boron Injection

MOV-SI-867A
MOV-SI-867B
MOV-SI-867C
MOV-SI-867D

Instrumentation Utilized for Safe Shutdown

LT-FW-474	LT-FW-494	PT-MS-484	PT-RC-455
LT-FW-475	LT-FW-495	PT-MS-485	PT-RC-456
LT-FW-476	LT-FW-496	PT-MS-486	PT-RC-457
LT-FW-484	PT-MS-474	PT-MS-494	LT-RC-459
LT-FW-485	PT-MS-475	PT-MS-495	LT-RC-460
LT-FW-486	PT-MS-476	PT-MS-496	LT-RC-461

IE Distribution System

480 v Substation 1N	125 v DC SWBRD 1	MCC-E1
480 v Substation 1P	125 v DC SWBRD 2	MCC-E2
DG1	125 v DC SWBRD 3	MCC-E3
DG2	125 v DC SWBRD 4	MCC-E4
4 kV Bus 1AE	Vital Bus 1	MCC-E5
4 kV Bus 1DF	Vital Bus 2	MCC-E6
	Vital Bus 3	MCC-E7
	Vital Bus 4	MCC-E8
		MCC-E9

AUXILIARY FEEDWATER SYSTEM ANALYSIS

The Auxiliary Feedwater System is a system available for emergency shutdown of station. The auxiliary feedwater safety function, in the event of loss of offsite power, is to deliver water to the steam generators at a sufficient rate to initially remove both sensible and decay heat for hot shutdown and to later remove decay heat until the transfer to the Residual Heat Removal System (RHR) is accomplished. One auxiliary feedwater pump and the flow paths to two steam generators is required. The only devices which are considered active are the auxiliary feedwater pumps since the discharge valves are normally open and need not open to perform this safety function. The steam admission valves to the steam drive auxiliary feed pump are air operated and fail open to the safe shutdown position with the loss of offsite power. A summary of the fire protection analysis for the Auxiliary Feedwater System is presented in the attached table. The analysis demonstrates that a fire in fire area PT-1A could jeopardize this system's availability; however, a fire in and of itself would not result in the loss of station control.

AUXILIARY FEEDWATER SYSTEM

FUNCTION: Decay and Sensible Heat Removal

FUNCTIONAL DIVERSITY: 2 Motor, 1 Steam Driven Pump; Main Control Room/ Aux. Shutdown Panel; Normal Feedwater Assumed Not Available

KEY SYSTEM COMPONENTS: FW-P-3A, FW-P-3B, FW-P-3C, MOV-151A, MOV-151B, MOV-151C, MOV-151D, MOV-151E, MOV-151F

Critical Fire Area[1]	Failure Mode/ Degree	Manual Alternatives Available	Automatic Alternatives Available	Separation	Recommended Position
CR-1	Primary Control/2	Yes	Yes	N.A.F.	Use auxiliary shutdown panel
CR-4	Remote Control/2	Yes	Yes	N.A.F.	Manual control from switchgear room
CS-1	Primary Control/2	Yes	Yes	N.A.F.	Use auxiliary shutdown panel
PT-1A (735'-6")	Component Loss/1	No	No	<20'	Add detection & suppression system

NOTES:

[1]The redundant and diverse methods and automatic and manual alternatives for a safe shutdown may be jeopardized due to a fire in the listed fire area. See the text.

N.A.F. = Not a factor. The results of the analysis are independent of the existing seperation.

BORON INJECTION SYSTEM

The Boron Injection System flow path is required to provide the negative reactivity shutdown margin at cold shutdown. The flow path consists of two sets of parallel valves, with one valve in each set required to open in order to establish the flow path. The fire hazards analysis demonstrates that automatic control and manual control from the control room could be jeopardized by a fire in each of the following areas: CS-1, CV-1, and CV-2; however, at least one valve in each set of valves would be accessible, thus allowing local manual actuation of the flow path. Boron injection is not required until plant cooldown is initiated.

BORON INJECTION SYSTEM

FUNCTION: Negative Reactivity Control

FUNCTIONAL DIVERSITY: Parallel valves used to establish the flow path

KEY SYSTEM COMPONENTS: MOV-SI-867A
MOV-SI-867B
MOV-SI-867C
MOV-SI-867D

Critical Fire Area[1]	Failure Mode/ Degree	Manual Alternatives Available	Automatic Alternatives Available	Separation	Recommended Position
CS-1	Primary Control/2	Yes	No	N.A.F.	Manual valve operation
CV-1	Remote Control/2	Yes	No	N.A.F.	Manual valve operation
CV-2	Remote Control/2	Yes	No	N.A.F.	Manual valve operation

NOTES:

[1]The redundant and diverse methods and automatic and manual alternatives for a safe shutdown may be jeopardized due to a fire in the listed fire area. See the text.

N.A.F. = Not a factor. The results of the analysis are independent of the existing separation.

CHEMICAL AND VOLUME CONTROL SYSTEM

The safe shutdown function of the Chemical and Volume Control System is to provide a source of reactor coolant grade water which would be available for Reactor Coolant Inventory control. The system has three charging pumps, multiple system control features, two independent sources of water to draw on, the Refueling Water Storage Tank (RWST) and the Chemical and Volume Control Tank (CVCT) and two available flow paths which provide the diversity which ensures functional integrity of the system in the event of a fire.

The fire protection analysis demonstrates that the most severe consequence of a fire (in either PA-1G or PA-1H) would be the loss of automatic control and power to the motor operator valves on the charging pump suction lines. These valves control the flow from either the CVCT or the RWST, and are physically separated by a concrete floor. The MOV's to the CVCT could be operated manually, if the fire caused the MOV's to the RWST to fail closed. This provides a backup flow path to control the Reactor Coolant Inventory. A fire in any other fire area would pose less severe consequences. As indicated in the attached Table, manual operation of a valve or secondary control of the system would ensure the necessary functional integrity of the system.

CHEMICAL AND VOLUME CONTROL SYSTEM

FUNCTION: Reactor Coolant Volume Control

FUNCTIONAL DIVERSITY: Separate sources of supply; Redundant independent controls; Redundant pumps

KEY SYSTEM COMPONENTS: CH-P-1A, CH-P-1B, CH-P-1C, FCV-CH-122, MOV-CH-115B, MOV-CH-115D, MOV-CH-289, MOV-CH-310, MOV-SI-836, MOV-SI-869A

Critical Fire Area[1]	Failure Mode/ Degree	Manual Alternatives Available	Automatic Alternatives Available	Separation	Recommended Position
CR-4	Remote Control/2	Yes	Yes	N.A.F.	Primary Control available; manual control from switchgear room available
CS-1	Primary Control/2	Yes	Yes	N.A.F	Use aux. shutdown panel
CV-2	Remote Control/2	Yes	No	N.A.F.	Manual valve operation
PA-1E	Control Power/3	Yes	No	N.A.F	Manual valve operation
PA-1F	Control Power/3	Yes	No	N.A.F.	Manual valve operation
PA-1G	Control Power/3	Yes	No	<20'	Manual valve operation
PA-1H	Component loss (valves)/1	Yes	No	<20'	Normal makeup water source available, manual valve operation

NOTES:

[1]The redundant and diverse methods and automatic and manual alternatives for a safe shutdown may be jeopardized due to a fire in the listed fire area. See the text.

N.A.F. = Not a Factor. The results of the analysis are independent of the existing separation.

COMPONENT COOLING WATER

The Component Cooling Water System (CCR) safe shutdown function is to provide cooling to the Residual Heat Removal (RHR) heat exchanger. To accomplish this the only active components needed to operate are one of the three CCR pumps and a flow path to one of the RHR heat exchangers. For a flow path to be available, two Motor Operated Valves (MOV) in one of two flow paths must operate. Each valve is equipped with a manual operator to allow for manual operation. Sufficient time is available for operator action since the reactor can be stabilized at the hot shutdown condition for an extended period of time prior to the switchover to RHR for the final cooldown. The nonnuclear safety portion of the CCR is automatically isolated by loss of offsite power.

The analysis demonstrates that the cables and components for the CCR could be impacted by a loss of the RA-1F fire area.

COMPONENT COOLING SYSTEM

FUNCTION: Decay Heat Removal, Secondary Side

FUNCTIONAL DIVERSITY: Three Component Cooling Water Pumps, Redundant Control Points

KEY SYSTEM COMPONENTS: CC-P-1A MOV-CC-112A2
CC-P-1B MOV-CC-112B2
CC-P-1C MOV-CC-112A3
MOV-CC-112B3

Critical Fire Area[1]	Failure Mode/ Degree	Manual Alternatives Available	Automatic Alternatives Available	Separation	Recommended Position
CR-4	Remote Control/2	Yes	Yes	N.A.F.	Control available from main control room
CS-1	Primary Control/2	Yes	Yes	N.A.F.	Control available from auxiliary shutdown panel; open valves manually
CV-2	Remote Control/2	Yes	No	N.A.F.	Control available from auxiliary shutdown panel; open valves manually
PA-1F	Component Loss/1	No	No	<20'	Installation of an automatic detection & suppression system

NOTES:

[1]The redundant and diverse methods and automatic and manual alternatives for a safe shutdown may be jeopardized due to a fire in the listed fire area. See the text.

N.A.F. = Not a factor. The results of the analysis are independent of the existing separation.

DIESEL GENERATOR FUEL OIL SYSTEM

The Diesel Generator Fuel Oil System consists of two independent subsystems. Each subsystem consists of a main fuel oil storage tank, two parallel fuel oil transfer pumps and a fuel oil day tank, with a 2 1/2 hr supply of fuel oil. The fire hazards analysis demonstrates that a fire in CS-1 or CV-3 could jeopardize remote control of the fuel oil transfer pumps, however, each pump is equipped with local control which ensures system availability in the event of a fire.

DIESEL GENERATOR FUEL OIL SYSTEM

FUNCTION: Fuel Oil for the Emergency Diesel Generators

FUNCTIONAL DIVERSITY: Main Fuel Oil Storage Tank Standby Fuel Oil Day Tank Redundant Fuel Oil Transfer Pumps with Local Control for each Day Tank

KEY SYSTEM COMPONENTS: EE-P-1A
EE-P-1B
EE-P-1C
EE-P-1D

Critical Fire Area[1]	Failure Mode/ Degree	Manual Alternatives Available	Automatic Alternatives Available	Separation	Recommended Alternatives
CS-1	Primary Control/2	Yes	No	N.A.F.	Local Operation
CV-3	Primary Control/2	Yes	No	N.A.F.	Local Operation

NOTES:

[1] The redundant and diverse methods and automatic and manual altervatives for a safe shutdown may be jeopardized due to a fire in the listed fire area. See the text.

N.A.F. = N.t a factor. The results of the analysis are independent of the existing separation.

IE ELECTRICAL DISTRIBUTION SYSTEM

This analysis demonstrates that the complete loss of fire areas CR-1, CR-3, CR-4, CS-1, CV-2, CV-3 or ES-2 could prevent the IE electrical distribution system from automatically performing its safe shutdown function.

When faults in the DC control cables are the potential cause of failure, manual operator action can be use to turn off control power to the breaker (which clears the fault) and then manually close the breaker thus restoring the safe shutdown function of the breaker. Faults in the power cable to the 4 kV and 480 busses cannot be cleared as quickly. Clearing of these faults would require rerouting of the cables.

In no case is the DC control power to both busses lost due to a fire in one fire area.

All 4 kV breakers required for safe shutdown can be operated locally and all breakers controlling safe shutdown pumps can be operated from the auxiliary shutdown panel as well as the control room.

Complete loss of CR-1 could cause loss of control cabling to both redundant 4 kV busses. Power cables are still available and can be energized by manual operation at the switchgear or operation of the auxiliary shutdown panel.

Complete loss of CR-3 could cause loss of power and control cables to orange 4 kV Bus 1AE and loss of control to purple 4 kV Bus 1DF. Fire detection and manual suppression is provided.

Complete loss of CR-4 could cause loss of power to both redundant 4 kV busses as well as associated control cables. Power cables for both redundant busses are run in conduit. The space occupied between redundant power cables is limited to conduit. Fire detection is presently installed and manual suppression is provided.

Complete loss of CS-1 could cause loss of control power to both redundant busses as well as power and control to MCC-E3, E4, E5 and E6. Combustible material is limited to fire retardant cable. Automatic fire detection and suppression is installed. Since the power cables to the 4 kV busses are not routed through CS-1 then manual operation of D/G supply breakers can be accomplished.

A complete loss of CV-2 could cause a loss of power to redundant MCC-E3 and E4. Both cables are in separate conduits and the space between the cables consist exclusively of conduits. Other combustibles is limited to fire retardant cables. Fire detection and suppression is presently installed.

A complete loss of CV-3 could cause a loss of power and control to both redundant 4 kV busses. Combustibles in this area are fire retardant cables only. Fire detection and suppression is proposed for this area.

A complete loss of ES-2 could cause a loss of power and control to the purple 4 kV bus and loss of the sequences for the redundant orange 4 kV bus. Manual sequencing of the orange bus can be accomplished from the auxiliary shutdown panel or locally. Combustibles in this area ES-2 is limited to fire retardant cables.

IE ELECTRICAL DISTRIBUTION SYSTEM

FUNCTION: Provides power to safe shutdown components

FUNCTIONAL DIVERSITY: Separate sources, battery backed vital hoses

KEY SYSTEM COMPONENTS:					
	480 V Substation 1N	125 V DC SW BRD No. 1	Vital Bus No. 1	MCC-E1-MCCE5	MCC-E9
	480 V Substation 1P	125 V DC SW BRD No. 2	Vital Bus No. 2	MCC-E2-MCCE6	MCC-E10
	DG 1	125 V DC SW BRD No. 3	Vital Bus No. 3	MCC-E3-MCCE7	
	DG 2	125 V DC SW BRD No. 4	Vital Bus No. 4	MCC-E4-MCCE8	
	4 KV Bus 1AE				
	4 KV Bus 1DF				

Critical Fire Area[1]	Failure Mode/ Degree	Manual Alternatives Available	Automatic Alternatives Available	Separation	Recommended Position
CR-1	Remote Control/2	No	No	<20'	Existing detection & suppression adequate
CR-3	Power & Control Loss/3	No	No	<20'	Existing detection & suppression adequate
CR-4	Power & Control Loss/3	No	No	<20'	Existing detection & suppression adequate
CS-1	Power & Control Loss/3	No	No	<20'	Add fire detection and suppression
CV-2	Power & Control Loss/3	Yes	No	N.A.F.	Existing detection and suppression adequate
CV-3	Power & Control Loss/3	No	No	<20'	Add fire detection and suppression
ES-2	Control Loss/2	Yes	No	<20'	Manually sequence loads

NOTES:

[1]The redundant and diverse methods and automatic and manual alternatives for a safe shtudown may be jeopardized due to a fire in the listed fire area. See the text.

N.A.F. = Not a factor. The results of the analysis are independent of the existing separation.

HEATING VENTILATION AND AIR CONDITIONING SYSTEMS

The Heating Ventilation and Air Conditioning Systems are auxiliary support systems. The loss of one of these systems does not directly jeopardize the safe shutdown capability of the station. The analysis evaluated the vunerability of the control room HVAC system, the diesel generator ventilation system and the emergency switchgear ventilation system to a fire. The results of that analysis are presented in the following tables.

A fire in fire area CR-2 could render the control room HVAC equipment inoperable because the equipment is subject to a common failure. However, failure of the system does not result in a reduction in the integrity of the station's safety systems. As defined in operating license technical specifications, control room habitability is demonstrated by verifying that the control room air temperature is less than 113°F. If, as a result of a fire and coincident loss of offsite power, the control room temperature could not be maintained below the existing limit, the plant would be shut down. The analysis also demonstrates that a fire in any other fire area would have a less severe impact on the control room HVAC.

Components of the Diesel Generator Supply and Exhaust Air System and the Emergency Switchgear and Battery Room Ventilation subsystems are not subject to a common failure. The control cables for the subsystems are subject to a common failure as indicated in the summary tables. However, these failures would not result in a reduction in the integrity of the stations safety systems.

The safe shutdown function of the intake structure ventilation system is to provide area cooling to each intake structure which contains a river water pump. One fan is provided for each intake structure VS-F-57A in IS-1, VS-F-57B in IS-2 and VS-F-57C in IS-3 power to IS-1 and IS-2 is redundant to each other. The power source to the fan in IS-3 and WS-F-57C can be powered from either the motor control center in IS-1 or the motor control centers in IS-3. Independence between these redundant power sources is achieved through use of a transfer switch, which allows only one power source at a time, and can be connected to fan VS-F-57C. In any event, the alternate intake structure is available.

Complete loss of any one fire area will not result in loss of area cooling to all three intake structure fire areas and functional diversity is provided by the alternate intake structure.

DIESEL GENERATOR SUPPLY AND EXHAUST AIR SYSTEM

FUNCTION: Auxiliary Support System, Diesel Generator Room Ventilation

FUNCTIONAL DIVERSITY: Separate Supply and Exhaust Fans

KEY SYSTEM COMPONENTS: VS-F-22A VS-D-2A VS-D-22-1A
VS-F-22B VS-D-2B VS-D-22-1B
VS-D-2C
VS-D-2D

Critical Fire Area	Failure Mode/ Degree	Manual Alternatives Available	Automatic Alternatives Available	Separation	Recommended Position
CR-4	Remote Contol/2	Yes	Yes	N.A.F.	Primary control maintained
CS-1	Primary Control/2	Yes	Yes	N.A.F.	Aux. shutdown panel
CV-3	Control Power/3	Yes	No	N.A.F.	Manually open system dampers

NOTES:

*The redundant and diverse methods and automatic and manual alternatives for a safe shutdown may be jeopardized due to a fire in the listed fire area. See the text.

N.A.F. = Not a factor. The results of the analysis are independent of the existing separation.

EMERGENCY SWITCHGEAR AND BATTERY ROOM VENTILATION

FUNCTION: Auxiliary Support System, Switchgear Room Ventilation

FUNCTIONAL DIVERSITY: Redundant supply and exhaust fans

KEY SYSTEM COMPONENTS: VS-F-16A VS-F-55B VS-D-55A
VS-F-16B VS-D-16A VS-D-55B
VS-F-55A VS-D-16B

Critical Fire Area[1]	Failure Mode/ Degree	Manual Alternatives Available	Automatic Alternatives Available	Separation	Recommended Position
CS-1	Primary Control/2	Yes	No	N.A.F.	Manually open system dampers

NOTES:

[1] The redundant and diverse methods and automatic and manual alternatives for a safe shutdown may be jeopardized due to a fire in the listed fire area. See the text

N.A.F. = Not a factor. The results of the analysis are independent of the existing separation

HEATING, VENTILATING, AND AIR CONDITIONING SYSTEM

FUNCTION: Auxiliary Support System, Control Room and Process Instrument Room Ventilation

FUNCTIONAL DIVERSITY: Individual Room Isolation, Alternate Control Room Ventilation Flow Path

KEY SYSTEM COMPONENTS: VS-F40A, VS-F40B, VS-AC-1A, VS-AC-1B, VS-D-40-1A, VS-D-40-1B, VS-D-40-1C, VS-D-40-1D

Critical Fire Area[1]	Failure Mode/ Degree	Manual Alternatives Available	Automatic Alternatives Available	Separation	Recommended Position
CR-2	Component Loss/1	No	No	< 20'	Adequate fire detection/suppression existing
CR-4	Remote Control/2	Yes	Yes	N.A.F.	Primary control maintained
CS-1	Primary Control/2	Yes	No	N.A.F.	Add fire detection/suppression
PA-1H	Remote Control/2	Yes	Yes	N.A.F.	Remote control maintained

NOTES:

[1]The redundant and diverse methods a nd automatic and manual alternatives for a safe shutdown may be jeopardized due to a fire in the listed area. See text.

N.A.F. = Not a factor. The results of the analysis are independent of the existing separation.

RESIDUAL HEAT REMOVAL SYSTEM ANALYSIS

The RHR safe shutdown function is to remove both decay heat and sensible heat in order to achieve and maintain cold shutdown. Flow from one of two pumps is required and a flow path to one of two heat exchangers is required. The active devices used to accomplish the safety function are: the RHR pumps, both the suction valves from the reactor coolant system, and the return valves to the reactor coolant system. Since the reactor coolant system can be brought to and maintained in an equilibrium state, i.e., hot shutdown, loss of this system as a result of fire can be tolerated until repairs and/or manual operator actions are taken prior to the continuation of the cooldown process.

RESIDUAL HEAT REMOVAL SYSTEM

FUNCTION: Remove decay heat from hot to cold shutdown

FUNCTIONAL DIVERSITY: Maintain hot shutdown until RHR is functional

KEY SYSTEM COMPONENTS: RH-P-1A, RH-P-1B, FCV-RH-605, MOV-RH-700, MOV-RH-701, MOV-RH-720A, MOV-RH-720B, MOV-RH-783

Critical Fire Area[1]	Failure Mode/ Degree	Manual Alternatives Available	Automatic Alternatives Available	Separation	Recommended Position
CR-4	Remote Control/2	Yes	Yes	N.A.F.	Manual control from switchgear room
CS-1	Primary Control/2	Yes	Yes	N.A.F.	Use auxiliary shutdown panel
RC-1	Component Loss/1	No	No	<20'	Add detection & suppression system

NOTES:

[1]The redundant and diverse methods and automatic and manual alternatives for a safe shutdown may be jeopardized due to a fire in the listed fire area. See the text.

N.A.F. = Not a factor. The results of the analysis are independent of the existing separation.

RIVER WATER SYSTEM

The safe shutdown function of the river water system is to provide cooling water to the diesel generator coolers, the charging pump coolers, the component cooling water system (for cold shutdown) and the control room HVAC system. The active components used for this are the river water pumps, the auxiliary river water pumps and discharge valve, and the diesel generator cooler and component cooling water inlet valves. The cooling functions can be accomplished with one of three river water pumps or one of two auxiliary river water pumps and a flow path to the heat exchangers (one of two pump discharge valves, and one of four diesel generator cooler inlets).

The fire hazards analysis demonstrates that the most severe consequences of the fire could be a loss of one of two system control stations. The analysis indicates that loss of both of the control stations is not possible.

RIVER WATER SYSTEM

FUNCTION:	Auxiliary heat disapation	FUNCTIONAL DIVERSITY:	Alternate intake structure - 2 pumps main intake structure multiple control stations - 3 pumps

KEY SYSTEM COMPONENTS:

WR-P-1A	WR-P-9A	MOV-RW-102A1	MOV-RW-102C2
WR-P-1B	WR-P-9B	MOV-RW-102B2	MOV-RW-102C1
WR-P-1C	MOV-RW-102A2	MOV-RW-102B1	MOV-RW-116A
	MOV-RW-113B	MOV-RW-113A	MOV-RW-116B
	MOV-RW-113C	MOV-RW-113D	

Critical Fire Area	Failure Mode/ Degree[1]	Manual Alternatives Available	Automatic Alternatives Available	Separation	Recommended Alternative
CR-4	Remote Control/2	Yes	Yes	N.A.F.	Primary Control Available
CS-1	Primary Control/2	Yes	Yes	N.A.F.	Use Aux. shutdown panel

NOTES:

[1] The redundant and diverse methods and automatic and manual alternatives for a safe shutdown may be jeopardized due to a fire in the listed fire area. See the text.

N.A.F. = Not a factor. The results of the analysis are independent of the existing separation.

SAFE SHUTDOWN INSTRUMENTATION

The Safe Shutdown Instrumentation monitors reactor coolant pressure, pressurizes level and steam generator pressure and steam generator level so that hot shutdown can be maintained and cooldown to the RHR mode can be achieved.

There are three monitors for each function, each powered by a redundant vital bus. Minimum instrumentation for safe shutdown consists of one of three of each type of monitor.

The analysis demonstrates that the steam generator pressure monitors and the pressurizer level and pressure monitors could be lost as a result of a fire in fire area RC-1. The steam generator pressure monitors are not needed for the hot shutdown mode.

SAFE SHUTDOWN INSTRUMENTATION

FUNCTION: Provide necessary information for safe shutdown

FUNCTIONAL DIVERSITY:

KEY SYSTEM COMPONENTS:

LT-FW-474	LT-FW-494	PT-MS-484	LT-RC-459
LT-FW-475	LT-FW-495	PT-MS-485	LT-RC-460
LT-FW-476	LT-FW-496	PT-MS-486	LT-RC-461
LT-FW-484	PT-MS-474	PT-MS-494	PT-RC-455
LT-FW-485	PT-MS-475	PT-MS-495	PT-RC-456
LT-FW-486	PT-MS-476	PT-MS-496	PT-RC-457

Critical Fire Area[1]	Failure Mode/ Degree	Manual Alternatives Available	Automatic Alternatives Available	Separation	Recommended Position
CR-4	Loss of Component/1	No	No	< 20'	Existing detection and suppression adequate
PT-1	Loss of Component/1	Yes	No	N.A.F.	Use reactor coolant loop instrumentation
RC-1	Loss of Component/1	No	No	< 20'	Use reactor coolant loop instrumentation
CR-1	Loss of Instrument Cable/2	Yes	No	N.A.F.	Use reactor coolant loop instrumentation
CS-1	Loss of Instrument Cable/2	Yes	No	N.A.F.	Use reactor coolant loop instrumentation

NOTES:

[1] The redundant and diverse methods and automatic and manual alternatives for a safe shutdown may be jeopardized due to a fire in the listed fire area. See the text.

N.A. F = Not a factor. The results of the analyses are independent of the existing separation.

APPENDIX A, SPECIAL MODELING TECHNIQUES

The analysis assumes that if a cable is associated with a safe shutdown component and passes through or is located in a given fire area the component is declared failed.

There are certain systems or components for which this model is too conservative. One such case exists for a component which can be operated from either electrical bus. The high head safety injections pump SI-P-1C, the component cooling water pump CC-P-1C, and the river water pump RW-P-1C are all examples of this type. Both electrical sources or the pump motor and power cables must be failed before the function is lost. This analysis initially assumes that cable failures are correlated to component failure by a logical OR function. In order to implement a logical AND function, the swing bus component is assigned a fiticious designation. When the pump is fed from the bus 1AE, the letter A follows the designation for the pump. When it is operated from the redundant bus 1DF the pump receives the letter B. Examples are CC-P-3CA and CC-P-3CB. Both of these circuits P-3CA and P-3CB must be declared fail for the actual pump P-3C to be declared failed.

A similar case exists for the 120 v a-c vital bus. This bus can be fed through an invertor from the d-c bus or from the 480 volt MCC through a step-down transformer or through an additional battery charger/inverter. All of these buses must fail for the vital bus to fail. Vital buses 3, 31, and 32 must fail for vital bus 3 to be declared failed.

QUESTION A.2-2

Fire Induced Spurious Equipment Operation

Identify any equipment required for safe shutdown (see item 2 above) that is subject to spurious operation as a result of a fire. Particular attention is directed to valves and valve position indicators. Discuss the effects on safe shutdown of such spurious operation.

RESPONSE

The answer to this question is dependent on the analysis of the problem defined in item 2 (i.e., valves and position operator wiring within the influence of a single postulated fire).

The only river water valves which influence safe shutdown are MOV-RW103A, RW103B, RW103C, and RW103D. Spurious opening of one of these valves will divert river water from the safe shutdown heat loads. This situation can be readily detected and corrected. Flow Indicator FI-RW103 and the position indicating lights are located in the control room. Flow to the Recirculation Spray Heat Exchanger can be terminated by closing MOV-103 or by closing at least one valve (inlet or outlet) in the heat exchanger line.

Spurious operation (closure) of MOV-RH700 or MOV-RH701 will cause loss of RHR. Position indicating lights are located in the control room for all of the above valves. In all cases, the valve may be manually repositioned by disengaging the motor drive and operating the hand wheel.

Spurious operation of valves in other systems was implicitly included in the fire hazards analysis since each valve that was essential to a safe shutdown function and the related cables which could cause operation were included in the area-by-area study. As explained in the system-by-system analysis, where it was found that such cables to redundant functional components could be affected by a single fire, appropriate consideration was given to automatic and manual alternatives for valve operation, and to alternate methods of performing safe shutdown functions.

QUESTION A.2-3

Instrument and Station Air System

Describe the function of the instrument and station air system in achieving and maintaining both hot shutdown and cold shutdown conditions. Identify any fire areas which contain components or piping of the air system and air operated valves whose position must change for shutdown. Verify that the loss of the air system will not prevent shutdown operations.

RESPONSE

The atmospheric dump valves located in PT-1 (valve house) are modulated by the station air system during hot shutdown. In the event of instrument air and/or instrument air failure, valves fail in the position required for hot shutdown. Although the atmospheric dump valves fail closed, they can be operated manually. The same function is provided by the self-actuated steam generator relief valves. Air-operated valves in the makeup path of the CVCS fail to the open position. Air-operated valves in the letdown path fail to the closed position. However, these valves can be operated manually. They are located in the valve penetration area in PT-1 or in PA-1. Since cold shutdown valve operations are not immediately needed, a temporary or permanent loss of air supply will not prevent shutdown operations.

QUESTION A.2-4

Safe Shutdown Systems - Valves

a. Provide a list of remotely-operated valves, with their fail positions, in safe shutdown systems identified in item 2 above.

b. Describe the provision and accessibility to manually operate these valves, if necessary, during the shutdown operations following fires which prevent remote operation of the valves.

RESPONSE

A list of valves is provided in the fire hazards analysis. All moto-operated valves fail "as is", and are equipped with hand operators for manual operation. Air-operated valves fail either open or closed, and can be manually operated. As stated in the response to Question A.2-3, all air-operated valves fail open in the CVCS makeup paths, and fail closed in the CVCS letdown paths. These letdown valves can be manually operated. Air-operated valves used for containment isolation fail closed on loss of air. Each valve has position indicators at its control stations. Accessibility of components has been discussed in the Fire Protection Review. In addition the capability of automatic and manual operation has been discussed in a system-by-system basis in the fire hazards analysis.

QUESTION A.4-1

Failure Analysis

The BVPS response addresses only examples given in staff position A.4 and does not provide an analysis of the depth and scope requested by the position. Provide a failure analysis which verifies that a single failure does not impair the primary and backup fire suppression capabilities. The analysis should include consideration of failures in the suppression system, the fire detection system, or the power sources for such systems.

RESPONSE

Attached Table A.4-1 identifies the probable failures in the fire suppression and detection systems. The primary or secondary fire suppression system is operable with a single failure. The sprinkler, deluge, and CO_2 systems are backed up by the hand hose stations that are supplied by motor- and diesel-driven water pumps. The fire detection system is supplied by two independent power supplies. The failure of the line voltage regulator feeding the fire detection panels will hamper their ability to determine the exact location of the fire. However, their alarm function is supplied by both normal and emergency lighting panels, and a general fire alarm will sound throughout the station.

TABLE A.4-1

FIRE DETECTION AND SUPPRESSION FAILURE ANALYSIS

Component Failure	Effect on System	Compensating Features
FIRE DETECTION SYSTEM		
Fire detection device	None	More than one detector is located in each safety-related fire area
Loss of normal ac power	None	Auto transfer switch to emergency power
Loss of voltage regulator	Loss of alarm in the control room	
SPRINKLERS-DELUGE		
Fusible link (wet pipe system)	Water sprayed onto equipment	Alarm sounded via water flow alarm check valve
Solenoid valve	Failure to automatically supply water	Valve position, indication manual override, hand hose & alarm in control room
125 V dc	Failure of deluge valve to open	Trouble alarm annunciator in control room, manual override, and hand hose
CO_2 SYSTEM		
Master solenoid valve	Failure to automatically supply CO_2	Manual override, and hand hose
Area solenoid valve	Failure to automatically supply CO_2	Manual override, and hand hose

TABLE A.4-1 (Cont)

Component Failure	Effect on System	Compensating Features
FP-C-2 Refrigeration compressor	Failure to maintain system pressure within limits	Alarm high or low pressure
PUMPING EQUIPMENT		
FP-P-1 Motor driven fire pump	Loss of one pump	System operable by diesel engine-driven fire pump
FP-P-2 Engine-driven fire pump	Loss of one pump	System operable by electric motor-driven fire pump
FP-P-3 Pressure maintenance pump	Loss of system pressure causing fire pumps to start and restore pressure	Pressure decreases until fire pump starts to restore pressure
FP-C-1 Air compressor	Loss of system pressure causing fire pumps to start and restore pressure	Pressure decreases until fire pump starts to restore pressure
PS-FP-101A Autostart pressure switch	Motor-driven pump will not start automatically	Engine-driven pump automatically starts, may be manually started from the control room
PS-FP-101B Autostart pressure switch	Engine-driven pump will not start automatically	Motor-driven pump automatically starts
Normal ac or dc power	Loss of one pump (motor-driven)	Diesel pump available

QUESTION A.5-1

Effects of Extinguishing Agents

Provide the results of an analysis which shows that rupture or inadvertent operation of a fire fighting system will not subsequently cause damage or failure of safety-related equipment required for safe shutdown.

RESPONSE

The information requested has been provided in the Fire Protection Program Review, page 4, Position A.5.

QUESTION A.5-2

Safety-related Systems Interlocked with Fire Fighting Systems

Identify any safety-related systems or their auxiliaries which are interlocked to and could be disabled by operation of a fire fighting system.

RESPONSE

There are no electrical interlocks that could defeat a safety function as a result of a fire. Certain dampers close upon CO_2 actuation in order to extinguish a fire. The activation of CO_2 suppression systems in either of the diesel generator rooms or water deluge systems in the charcoal filter banks will cause the loss of service of that particular component. However, there is no effect on plant safety due to availability of redundant equipment.

QUESTION A.5-3

Fire Suppression Systems

Provide an analysis which shows that the fire suppression system meets the guidelines contained in APCSB Branch Technical Position 3-1.

RESPONSE

The information requested has been provided in the Fire Protection Program Review, page 4, Position A.5.

QUESTION B.3-1

Fire Brigade Equipment

Describe the equipment provided for the fire brigade. Describe means that will be used to either override door locking mechanisms or breach a barrier to provide fire brigade access and personnel egress in the event of a locking mechanism failure. Describe the training and tools provided for this purpose.

RESPONSE

The equipment provided the fire brigade consists of the following:

- Strategically located portable fire extinguishers throughout the plant
- Fire hose and cart house hose stations
- Portable lighting equipment
- Forcible entry tools (axes and pry bars)
- First aid equipment
- Spare auto sprinkler heads
- Personnel protective equipment (hard hats, rubber boots, fire suits and gloves)
- Respiratory protection equipment
- Transportation facilities onsite

In the event of a locking mechanism failure, manual key overrides are installed on the doors. The keys are stored on a key ring in the control room, easily accessible to the fire brigade, and are taken along on each emergency by the Emergency Squad.

QUESTION B.3-2

Shared Emergency Equipment

List the emergency equipment that is shared or proposed to be used by both the fire brigade and the security team.

RESPONSE

Presently, no emergency equipment is shared, or proposed to be shared, by the fire brigade and the security team.

QUESTION B.4-1

Supplemental Fire Department

Describe the procedures and required authorization for entry, command and supervision of offsite fire department.

RESPONSE

In the event that offsite fire fighting assistance is necessary, procedures are outlined in the Station's Operating Manual. The procedures are described below:

a. The Emergency Squad shall execute fire fighting procedures as directed by the Squad Chief until such time as the fire is extinguished or outside assistance is obtained.

b. Upon notification of a call for outside fire assistance, the main gate is notified by a Shift Supervisor that a fire truck(s) is coming onsite and is authorized for entry. The guard is informed of the location of the fire in order to control access (providing TLD badges), and to escort the truck to the scene of the fire.

c. The Station Emergency Squad is primarily responsible for fire fighting and the Emergency Squad Chief shall direct and coordinate all fire fighting activities of the Squad and any outside assistance groups.

QUESTION B.5-1

Fire Brigade Organizational Chart

Provide an organizational chart of the fire brigade of each shift which shows the brigade size, composition and chain of command and which designates the normal duty position of the brigade leader; i.e., operator, electrician, maintenance man, etc.

RESPONSE

The following is extracted from Chapter 56 Section 4, Procedure I and lists the Emergency Squad Organization (Fire Brigade Organizational Chart).

Emergency Squad Organization

The function of the Emergency Squad is to execute the necessary action during an emergency. Members of the squad are assigned as follows:

1. Squad Chief - Shift Supervisor or, in his absence, the Station Operating Foreman.

    a. Coordinate the execution of emergency procedures for personnel injury and fire and ensure that the squad has the proper equipment.

    b. Safeguard the squad and all station personnel.

    c. Augment the squad with any available personnel if the fire or first aid needs are such that the basic squad cannot adequately control the incident.

2. Squad Captain - Plant Operator.

    a. Direct the operation of the squad.

    b. Clear all energized equipment which may endanger safe execution of the plan.

    c. Assure availability of necessary emergency equipment.

3. Additional Squad Members, a minimum of three of the following: Nuclear Operator, Start-up Operator, Shift Chemist, Radiation Control Technician.

    Carry out the orders of the squad captain in extinguishing the fire or caring for the injured.

QUESTION B.5-2

Fire Brigade Physical Examination

Confirm that all fire members are provided with a periodic physical examination to screen out personnel with heart or respiratory disorders, or provide justification for any exceptions.

RESPONSE

Periodic physical examinations and reviews are conducted by the DLC Medical Department which meets Regulatory Guide 8.15.

QUESTION B.5-3

Fire Protection Organization

Identify the contractor or onsite management position responsible for implementing the personnel indoctrination program discussed in subsection 1.0d(5) of Attachment No. 1 to Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance.

RESPONSE

The onsite management position responsible for implementing the personnel indoctrination program is the Station Superintendent, via the approved and presently implemented Station Indoctrination Training Program.

QUESTION B.5-4

Control of Ignition Sources

Confirm your commitment that your procedure for the control of ignition sources complies with Section 2.0 of Attachment No. 4 to Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance.

RESPONSE

Station approved procedures are established to cover the requirements for control of welding, cutting, grinding, and open flame work. The program does not utilize a specific permit for the work.

QUESTION B.5-5

Fire Fighting Procedures

Confirm your commitment that your fire fighting procedures comply with subsections 1d and 1g of Attachment No. 5 to Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance.

RESPONSE

An in-depth analysis and review is presently being conducted and procedures are being developed to establish strategies for specific safety-related, potentially hazardous areas.

Present fire fighting procedures are in compliance with section 1g of Attachment No. 5 on coordination of fire fighting activities with offsite fire departments in the event they are needed.

Question C-1: <u>Quality Assurance (C)</u>

1. Confirm that the QA program is under the manage control of the QA organization.

2. Confirm your commitment that the stations QA program under 10 CFR Part 50, Appendix will be implemented to comply with the requirements of Appendix A to BIP 9.5-1 or Regulatory Guide 1.120.

Response C-1: The Beaver Valley Power Station Unit No. 1 Fire Protection Quality Assurance Program is presently under development. This program will incorporate requirements 1.0 to 10.0 in Attachment No. 6 of your February 3, 1978 letter which provided the guidelines for Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls, and Quality Assurance.

This program will be managed by the Station Senior Engineer responsible for Fire Protection, Emergency Preparedness Planning, and Industrial Safety. When necessary, he will be assisted by the Power Stations Department Safety Engineer who is an active member of the Society of Fire Protection Engineers.

Question C.10-1: Confirm that an in-house audit plan will be implemented which does not rely in total ou inspections and audits by insurance underwriters.

Response C.10-1: An in-house audit plan presently exists that does not rely in total on inspections and audits by insurance underwriters. The annual audit of the Fire Protection Program required by BVPS Unit 1 - Technical Specification 6.5.2.8.i will be performed under the sponsorship of the Off-Site Review Committee utilizing DLC personnel or qualified consultants. In addition, the DLC - QA Department will perform an annual audit of the Fire Protection Program.

QUESTION D.1-1

Fire Barrier

Identify the fire barriers, enclosing separate fire areas, that do not have a minimum fire rating of three hours. For those barriers, describe the fire rating of the associated doors, ventilation dampers and seals for cable, pipe and ventilation duct penetrations.

RESPONSE

Three-hour-rated fire barriers are provided between fire areas as described in the Fire Protection Program Review, pages 23-24, except as noted in Section F of the report and as summarized below:

Fire Barrier	Fire Rating
Control room doors to computer room	<3 hr
Cable spreading room floor slab	>1 1/2 hr
Cable spreading room door to SE stairwell	1 1/2 hr
Computer room 8 in concrete block wall	<3 hr
Normal switchgear area doors (to be replaced)	<3 hr
Radwaste building ventilation duct penetrations	1 1/2 hr
Radwaste building interior doors to stair towers (one perimeter door to be replaced)	1 1/2 hr
Charging pump cubicle exhaust damper (to be replaced)	1 1/2 hr

Except where the above barrier components are to be replaced, the barriers are considered adequate as they are more than that required by the fire loading analysis. Also see Question D.1-4.

QUESTION D.1-2

Steel Structures

Describe the type of fire protection, if any, applied to steel structures. Evaluate the possibility of fire damage to protected and unprotected steel structures and the effect of such damage on the safe plant shutdown capability.

RESPONSE

In general, structural steel is not fireproofed (protected) unless it is part of a fire barrier or part of a designated fire area. This is described in detail in report BVPS-1, Fire Protection Program Review APCSB9.5-1 Appendix A, which contains detailed fire hazard analysis and a description of barriers surrounding the fire areas (Ref. D1.d, page 18).

The ceilings of areas ES-1, ES-2, MG-1, CR-2, CR-3, and CR-4 do have exposed structural steel supporting the floor of the cable mezzanine. This has not been committed to be fireproofed (protected) because of the results of the fire hazards analysis identified above.

QUESTION D.1-3

Drains

1. Provide the results of an analysis which shows that drains have sufficient capacity, and/or equipment pedestals have sufficient height to prevent standing water from sprinklers and fire hoses from damaging safety-related equipment or supporting systems necessary for safe shutdown of the plant. As an alternate, show that the standing water does not damage such equipment.

2. Identify the areas containing safe shutdown equipment that are not provided with floor drains. Describe the drainage path for those areas without drains.

3. Identify the areas containing combustible liquids that are not provided with floor drains. Describe the drainage path and provisions for containing or diverting the combustible liquid in those areas without drains. In those areas with drains, state the capacity and location of the drain reservoirs and describe the provisions to prevent the spread of flammable liquid fires via the drain system to areas which may jeopardize safety-related equipment.

RESPONSE

The information requested has been provided in the Fire Protection Program Review, pages 21-23, Position D.1.

QUESTION D.1-4

Pipe and Ventilation Duct Penetrations

Provide the results of an analysis which shows that the fire barrier penetration seals for pipe penetrations and ventilation ducts are adequate to prevent the spread of smoke and fire through the barrier considering the combustible loading and possible air pressure differential.

RESPONSE

The adequacy of fire barriers and pipe and ventilation duct penetrations has been previously evaluated. See the Fire Protection Program Review, pages 23 through 25, Position D.1.

Attached is a copy of fire test reports on testing done by the Portland Cement Association, as well as NELPIA's letter of generic approval for use of cellular concrete in penetration seals as performed at Beaver Valley-1.

In addition, a copy of BVTM-160, Leak Testing of Typical Penetration Flood Seals, is attached. See also the previous response to Questions PF-3 and D.3-2.

NUCLEAR ENERGY PROPERTY INSURANCE ASSOCIATION

85 Woodland Street

Hartford, Conn. 06102

F. J. GOODFELLOW
General Manager

January 16, 1974

Mr. W. A. Lotz, P. E.
Dabron Corporation
Room #107 - 1300 Wirt Road
Houston, Texas 77055

Dear Mr. Lotz:

CABLE PENETRATIONS - FIRE STOPS

Foamed-in place cellular concrete (portland cement and aggregates) for fire stops for cable pans and conduit for pass-through fire walls and floors has NEPIA's generic approval. Specific drawings and specifications should be submitted for review.

A copy of this letter should accompany any submittal to our Field Offices.

Sincerely,

J. J. Carney
Engineering Manager

JJC/sv

227 THORN AVENUE, BOX 32, ORCHARD PARK, NEW YORK 14127 PHONE 716-662-1005

September 8, 1976

Stone & Webster Engineering Corporation
Summer STreet
Boston, Massachusetts

Attention: Mr. Peter Talbot

Reference: Penetration Seals at Beaver Valley

Dear Mr. Talbot:

Enclosed please find copies of fire test reports published by the Portland Cement Association on our high and low density cellular concrete.

If we can be of any further assistance, please do not hesitate to contact us.

Very truly yours,

Timothy H. Poplawski

Timothy H. Poplawski

THP/jp

Enclosure

227 THORN AVENUE, BOX 32, ORCHARD PARK, NEW YORK 14127 PHONE 716-662-1005

FIRE TESTS OF 3x3-FT. SPECIMENS MADE WITH STANDARD HIGH-DENSITY CELLULAR CONCRETE-PHASE I

BY: Melvin S. Abrams

DATE: January 1976

A Research Report
for
Darbron Corporation
Box 32
Orchard Park, New York 14127

Submitted by
PORTLAND CEMENT ASSOCIATION
RESEARCH AND DEVELOPMENT
CONSTRUCTION TECHNOLOGY LABORATORIES
Old Orchard Road
Skokie, Illinois 60076

FIRE TESTS OF 3x3-FT. SPECIMENS MADE WITH STANDARD HIGH-DENSITY CELLULAR CONCRETE-PHASE I

by

Melvin S. Abrams*

S Y N O P S I S

Fire tests were conducted on 3x3-ft. specimens 3-, 5-, and 7-in. thick to determine heat transmission characteristics of standard high-density cellular concrete. After force-drying in a kiln heated to between 170 and 180°F, specimens were tested in a horizontal position with the central 33x33-in. of the bottom surface exposed to fire. No load was applied. Temperatures within the concrete and of the unexposed surface (side away from the fire) were monitored. The fire endurance periods in all tests were determined by an average temperature rise of 250°F on the unexposed surface.

Fire endurance periods, corrected for moisture were: 1 hr. 48 min for 3-in.; 4 hr. 41 min. for 5-in., and 7 hr. 42 min. for 7-in. thick slabs.

DESCRIPTION OF SPECIMEN

Tests were conducted on 3-, 5-, and 7-in. thick 3x3 ft. slab specimens. These were fabricated at the sponsor's facility in Rainier, Oregon, on September 24, 1975. Mr. Charles Schmidt of the Portland Cement Association was present and assisted in the fabrication of the specimens.

Wood forms, butt-welded chromel-alumel thermocouples, and humidity wells were provided by the Portland Cement Association. Forms were assembled at the job site. The butt-welded

*Manager, Fire Research Section, Engineering Development Department, Portland Cement Association, Skokie, Illinois

thermocouples for measuring temperatures at various elevations in the concrete were positioned in the forms as described in PCA Research Bulletin 223(1)*. Thermocouple locations in each specimen are given in Table 1. A Monfore-type humidity well(2) was located in each slab so that the moisture condition of the concrete could be determined at mid-depth.

Information on proportions of the concrete mix was furnished by the sponsor. These data are given in Table 2. All components of the concrete were supplied on site by the sponsor. During casting of the specimens, 6-in. diameter by 12-in. high cylinders were made for strength determinations. Three cylinders each were made for Specimens 1 and 2. Two cylinders were made for Specimen 4.

Forms were stripped from the specimens after one day. The concrete was moist-cured under damp burlap for 7 days. Slab specimens and cylinders were then protected with foamed plastic material and carefully crated for shipment. On October 4, 1975, they were shipped to the Portland Cement Association. One cylinder each from Specimens 1 and 2 was supplied by the sponsor to Pittsburgh Testing Laboratory in Portland Oregon. These were used for an 8-day moist-cured compressive strength determination.

METHOD OF TEST

Specimens and cylinders were received at the PCA Fire Research Laboratory on October 16, 1975. After uncrating

*Superscript numbers in parentheses designate references on Page 7

one cylinder for each specimen was placed in a 100% relative humidity fog room to moist cure for 28 days. After this time, compressive strength was determined. The three slab specimens, along with companion cylinders were placed in a heated drying kiln maintained at 170 to 180°F and 0 to 25% relative humidity. These specimens were dried until the relative humidity at mid-depth of the concrete reached 75% or less.

When a specimen reached the proper moisture condition, it was removed from the kiln and cooled. Prior to test, the thickness of each specimen was determined using the equipment shown in Fig. 1. The method is described in Ref. 3. The specimen was then placed in a rigid restraining frame as shown in Fig. 2, grouted securely, and placed on the furnace in a horizontal position as shown in Fig. 3.

Specimens were tested without applied load. Test procedures are described in Ref. 1. Temperatures within the concrete were measured at the location shown in Fig. 4, and automatically recorded during the tests. Unexposed surface temperatures were measured using procedures described in ASTM E119[4]. Measurements were obtained at the four points shown in Fig. 4. At the time of test, the compressive strength of the kiln-dried companion cylinder was determined.

Furnace temperatures, as measured by two thermocouples located in the furnace 12-in. below the test slab, were monitored throughout the tests. The maximum variations for the

three tests from the Standard ASTM E119[4] time-temperature curve are shown in Fig. 5

ANALYSIS OF RESULTS

A summary of test data is given in Table 3.

Fire endurance periods were based on a 250°F rise of the average temperature of the unexposed surface. Results were adjusted to include the effects of elevated temperature forced drying on the moisture condition of the concrete. The corrections were made in accordance with the procedures described in ASTM Designation E119, Appendix A5- Method of Correcting Fire Endurance of Concrete Slabs Determined by Unexposed Temperature Rise for Non-Standard Moisture Content[4]. The procedure describes a method for adjusting the fire endurance of concrete slabs obtained when the moisture condition within the slab at time of test is different than that corresponding to a condition of 75% relative humidity at 73°F. It also takes into account drying conditions other than at temperatures of 70 to 80°F and 30 to 40% relative humidity. The procedure is based on work described in several publications[1,5,6].

Adjusted fire endurances were: 1 hr. 48 min. for the 3-in. slab, 4 hr. 41 min. for the 5-in. slab, and 7 hr. 42 min. for the 7-in. slab. Figures 6 and 7 show the average unexposed surface temperatures obtained during the tests.

The slab thickness-fire endurance relationship for the standard high-density cellular concrete tested is shown

in Fig. 8. Also shown is the relationship for a normal weight siliceous aggregate concrete with about the same density as the cellular concrete. For the same slab thickness, the fire endurance of the cellular concrete was considerably higher than that of the siliceous aggregate concrete. The higher fire endurance of the cellular concrete is attributed to a high volume of cement paste, a high air content, and the small size, approximately 1/8 in., of the ilmenite aggregate.

Figure 9 shows the average temperature within the cellular concrete at various distances from the heated surface. Similar information is plotted for the normal weight siliceous aggregate concrete. With the exception of the temperatures at 1/4 in. and 1/2 in. from the heated surface, the temperatures within the cellular concrete were lower than those of the normal weight siliceous aggregate concrete.

Some small flexure cracks were observed on the exposed and unexposed surfaces of the specimens during the tests. Shrinkage of the concrete during cooling caused more extensive cracking of Specimen 4. The condition of the surfaces of Specimen 1 shortly after test and of Specimens 2 and 4 about 16 hours after test are shown in Figs. 10, 11 and 12. Cracks were darkened with a felt-tip pen for the photographs.

Furnace atmosphere, unexposed surface, and internal concrete temperatures are included in an Appendix to this report.

SUMMARY

Three fire tests of standard high-density cellular concrete were carried out. These tests were conducted to determine the heat transmission characteristics of this type of concrete. Considerably higher fire endurance periods were obtained for the cellular concrete than for similar normal weight siliceous aggregate concrete specimens of about the same density. Generally, lower temperatures were obtained within the cellular concrete than in the siliceous aggregate concrete. Crack patterns observed during the tests of the cellular concrete were similar to those of other concretes of the same unit weight.

TABLE 3 - TEST DATA AND RESULTS

Specimen Thickness, in.	2.97	5.16	7.16
Date of Test	10/27/75	11/7/75	11/5/75
Relative Humidity at Test, Percent	40	31	70
Uncorrected Fire Endurance, Hr:Min[1]	1:09	3:20	6:46
Corrected Fire Endurance, Hr:Min[1]	1:48	4:41	7:42
Duration of Test, Hr:Min.	4:03	4:03	6:51
Compressive Strength at Test, psi	4000	3640	4350

[1]Based on rise of average unexposed surface temperature rise of 250°F

FIRE TEST OF A 3x3-FT. SPECIMEN MADE WITH STANDARD LOW-DENSITY CELLULAR CONCRETE-PHASE IV

By: Melvin S. Abrams

Date: February 1976

A Research Report

for

Darbron Corporation
Box 32
Orchard Park, New York 14127

Submitted by
PORTLAND CEMENT ASSOCIATION
RESEARCH AND DEVELOPMENT
CONSTRUCTION TECHNOLOGY LABORATORIES
Old Orchard Road
Skokie, Illinois 60076

FIRE TEST OF A 3x3-FT. SPECIMEN MADE WITH STANDARD LOW-DENSITY CELLULAR CONCRETE-PHASE IV

by

Melvin S. Abrams*

SYNOPSIS

A fire test was conducted on a 3x3-ft. specimen 3-1/2-in. thick to determine the heat transmission characteristics of standard low-density cellular concrete. After conditioning in a room maintained at 70 to 80F, and 30 to 40% relative humidity, the specimen was tested in a horizontal position with the central 33x33 in. of the bottom surface exposed to fire. No load was applied. Temperatures within the concrete and of the unexposed surface (side away from the fire) were monitored. The fire endurance period in the test was determined by an average temperature rise of 250F on the unexposed surface.

The fire endurance period, corrected for moisture was 4 hr. 48 min. for the 3-1/2-in. thick specimen.

DESCRIPTION OF SPECIMEN

A test was conducted on a 3-1/2-in. thick 3x3-ft. slab specimen fabricated at the sponsor's facility in Rainier, Oregon, on September 24, 1975. Mr. Charles Schmidt, of the Portland Cement Association, was present and assisted in the fabrication of the specimen.

Wood forms, butt-welded chromel-alumel thermocouples, and humidity wells were provided by the Portland Cement Association. The form was assembled at the job site. The butt-welded thermocouples for measuring temperatures at various elevations in the concrete were positioned in the forms as described in

*Manager, Fire Research Section, Portland Cement Association, Research and Development, Construction Technology Laboratories, Skokie, Illinois.

at mid-depth of the concrete specimen was less than 80%.

When the specimen reached the proper moisture condition, it was removed from the drying room. Prior to test, the thickness of the specimen was determined using the equipment shown in Fig. 1. The method is described in Ref. 3. The specimen was then placed in a rigid restraining frame as shown in Fig. 2 and grouted securely. Finally, the specimen was placed on the furnace in a horizontal position as shown in Fig. 3.

The specimen was tested without applied load. Test procedures are described in Ref. 1. Temperatures within the concrete were measured at the locations shown in Fig. 4 and automatically recorded during the test. Unexposed surface temperatures were measured using procedures described in ASTM Designation: E119[4]. Measurements were obtained at the four points shown in Fig. 4. At the time of test, the compressive strength of the companion cylinder was determined.

Furnace temperatures, as measured by two thermocouples located in the furnace 12 in. below the test slab, were monitored throughout the test. The maximum variations for the test from the Standard ASTM Designation: E119[4] time-temperature curve are shown in Fig. 5.

ANALYSIS OF RESULTS

A summary of test data is given in Table 2.

The fire endurance period was based on a 250F rise of the average temperature of the unexposed surface. The fire endurance was adjusted for the non-standard moisture content

TABLE 2 - TEST DATA AND RESULTS

	Specimen 5
Specimen Thickness, in.	3.65
Date of Test, mo/day/yr	11/10/76
Relative Humidity at Test, Percent	77
Uncorrected Fire Endurance, Hr:Min[1]	5:06
Corrected Fire Endurance, Hr:Min[1]	4:48
Duration of Test, Hr:Min	5:12
Compressive Strength at Test, psi	1120

[1]Based on rise of average unexposed surface temperature of 250F

of the specimen at time of test. The correction was made in accordance with the procedures described in ASTM Designation: E119, Appendix A5-Method of Correcting Fire Endurance of Concrete Slabs Determined by Unexposed Temperature Rise for Non-Standard Moisture Content[4]. The procedure describes a method for adjusting the fire endurance of concrete slabs obtained when the moisture condition within the slab at time of test is different than that corresponding to a condition of 75% relative humidity at 73F. The procedure is based on work described in several publications[1,5,6].

The adjusted fire endurance period was 4 hr. 48 min. for the 3-1/2-in. thick slab. Figure 6 shows the average unexposed surface temperatures obtained during the test.

The fire endurance for the 50 pcf (40 pcf oven dried standard low-density cellular concrete) is shown in Fig. 7. Also shown is the slab thickness-fire endurance relationship obtained from tests conducted previously by PCA. The PCA test data is interpolated from results given in Fig. 3 of Ref. 3. As shown in Fig. 7, the fire endurance of the 3-1/2-in. (nominal) thick specimen falls right on the curve for a cellular concrete of the same unit weight tested previously at the PCA Laboratories. Therefore, it would be expected that the slab thickness-fire endurance relationship for the standard low-density cellular concrete would be the same as that shown in Fig. 7.

QUESTION D.1-5

Curbed Areas

Provide the results of an analysis that shows that curbed areas surrounding combustible liquid tanks have sufficient capacity to contain the full contents of the tanks plus the quantity of water required for extinguishment of a fire involving the combustible liquid.

RESPONSE

The information requested has been provided in the Fire Protection Program Review, pages 75-76, Position F.9.

QUESTION D.2-1

Piping Containing Combustibles

Identify all piping containing flammable gas or combustible liquid which is routed through areas containing safety-related equipment, safety-related cables or through which personnel must pass to reach safety-related equipment for local operation. Provide an analysis to show that a fire involving the liquid or gas will not prevent safety shutdown or result in the loss of function of a safety-related system.

RESPONSE

The only piping containing flammable liquids within safety-related areas is in the vicinity of the diesel generator fuel oil day tanks and the fuel oil storage tank for the diesel-driven fire pump. See also the response to Positions F.9 and F.10 (Fire Protection Program Review, pages 75-76 and 110-113) and PF-2.

QUESTION D.2-2

Diesel Fuel Transfer Shut-off

Describe the means provided to automatically and/or manually stop the transfer of diesel oil from the bunker tanks to the diesel generator day tanks in the event of a fire in the area housing the day tank, or through which the fuel oil transfer piping is routed.

RESPONSE

Each transfer pump is stopped manually by means of local control switch at each pump.

QUESTION D.2-3

Combustible Fluid Reservoirs and Storage

Provide a listing of all fixed tanks and pumps which contain oil or other combustible fluid and indicate the location of the container and quantity of combustible fluid contained. Describe the fire protection provisions associated with each such location.

RESPONSE

This information is provided in Table 1 of the Fire Protection Program Review (located after page 150).

QUESTION D.3-1

Interface between Safety and Non-Safety Equipment

Certain cables electrically connected to equipment necessary for safe shutdown may be used for functions designated as non-safety-related and therefore classified as non-safety-related. Examples of these might be remote indicating lights for valves, breakers etc. Describe whether such cables are kept with the safety division to which they were originally connected and if not, describe the effects on the safe shutdown equipment due to shorts to these cables as a result of fire.

RESPONSE

Annunciator cables are run with other non-safety cables, and they are isolated from the safety circuit. A short in the annunciator circuit does not have any effect on the operability of safety-related devices.

Remote indicating lights are treated as Class IE and are always kept within the electrical division.

Ammeters remote from safe shutdown switchgear are routed with non-safety cables. A short to this cable does not have an effect on the operability of the safety-related device.

QUESTION D.3-2

Fire Stops

Provide a detailed description of fire breaks and fire stops. Include sketches, identification of materials of construction, and description of test results which demonstrate the effectiveness of fire stops used on electrical cubicles and vertical cable trays; and for intersection between horizontal and vertical cable runs. Provide the criteria that were used in the design of the fire breaks and fire stops.

RESPONSE

See page 24 of the Fire Protection Program Review for a description of existing low-density cellular concrete used in electrical cable penetration fire stops. New fire stops installed after mid-1978 utilize silicon foam following an ANI-approved installation procedure.

QUESTION D.3-3

Cable Insulation Materials

Identify all types of cable used in all areas of the cable tray system. For each type of cable, identify the materials used for insulation and jacketing. State the combustion and toxic characteristics of each type of material. Identify whether flame tests were performed on single and jacketed assemblies. Provide the acceptance criteria and results of the flame tests. Identify the flame temperature used, the exposed area, and the heat rate. Provide a comparison between these test procedures and the IEEE 383 flame test procedures.

RESPONSE

The following itemized list represents all the types of cable used in the BVPS-1 cable tray system.

Cable Type	Manufacturer	Insulation	Jacket
5,000 V Power	Kerite Co.	HT Kerite	NS Neoprene
600 V Power	Okonite Co.	Thermoset Ethylene Propylene Rubber	Thermoset Neoprene Compound
1,000 V Control	Okonite Co.	Thermoset Ethylene Propylene Rubber	Thermoset Neoprene Compound
Instrument	Continental Wire	F. R. Cross-Linked Polyethylene	F.R. Chlorosulfonate Polyethylene
		F.R. Cross-Linked Polyethylene	Asbestos Braid
		Polyethylene Type I ASTM-D-1248	Polyethylene Type I ASTM-D-1248
Thermocouple	Boston Insul. Wire	Thermoset Silicone Rubber	Asbestos Braid
		Glass Braid Silicone, Varnish Saturated	Asbestos Braid
High Temperature	Cerro Wire & Cable	Methyl-Vinyl Silicone Rubber	Asbestos Braid
Coaxial	Rachem	Extruded Alkane Imide Plus Cross-Linked Polyolefin	Extruded Cross-Linked Polyolefin

With the exception of the 5,000 V Power Cable manufactured by the Kerite Co., test data have been obtained for all cable. The cable has been flame tested for individual conductors per ASTM-D2633 or IPCEA 5-19-81 as required. Vertical flame tests similar to 2.5.4.5 of IEEE-383 were performed on each cable type, with the results that all passed. Flame temperature, heat rates, and exposed areas are not required per IEEE-383 and, therefore, in the majority of cases not available. Test data are on file.

Information on Kerite 5,000 V Power Cable is attached. Reports of Fire Tests Nos. 74 VG 25-P and 75 VG 32-P show that the single and three conductor 5KV H.T. Kerite insulated and HTNS jacketed single conductor and those triplexed with galvanized steel interlock armor are non-propagating as tested using the gas burner flame source as specified in IEEE 383-1974.

49 Day Street
Seymour, Connecticut 06483
(203) 888-2591

the kerite company

12690,67

October 27, 1978

Stone & Webster Engineering Corporation
P.O. Box 2325
Boston, Massachusetts 02107

Attention: Mr. James Cumiskey
Project Engineer

Re: Duquesne Light Company
Beaver Valley Generating Station
Unit 1
P.O. No. VC227 of 11/1/71
Kerite No. B-59

Gentlemen:

Confirming our teletype of 10/25, we are enclosing Kerite Reports of Fire Tests Nos. 74 VG 25-P and 75 VG 32-P showing that the single and three conductor 5KV H.T. Kerite insulated and HTNS jacketed single conductor and those triplexed with galvanized steel interlock armor are non-propagating as tested using the gas burner flame source as specified in IEEE 383-1974.

We certify that the cable constructions and materials used on these tests are identical to those supplied on the referenced order.

Should you have further questions, please do not hesitate to call.

Yours truly,

THE KERITE COMPANY

A. Hubbard

A. Hubbard III
Manager, Sales Engineering

AH:sc
Encs.

REPORT ON FLAME TEST CONDUCTED ON POWER CABLES
July 22, 1974

A. OBJECTIVE

The objective of this flame test is to demonstrate the ability of a multiconductor HTK insulated and HTNS jacketed cable with an outer galvanized steel interlocked armor not to propagate a fire under test specifications in IEEE Std. 383-1974.

B. CABLE TESTED

3/c No. 1/0 (str.) AWG, 5000 volt, 125 mil HTK (N-98) insulation, 95 mil HTNS (HI-70) jacket; cabled with asbestos laterals and an overall galvanized steel interlocked armor.

C. TEST FACILITY AND INSTRUMENTATION

The test was conducted on July 22, 1974, in the test facility at The Kerite Company, Seymour, Connecticut. An American Gas Furnace Company 10" ribbon burner was used to provide the flame source. A Lewis Engineering Pyrometer was used in conjunction with a calibrated thermocouple to monitor the flame temperature throughout the test. A laboratory timer was used in timing the test.

D. TEST PROCEDURE

The test was conducted generally in accordance with IEEE Std. 383-1974, Section 2.0, Paragraph 2.5. The flame source used was gas with a mixture of compressed air. The pressures used during the test are as follows.

The gas pressure was -4.6 cm of water as measured on the gas supply of the Venturi mixer.

The air pressure was +4.4 cm of water as measured at the air inlet of the Venturi mixer.

Pressures were measured using water manometers under dynamic conditions.

The flame temperature was adjusted to approximately 1500°F and a length of about 12". The flame was placed in proper contact with the cable samples which had been installed in a 9" wide, 3" deep, and 8 ft. long galvanized steel tray. The three cable samples were 8 ft. long, and installed in the tray with about one-half cable diameter between cables.

The flame was left in contact with the cables for twenty minutes. Appropriate test data was recorded.

E. TEST DATA

1) Time for specimen to ignite. ? *

2) Time specimen continued to burn upon removal of flame. 52 sec.

3) Maximum length of sample burned. Include char distance. 7 inches

4) Post test dissection. Upon removal of armor interlock in area of hot test flame jacket on individual conductors was charred for a maximum of 7" and consumed for a maximum of 4".

* Unable to determine at what time cable ignited because of armor interlock. However, five minutes into test flames were noted emitting from the laps in the armor.

Minutes	Flame Temperature °F	Minutes	Flame Temperature °F
0	.1680	11	1720
1	1550	12	1740
2	1580	13	1730
3	1620	14	1750
4	1680	15	1820
5	1670	16	1770
6	1670	17	1750
7	1700	18	1850
8	1680	19	1700
9	1760	20	1770
10	1720		

F. CONCLUSIONS AND RECOMMENDATIONS

This cable shows no evidence of propagating a fire. This type of cable, thus, qualifies as a fire resistant cable in the context of the test configuration.

G. ATTESTATION

The above test was personally witnessed by the undersigned and the data presented above is accurate and complete to the best of my knowledge and belief.

Robert J. Mosley

R. J. Mosley
Technician

RJM/pp

Approved by R. B. Budrow

R. B. Budrow
Mgr., Cable Applications

Subscribed and sworn to before me this 20 day of February, 1975.

Frank F. Marsico, Jr.

Notary Public

My Commission Expires Mar. 31, 1976

74 VG25-P

These pressures were measured for both air and fuel at the inlet of the mixer.

The flame source was placed 3 inches away from the cables and allowed to burn for 20 minutes. At the end of 20 minutes, the flame source was shut off and the cable was allowed to burn until it self-extinguished or was totally consumed. All pertinent data was recorded. The temperatures indicated in the next section were measured by a thermocouple located 2-7/8" from the burner face. The test was performed three times for reproducibility.

E. TEST DATA

	Test No. 1	Test No. 2	Test No. 3
1) Time for specimen to ignite.	35 sec.	36 sec.	38 sec.
2) Time specimen continued to burn after removal of flame source.	0 sec.	0 sec.	0 sec.
3) Maximum length of sample burned.	34"	42"	46"

4)

Minutes	Flame Impingement Temperature (°F)		
Start	1475	1500	1450
1	1500	1550	1525
2	1610	1575	1525
3	1625	1600	1575
4	1625	1575	1575
5	1630	1600	1575
6	1650	1650	1575
7	1625	1625	1575
8	1625	1675	1575
9	1625	1675	1550
10	1600	1625	1550

Test Number: 75 VG-32-P
Reference Number: 1G-7/18/75
2G-7/28/75
3G-7/28/75

Minutes	Flame Impingement Temperature (°F)		
11	1650	1625	1540
12	1600	1625	1540
13	1590	1625	1525
14	1575	1600	1525
15	1575	1625	1525
16	1550	1675	1525
17	1575	1600	1525
18	1550	1625	1525
19	1550	1625	1500
20	1560	1600	1500

F. CONCLUSIONS AND RECOMMENDATIONS

This cable shows no evidence of propagating a fire. This type of cable thus, qualifies as a fire resistant cable in the context of the test configuration.

G. ATTESTATION

The above test was personally witnessed by the undersigned and the data presented above is accurate and complete to the best of my knowledge and belief.

John Osborn
J. Osborn
Technician

Approved: Paul D. Basconi
Paul D. Basconi
Mechanical Engineer

Subscribed and sworn to, before me, this 28 day of July, 1975.

PDB/JO/pp

Jane Hill
Notary Public
My Commission

QUESTION D.4-1

Method of Heat and Smoke Venting

In all the areas where manual fire fighting is proposed as either primary or backup means of suppression, describe the methods which would be used for heat and smoke removal using either fixed or portable air handling equipment. If the plant HVAC systems are proposed for such service, provide design data to show that these systems are rated for the conditions (temperature and capacity) required when used for this service.

RESPONSE

The fire areas in which manual fire suppression (extinguishers and/or hose) is proposed are identified on the summary sheets included with the fire hazards analysis. This tabulation also indicates which fire areas house safety-related equipment. The removal of heat and smoke from areas of the plant would be effected by utilizing installed ventilation or, if these installed systems are incapacitated, by alternate methods as described in the Fire Protection Program Review, pages 33-34 and 36, Position D.4.

QUESTION D.4-2

Prevention of Fire and Smoke Spread

Describe the manner in which fire and smoke are prevented from spreading from area to area via the normal and emergency ventilation systems in all parts of the plant areas. Describe the location, actuation method and fire rating of dampers used for fire and smoke control in both air supply and return air systems. Describe the details of interlocks for ventilation system shutdown or mode change that can be utilized for fire and smoke control.

RESPONSE

The responses to Positions D.4.a (page 36) and D.3.i (pages 33-34) describe the prevention of fire and smoke spreading.

QUESTION D.4-3

Ventilation System Power and Control

Identify the areas where ventilation systems power supply or controls are located within the area they serve. Provide the basis for leaving ventilation systems power and control cables within the area they serve.

RESPONSE

The ventilation systems for the following safety-related areas have been investigated in detail, and it has been determined that the power supply or controls are located within the area they serve:

CR-2	Control Room HVAC Room
CR-3	Communication and Relay Room
CR-4	Process Instrument
DG-1	Diesel Generator Cubicle
DG-2	Diesel Generator Cubicle
IS-1, -2, -3	Intake Structure

CR-2, CR-3, and CR-4 are served by the same ventilation system exhaust fans VS-F-40A or B. Heat and smoke may be removed from these areas by using:

1. The normal ventilation equipment, if still operational;
2. The ventilation exhaust in adjacent area NS-1 by opening doors under strict administrative control of fire brigade, and running FN-18 which serves NS-1 under full exhaust with no recirculation. (A temporary connection to the duct system is an alternate option); or
3. Portable fans with elephant-trunk vent hoses installed via room NS-1 to the stairway at 5C, through clean shop to turbine room where the roof fans will exhaust to the atmosphere.

DG-1 or DG-2 are served by separate ventilation exhaust fans. If the normal ventilation system is not available, each room may be ventilated by portable fan equipment set in the outside doorway with the opposite door open to provide a ventilation air supply.

IS-1, -2, and -3 have individual inlet fans. If the normal ventilation system is unavailable, each room may be vented by

portable fan equipment to the general area where the roof fans exhaust to the atmosphere.

It was determined that the ventilation systems for the following safety-related areas have power supply and controls outside their respective fire area:

RC-1	Reactor Containment - Purge System
CR-1	Control Room
CS-1	Cable Tray Mezzanine - See response to Position F.3.b (page 69 of Program Review)
ES-1, -2	Emergency Switchgear Room - See response to Position D.3.i (page 33 and 34 Program Review)

Portable equipment will be used for CV-1 and -2 cable vaults and CV-3 cable tunnel on the basis outlined on page 34 of the Program Review.

All other safety-related areas will use:

1. Normal ventilation equipment if available;

2. Adjacent exhaust systems with or without portable equipment;

3. Portable ventilation fans with or without elephant trunks; or

4. Natural chimney effect where applicable.

QUESTION D.4-4

Preventing Recirculation of Ventilation Air

Describe the separation between the air intakes and exhausts for normal and emergency ventilation systems and the provisions which prevent smoke from being drawn back into the plant.

RESPONSE

As discussed in the original Fire Protection Program Review Response to Position D.4.e., the only safety-related areas whose functions would be affected by external smoke would be control room areas CR-1 thru CR-4 (personnel habitability) and diesel generator cubicles DG-1 & DG-2 (equipment startup and run). The locations of the air intakes and exhausts for these areas are depicted in Figures 9.5-14 and 16, respectively.

Smoke detection and control within the control room areas are discussed in the Position F.2 Response. In addition, the control room is provided with a bottled air emergency pressurization system.

The remote location of the diesel generator cubicles (Figure 9.5-2) minimizes the possibility of smoke from other fire areas impacting diesel generator availability. The existing area ionization detection system with control room and local alarm for these cubicles, as discussed in Position F.2 Response, provides remote indication of any smoke buildup in these areas from smoke venting of any other fire area. This remote smoke identification capability provides control room input to decide if termination of smoke venting from other fire areas is warranted. The individual fixed-flooding CO_2 fire suppression system for each cubicle with automatic shutdown of the associated exhaust fan and closure of intake and exhaust dampers, as discussed in Position F.9 Response, minimizes the smoke generation from any postulated diesel generator cubicle fire, and limits the amount of smoke that would be expelled to the atmosphere.

QUESTION D.5-1

Separation of Redundant Communication Systems

Describe the proximity of the cables for redundant communication systems to each other at the containment penetration. Identify any parts of the plant to or from which communication by both systems might be lost to a single fire and discuss how the communication will be maintained during the fire emergency.

RESPONSE

Containment

Cables servicing the page-party, calibration jack, and PAX telephone systems are routed in separate conduit systems, both within the containment and throughout the plant. However, these systems are routed through a common penetration, No. 88. A fire in fire area PT-1 or RC-1 could cause a partial loss of these systems in the containment.

The personnel hatch is serviced from the containment side for page-party, private-line phone, and calibration jack systems. A fire in PT-1 or RC-1 could cause a loss of these systems. In addition, a PAX telephone is serviced from the plant side of the hatch. A fire in area PA-1 could cause a partial loss of this phone service.

Loss of Alternate Communications between Areas in the Plant

The PAX switchboard telephone system is located in the communications equipment room, fire area CR-3. A fire in this area could cause partial or total loss of all PAX telephone service in the plant.

Main PAX telephone boxes are located as follows:

Building	Location	Fire Area
Control 735'	Control Rm	CR-1
Service 713'	Proc Instr Rod Rm (N. Wall)	CR-4
Service 735'	Fire Passage (E. End)	SB-3
Turbine 693'	(S.E. Corner)	TB-1
Reactor 735'	(Column 10)	RC-1
PA 722'	(N.W. Corner)	PA-1

In addition to the above panels, telephone boxes are located in remote areas such as Intake Structure, Alternate Intake, Meteorological Shelter, Radio Building, Relay House.

A fire in the area of a telephone box may cause loss of PAX service within that area.

The page-party system is routed throughout the plant. A fire in a particular area could cause total loss of the plant system if a short circuit results. If the cables fail open, then service would be segregated. Within a short period of time, the affected area could be severed and partial use of the page-party system restored.

A calibration jack system is routed throughout the plant. It has a susceptibility to loss of service by fire similar to that of the page-party.

Portable VHF radios are also used and are not dependent on the hard-wired systems; they are part of the EPP.

QUESTION D.5-2

Proximity of Regular and Emergency Lighting Wiring

Provide the results of an evaluation of the potential for a fire in a safety-related area to cause damage to electrical wiring which would result in the loss of both regular and emergency lighting to areas providing access to the fire.

RESPONSE

The information requested has been provided in the Fire Protection Program Review, pages 43-44, Position D.5.

Suitable sealed-beam,battery-powered portable hand lights are available to the fire brigade as a part of the normal emergency equipment.

QUESTION E.1-1

Fire Detection System Design

Provide data for the numbers and locations of fire detectors in each safety-related area and in other areas which could affect safety-related areas as a result of postulated fires.

RESPONSE

Refer to Table 1 of the Fire Protection Program Review, located after page 150. Fire detection equipment has been provided in the following areas:

Zone	Description		Ionization No. of Detectors
ES-1	Emergency SWGR Room A		5
	Battery Rm. 1		1
	Battery Rm. 3		1
ES-2	Emergency SWGR Room B		5
	Battery Rm. 2		1
	Battery Rm. 4		1
MG-1	MG Rod Control Room		4
CR-4	Process Inst & Rod Position		12
CR-2	Air Cond. Equip. Rm.		2
	Pump Rm.		2
CR-3	Communication Equip. Rm.		2
NS-1	480 & 4160 SWGR Rm.		13
CR-1	Control Room		7
	Office		1
	Computer Room		2
DG-1	Diesel Generator Room		3
DG-2	Diesel Generator Room		3
CS-1	Cable Tray Mezzanine		31
CV-1	West Cable Vault		3
	West Cable Tunnel		2
CV-2	East Cable Vault		3
	East Cable Tunnel		2
IS-1*	Pump Cubicle	(Heat Detectors)	2
IS-2*	Pump Cubicle	(Heat Detectors)	2
IS-3*	Pump Cubicle	(Heat Detectors)	2
IS-4*	Pump Cubicle	(Heat Detectors)	2

*Proposed

QUESTION E.3-1

Fire Suppression System Design

Provide the design data for all automatic suppression systems (both existing and proposed) including such items as design densities, soak times, power supplies, and associated alarms. Identify areas of non-compliance with appropriate NFPA Standards.

RESPONSE

Automatic Fire Suppression Systems as described in the "Fire Hazards Analysis summary sheet" are:

Area Code	Plant Identification	Type	Alarm	Power
CS-1 (Proposed)	Cable Tray Mezzanine	CO_2 - Total Flooding	C.R./Local	125 V-DC
CR-4	Process Instrument and Rod Pos. Room	Halon	C.R./Local	125 V-DC
D.G. 1; 2	Diesel Generator Cubicle	CO_2 - Total Flooding	C.R./Local	125 V-DC
MF-1; 2	Main Exhaust Filter Banks	Water Spray Deluge	C.R./Local	125 V-DC
CV-1	West Cable Vault	CO_2 - Total Flooding	C.R./Local	125 V-DC
CV-2	East Cable Vault	CO_2 - Total Flooding	C.R./Local	125 V-DC
TR-1 to TR-5	Main and Station Transformers	Water Spray Deluge	C.R./*Local	125 V-DC
TB-1	Turbine Building Generator Area	Wet Pipe Sprinkler	C.R./*Local	125 V-DC
TB-2	Turbine Oil Reservoir	Water Spray Deluge	C.R./*Local	125 V-DC
TB-3	Hydrogen Seal Oil Unit	Water Spray Deluge	C.R./*Local	125 V-DC
TO-1	Turbine Oil Storage Room	Wet Pipe Sprinkler	C.R./*Local	125 V-DC

Area Code	Plant Identification	Type	Alarm	Power
AB-1	Auxiliary Boiler Rm	Wet Pipe Sprinkler	C.R./*Local	125 V-DC
TG-1	Turbine Generator	CO_2	C.R./Local	125 V-DC
RS-1	Records Storage Rm	Wet Pipe Sprinkler	C.R./*Local	125 V-DC
WH-1, 2	Warehouse	Wet Pipe Sprinkler	C.R./*Local	125 V-DC
CE-1	Controlled Environment Storage Rm	Halon Total Flood	C.R./Local	125 V-DC
SB-1	PCA Shop	Wet Pipe Sprinkler	C.R./*Local	125 V-DC
CL-1	Chemical Lab	Wet Pipe Sprinkler	C.R./*Local	125 V-DC
SH-1	Clean Shop	Wet Pipe Sprinkler	C.R./*Local	125 V-DC

* = Local Alarm Exists at Sprinkler Header.

The design of the total flooding carbon dioxide fire protection system conforms to the standards for carbon dioxide systems, NFPA No. 12 - 1972. The design density for each CO_2 protected area is 52 percent. Two shot capability is provided.

The design of the sprinkler and water spray fire protection systems conforms to the standards for sprinkler system, NFPA No. 13 - 1972, and the standards for water supply systems, NFPA No. 15 - 1969, and the requirements of the Nuclear Energy Properties Insurance Association (NEPIA).

For the turbine floor, the sprinkler coverage (design densities) is at a rate of not less than 0.30 gpm per sq ft with all sprinklers within any 3,000 sq ft area operating, and not less than 0.2 gpm per sq ft with all sprinklers within any 10,000 sq ft area operating. Ordinary hazard areas have a design density of not less than 0.25 gpm. Examination of the available fire protection documents did not reveal any noncompliance with the above NFPA standards.

QUESTION E.3-2

Requirements for Manual Hose Stations

Demonstrate that all points of safety-related areas and areas with major fire hazard can be reached with the hose line stored at the manual hose stations. Provide an analysis to support the position that hose stations need not be located in such safeguards areas as the pipe tunnel and cable vaults, diesel generator cubicles, and containment.

RESPONSE

The coverage provided by manual hose stations was reviewed. Enclosed Table E.3-2 lists additions and revisions to the existing manual hose system which would provide coverage with a maximum 100-foot hose line, conservatively assuming a 30-foot reach for the hose stream. In the analysis, obstructions of structures and equipment were considered.

TABLE E.3-2

MANUAL HOSE STATION FIRE PROTECTION REVIEW
BY FIRE AREA

RC-1

El 767'-10"

Add 100' hose rack at columns 4, 8, 11, & 14.

El 738'-10"

Add 100' hose rack at columns 4 & 15:

One inside doorway to room located inside crane wall between columns 1 & 3.

One outside crane wall near doorway by column 8.

El 718'-6"

Add 100' hose rack at columns 4, 8, & 14.

El 692'-11"

Add 100' hose rack at columns 4, 8, & 14.

Total of 100' hose racks = 14.

CR-2

Add 75' hose rack in stairs by G-11.

CS-1

Add 50' hose rack by stairs at G-11.

Add 50' hose rack by stairs at D-5 (also for NS-1).

Add 50' hose rack by columns 7 & 9.

DG-1

Add 75' hose rack by door.

DG-2

Add 75' hose rack by door.

TABLE E.3-2 (Cont)

IS-1 to 4

Existing hose rack is adequate.

PT-1

Add 50' hose rack in following locations:

At door to PT-1 by personnel hatch El 767'-10".

At door in vent room beside main steam area El 751'-0".

In stairwell by columns 10 1/4 El 756'-0".

Just inside door to main steam area El 756'-0".

Add 75' hose rack in following locations:

Just inside door from west cable vault with auxiliary feed pump.

Just inside door, west of centerline of RC El 747'-0".

(These with hose racks to be added to CV 1 & 2 take care of all equipment requiring hose protection in PT-1. If all PT-1 needs protection, add (3) 50' hose racks to El 722'-6").

FB-1

Existing hose rack is adequate.

PA-1, 1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1l, 1m, 1n, 1o, 1p, 1q, 1r

El 722'-6"

To keep hose rack at G7/8 - 11 1/2 from being cut off by fire and to effectively fight fire in 1c, increase hose L-13 from 50' to 75'.

El 735'-6"

Add 50' hose rack in room located in southwest corner of auxiliary building. Put in northeast corner of room.

Increase hose L-13 from 50' to 75'. This is to keep hose rack at G7/8 - 11 1/2 from being cut off.

TABLE E.3-2 (Cont)

To be on safe side for areas 1g & 1h, increase length of hose at G7/8 - 8 7/8 from 50' to 75'.

Add 100' hose rack by coolant recovery tank BR-TK-4A.

El 752'-6"

Change 50' hose rack at G7/8 - 8 7/8 to 75' to adequately protect 1k and keep hose rack at L-9 3/8 from being cut off by fire.

Change 50' hose rack at L-9 3/8 to 75' to adequately protect PA-1i.

Change 50' hose rack at G1/8-11 1/8 to 75' for PA-1e.

El 768'-7"

Hose rack at 11 1/2-G1/8; if VS-F-4A and or 4B catch fire, hose rack will be inaccessible. Move out to G7/8-10 7/8 or G7/8-11 1/2.

CV-1 & 2

Add 50' hose rack in stairwell El 735'-6" between east and west cable vault. This also gives access to PT-1.

Totals

100' hose rack to be added = 15

75' hose rack to be added = 5

50' hose rack to be added = 10 (+3 if needed, see note in PT-1).

50' hose rack to be increased to 75' = 6

Hose rack to be relocated = 1

Reference Drawings

Fire Area	Reference Drawing
RC-1	11700-RM-1 Series
CR-2	11700-RB-17

TABLE E.3-2 (Cont)

	11700-RE-27C
CS-1	11700-RE-34AC
DG-1	11700-RB-27A
DG-2	11700-RB-27A
IS-1 to 4	11700-RB-26B
PT-1	11700-RM-1 Series
FB-1	11700-RB-23
PA-1 & 1a to 1r	11700-RM- 2 Series 11700-RB- 6 Series 11700-RC-24 Series
CV-1 & 2	11700-RM-1B

QUESTION F.1-1

Fire Hazard at the Containment Cable Penetration

Identify the consequences on safe shutdown of a fire at the cable penetration area on either side of containment.

RESPONSE

A fire in a cable penetration area on either side of containment will not affect cables in a redundant safety system required for safe shutdown due to physical separation and concrete fire barriers.

QUESTION F.4-1

Fire Hazards Associated with the Plant Computer

Provide the results of an analysis which demonstrates that a fire within the computer area will neither expose any safety-related equipment nor affect the safe plant shutdown. Verify that the barrier around the area is compatible with the combustible loading in the area.

RESPONSE

The computer room is not safety-related and is provided with an 8-inch concrete block wall fire barrier separating this room from the control room. The fire loading for this area is 8,995 Btu/sq ft. (See Table 1 of the Fire Protection Program Review, located after page 150.) The existing wall is more than adequate, considering the fire loading.

QUESTION F.6-1

Remote Shutdown Panels

Identify the location of all remote shutdown panels and provide the results of analysis to demonstrate that no fire which could impair the control from the control room could also prevent the control from these areas. Specifically, justify why an automatic fire detection system is not needed in the intake structures areas (IS 1, 2 & 3) where remote safety related panels are located.

RESPONSE

The shutdown panel (SDP) contains all of the necessary controls for achieving hot shutdown and is located in Fire Area CR-4 which is located in the service building at elevation 713 ft-6 in. This fire area is separated from the control room by two fire walls. Should the control room become inaccessible due to fire, the reactor can be maintained at hot shutdown from the shutdown panel. Faults which occur in the control room side of the control circuit may be isolated by use of the transfer switch which is located on the shutdown panel (SDP).

An automatic fire detection system will be installed in the intake structures IS-1, 2 and 3.

QUESTION F.14-1

Radiological Consequences of a Fire

Evaluate the radiological consequences of a fire in radwaste areas and areas containing contaminated materials such as filter cartridge, spent resin, etc.

RESPONSE

Fires in the primary auxiliary building are discussed on pages 35-37 and 120-122 of the Fire Protection Program Review.

PF-1

Fire Brigade Training (B-5)*

Fire Brigade training should include the following:

1. Regular planned meetings held every three months which repeat the classroom instruction program over a two year period.

2. Practice sessions at regular intervals but not to exceed one year for each brigade member.

3. Drills performed at regular intervals but not to exceed three months for each brigade. At least one drill per year to be performed on a "back shift" for each fire brigade. A sufficient number of these drills, not less than one for each fire brigade per year, to be unannounced to determine the fire readiness of the plant fire brigade leader, fire protection systems, and equipment.

RESPONSE

1. A schedule has been implemented to review the classroom instructional program over a 2-year period.

2. Practice sessions are held approximately each year for each brigade member and, thus far, has been successful, with no inability on the part of the brigade member to perform his duties.

3. Drills will be held approximately once per quarter which includes personnel injury, fire drills, etc, for each fire brigade. At least one drill is conducted on a back shift, and there will also be an unannounced drill.

PF-2

Control of Combustibles (B-5)

All waste, debris, scrap, rags, oil spills, or other combustibles resulting from the work activity should be removed in the area following completion of the activity, or at the end of each work shift (whichever is sooner).

RESPONSE

Maintenance activities that are ongoing 24 hours a day will be kept reasonably clear of highly combustible material.

For noncontinuous activities, highly combustible materials will be cleaned up at the end of the shift or activity, whichever is sooner.

Low-hazard combustible materials, such as scaffolding timbers, will be removed at the end of the activity.

PF-3

Electrical Cable Penetration Qualification (D-3)

The cable penetration fire barriers should be tested to demonstrate a three-hour rating, as is required for fire barriers. The test should be performed or witnessed by a representative of a qualified independent testing laboratory, and should include the following:

(1) The tests should be performed in accordance with ASTM E-119 and the following conditions.

(2) The cables used in the test should include the cable insulation materials used in the facility.

(3) The test sample should be representative of the worst case configuration of cable loading, cable tray arrangement, anchoring and penetration fire barrier size and design. The test sample should also be representative of the cable sizes in the facility. Testing of the penetration fire barrier in the floor configuration will qualify the fire stop for use in the wall configuration also.

(4) Cables penetrating the fire barrier should extend at least three feet on the unexposed side and at least one foot on the exposed side.

(5) The fire barrier should be tested in both directions unless the fire barrier is symmetrical.

(6) The fire barrier should be tested with a pressure differential across it that is equivalent to the maximum pressure differential a fire barrier in the plant is expected to experience.

(7) The temperature levels of the cable insulation, cable conductor, cable tray, conduit, and fire stop material should be recorded for the unexposed side of the fire barrier.

(8) Acceptance Criteria - The test is successful if:

(a) The cable penetration fire barrier has withstood the fire endurance test without passage of flame or ignition of cables on the unexposed side for a period of three hours, and

(b) The temperature levels recorded for the unexposed side are analyzed and demonstrate that the maximum temperature is sufficiently below the cable insulation ignition temperature, and

(c) The fire barrier remains intact and does not allow projection of water beyond the unexposed surface during the hose stream test.

If previous test can be shown to meet the above position, the licensee should provide the results of the tests to show that the above position is met.

RESPONSE

Refer to response D.3-2. Also, see attachments Chemtrol Corp. Evaluation report dated March 22, 1978, and Chemtrol Material and Installation Qualification sheets.

FOR INFORMATION ONLY

102	01 002 001			101			

E.M. No. 20114

ENGINEERING MEMORANDUM
DUQUESNE LIGHT COMPANY
BEAVER VALLEY POWER STATION UNIT 1

015	N/A	D.C.P.	CHARGEABLE? ☐ YES ☒ NO
102	II	CAT.	CHARGE DIST.
103		C.O.	PAGE 1 OF 7

TO: H.A. VANWASSEN

RESPONSE DUE: N/A

PROBLEM:

The attached sheets on fire penetration seal may be required by Engineering to evaluate the seals for a preparation of a response to the NRC Questions on fire seals

REFERENCES: EM 20111 CHARGE TIME TO

PREPARED BY: R. Burski EXTENSION: 5148

APPROVED BY: R. [illegible] DATE: 5/29/75

E. J. HUESMANN - NOTED

TO:

ASSIGNED TO:

DEPARTMENT

RESPONSE

REFERENCES:

PREPARED BY:

EXTENSION:

ENGR. CHG. NOTICE:

APPROVED BY:

DATE:

FORM 018-4984

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X		Proj. Team SRP
X		Chief Const. Inspect.

Chemtrol Corporation

330 North Belt East
Houston, Texas 77060

Area Code 713/447-6818
TWX: 910 881 6223
Cable: CHEMTROL

LETTER OF TRANSMITTAL

Quality Assurance Department

Transmittal Number: 100-26

TO: Beaver Valley Nuclear Power Sta	DATE August 18, 1978 — JOB NO.
Duquesne Light Co.	RE: Certificate of Compliance for
P. O. Box 4 Shippingport, PA 15077	Silicone Dispensing Machine
ATTN: Mr. J. V. Vassello	#CT106-215

GENTLEMEN:
WE ARE SENDING YOU (X) ATTACHED ( ) UNDER SEPARATE COVER
( ) DRAWINGS ( ) COPY OF LETTER

( ) SPECIFICATIONS
( ) QUALITY ASSURANCE MANUAL ( ) QUALITY CONTROL PROCEDURES
( ) QUALITY ASSURANCE MANUAL REVISION ( ) QUALITY CONTROL PROCEDURE REVISION

(XX) Certificate of Compliance for Silicone Dispensing Machine #CT106-215

COPIES	DATE	SERIAL NO.	DESCRIPTION
1	7/3/78	CT106-215	Certificate of Compliance

THESE ARE TRANSMITTED
( ) FOR APPROVAL (X) AS REQUESTED ( ) FOR REVIEW AND COMMENT
(XX) FOR YOUR USE ( ) RETURNED FOR CORRECTIONS ( ) FOR BID DUE ______
( ) ______

REMARKS: ______

COPY TO: ______ SIGNED Marie E. Edwards
Document Control

Please return copy of this transmittal to Chemtrol Corporation, acknowledging receipt of the above listed document(s).

TRANSMITTAL:
( ) COMPLETE ( ) NOT COMPLETE ( ) DISCREPANCIES NOTED BELOW

______

______

Rct'd by______ Title______ Date______

CT/QC-15 (4/78)

Chemtrol Corporation
530 North Belt East, Suites 105/112
Houston, Texas 77060

Area Code 713/447-0818
TWX: 910 881 6223
Cable: CHEMTROL

CERTIFICATE OF COMPLIANCE

RE: CHEMTROL CORPORATION Silicone Foam DISPENSING
UNIT NO. CT-106-215 DATE OF SERVICE July 3, 1978

WE HEREBY CERTIFY THAT THIS EQUIPMENT, SERIAL NO. CT-106-215, COMPLIES WITH OUR STANDARD MANUFACTURING REQUIREMENTS AND OUR PUBLISHED LITERATURE.

CHEMTROL CORPORATION

L. Charles S

L. CHARLES SPRIGGS
QUALITY ASSURANCE MANAGER

(CT/QC-17)
8-77

MATERIAL TEMPERATURE INDICATOR
CALIBRATION CERTIFICATE

UNIT NO. CT106-215 TYPE CT-18 Silicone Foam Dispensing

DATE July 3, 1978

The Material Temperature Indicators as used on Chemtrol Silicone Foam Dispensing Units is an adjustable pyrometer device.

This is a thermocouple measuring device and is calibrated upon installation. When accurate thermocouple measurements are required, it is common practice to reference both legs to copper lead wire at the ice point so that copper leads may be connected to the emf readout instrument. This procedure avoids the generation of thermal emfs at the terminals of the readout instrument. Changes in reference junction temperature influence the output signal and practical instruments must be provided with a means to cancel this potential source of error. This can be accomplished by placing the reference junction in an ice water bath at a constant $0^{\circ}C$. ($32^{\circ}F$.). In lieu of an ice water bath, alternate methods as listed may be used:

Alternate 1: Electrical Bridge Method

Alternate 2: Thermoelectric Refrigeration Method

Alternate 3: Heated Oven References

This instrument has been calibrated by one or more of these methods and is certified to be accurate ± 2% (at $77^{\circ}F$. ambient temperature).

Tested by: Bruce Roberson/Lee Moritz

Date: July 3, 1978

Approved by: L Charles [signature]

CT/QC-18
August, 1977

530 North Belt East, Suites 105/112
Houston, Texas 77060

Area Code 713/447-6818
TWX: 910 881 6223
Cable: CHEMTROL

Equipment Manufacture

Quality Assurance Checklist

Unit No: CT106-215 Type: CT-18 Silicone Foam Dispensing

Manufacturer: Chemtrol

Date of Inspection: July 1, 1978 Inspector: Rod Warfield

Certified for Conformance by: L Charles Spriggs Date: July 3, 1978
Quality Assurance Manager

Dispensed Material Check

Date: July 3, 1978 Performed By: L. Charles Spriggs

Density: 18.0 lb/ft^3 Cell Structure: Pass [X] Reject [ ]

T... Amb. 68^0 Mat'l. 72^0 Verified By: Bruce Roberson

Lot No. EV107157 Snap Time: 1 min. 15 seconds

General Comments

CT/QC - 16.01
8/77
Rev. 2/78

Quality Assurance Checklist

Instrumentation

Description	Manufacturer	Certification Number	Pass	Hold	Reject	Remarks
Line Pressure-2" 0-200 lbs.	Wika	1562-33	X			
Pump Pressure-2" 0-200 lbs.	Wika	1562-34	X			
'A' Mat'l Pressure 0-2000 lbs.	Wika	1562-35	X			
'B' Mat'l Pressure 0-2000 lbs.	Wika	1562-36	X			
Stroke Counter Reset	Hecon Corporation		X			
Stroke Counter Accumulative	Hecon Corporation		X			

Temperature Indicators

Description	Manufacturer	Pass	Hold	Reject	Remarks
Mat'l Temp.	Mastercraft Pyrometer	X			
Ambient Temp.	Mastercraft Pyrometer	X			
3 Position Switch					

Pump

Description	Manufacturer	Pass	Hold	Reject	Remarks
Pump No. 208-341 Series No. 106	Serial #A223 Graco	X			
Air Motor No. 207-457 Series No. #H7P	Graco	X			
Mounting	Tanco	X			
Interior Hoses & Fittings	Nylaflow	X			
Recirculation Valves	Graco	X			
Pressure Regulator	Asco (0-125 PSI)	X			
Low Level Warning	Ranco	X			
Intake Air Filter	Master Pneumatic FD100-3	X			

Electrical

Description	Manufacturer	Pass	Hold	Reject	Remarks
Wiring Harness	Chemtrol	X			
Circuit Breaker (Double Pull)	AMF - Potter Brumfield	X			
Lead (4')	W. W. Grainger	X			
Pigtail	Chemtrol	X			

Tank Heat

Description	Manufacturer	Pass	Hold	Reject	Remarks
Heating Element	Thermon	X			
Thermostat Control	Ranco	X			
Control Switches	AMF Pottcr Brumfield	X			
Indicator Lights	Dialco	X			

Hose Heat

Description	Manufacturer	Pass	Hold	Reject	Remarks
Heating Element	Chromolox	X			
Thermostat Control	Briskeat	X			
Control Switches	AMF Potter Brumfield	X			
Indicator Lights	AMF Potter Brumfield	X			

Cabinet

Description	Manufacturer	Pass	Hold	Reject	Remarks
Cabinet	Tanco	X			
Casters	W. W. Grainger	X			4" Ø
Handles	Stanley	X			Casket Style
Hoisting Rings	Bayou City & Bolt	X			2" Ø
Material Tanks	Tanco	X			17 gal. stainless steel
Appearance	Tanco	X			Good
Paint	Tanco	X			Good

CT/QC - 16.03
8/77
Rev. 2/78

Description	Manufacturer	Pass/Hold/Reject			Remarks
Matr al Lines 1/2' .00'	Nylaflow	X			
Air e 5/16"x100'	Binks	X			
Insulation-100'	Armorflex	X			
Connections & Fittings	Kinetics	X			
Hose Covering	Competition Marine	X			
Dispensing Whips	Kinetics	X			

Dispensing Gun

Description	Manufacturer	Pass/Hold/Reject			Remarks
Dispensing Gun	Serial Number #417491	X			
Connections & Fittings	Binks & Shop	X			
Ter rature Indicator	--Pocket-Thermometer assigned to QC Insp.	X			

Optional Cooling

Description	Manufacturer	Pass/Hold/Reject			Remarks
Cooling Unit	N/A				
Cooling Pump					
Hoses & Fittings					
Water Reservoir					
Mounting					
Circuit Breaker					
Indicator Lights					

330 North Belt East, Suite 103
Houston, Texas 77060

Area Code 713/447-...
TWX: 910 881 6223
Cable: CHEMTROL

March 22, 1978

Beaver Valley Power Station
Duquesne Light Company
P. O. Box 4
Shippingport, PA 15077

ATTN: Mr. J. V. Vasselo

Dear Mr. Vasselo:

RE: Evaluation Report - Daily Record
Beaver Valley Nuclear Power Station Unit 1
Duquesne Light Company
Chemtrol Job No. 8010
Duquesne P. O. #C005851 dated 2/16/78

Attached is a copy of the Evaluation Report of your Beaver Valley Nuclear Power Station - Unit 1. This report includes a copy of the Daily Record for myself and our Mr. R. Warfield as well as the Evaluation Findings.

If you have any questions regarding this evaluation, please contact me at your convenience.

Per our discussion on March 17, 1978, I am also enclosing the latest printing of our Design FC-225 Guide Specifications and the latest revision of our Quality Assurance (For Information Only) for your reference.

Please feel free to contact me if you have any further questions.

Sincerely,

CHEMTROL CORPORATION

L. Charles Spriggs

L. Charles Spriggs
Quality Assurance Manager

LCS/me

Attachments

cc: Mr. A. J. Moritz
Mr. J. Young
Mr. H. Russell
Mr. R. Sanchez
Mr. F. Farese

330 North Belt East, Suite 103
Houston, Texas 77060

Area Code 713/447-6516
TWX: 910 881 6223
Cable: CHEMTROL

BEAVER VALLEY - UNIT 1

DUQUESNE LIGHT COMPANY

EVALUATION REPORT

CHEMTROL CORPORATION
MARCH 22, 1978
L. CHARLES SPRIGGS
ASSISTED BY ROD WARF

REPORT ON FLAME TEST CONDUCTED ON POWER CABLES

July 28, 1975

Test Number:	75 VG 32-P
Reference Number:	1G-7/18/75
	2G-7/28/75
	3G-7/28/75

A. OBJECTIVE

The objective of this flame test is to demonstrate that an HTK insulated, HTNS jacketed, non-shielded power cable will not propagate a fire.

B. CABLE TESTED

1/c, #6 AWG (7) str., 5 KV, 125 mils HTK (N-98) insulation, 80 mils HTNS (HI-70) jacket.

C. TEST FACILITY

The tests were conducted July 17 and 28, 1975 at The Kerite Company Fire Test Facility. An American Gas Furnace Company 10 inch wide ribbon burner was used to provide the flame source. A direct readout Omega pyrometer was used in conjunction with a thermocouple to monitor flame temperature throughout the test. A laboratory timer was used to measure the duration of the test. The test specimen was installed in a 12 inch wide, 3 inch deep, 11 foot high ladder type tray.

D. TEST PROCEDURE (IEEE 383-1974)

A single layer of seven 8 ft. lengths of test cable were mounted in the center 6 inches of the tray, allowing a space of 1/2 cable diameter between cables.

The flame source was adjusted so that the temperature was approximately 1500°F and approximately 15 inches in length. Under dynamic conditions the following manometer readings were recorded for both air and fuel in centimeters of water.

	Air	Fuel
Test No. 1	4.4	2.5
Test No. 2	4.4	2.4
Test No. 3	4.4	2.5

TO: Harry Russell

FROM: L. Charles Spriggs DATE: March 20, 1978

RE: Evaluation Report - Daily Record
Beaver Valley Nuclear Power Station - Unit I
Duquesne Light Company
Shippingport, PA 15077
Chemtrol Proposal 177-150
Chemtrol Job No. 8010
Duquesne P. O. #C005851 dated February 16, 1978

Verbal request from Mr. J. V. Vasselo, Training Supervisor at the above mentioned plant to proceed with evaluation per Item 3.0, Section 1 of our Commercial Proposal and Item 1.1 of the correspondence from Mr. Ralph J. Block, Chemtrol Contract Administrator.

Listed below is a report of the daily activities performed to accomplish this evaluation:

1.0 Monday, March 13, 1978
L. Charles Spriggs and R. Warfield departed Houston, Texas at 3:35 p.m. on American Airlines #146 with arrival in Pittsburgh at 6:58 p.m.

2.0 Tuesday, March 14, 1978
Arrived Beaver Valley Power Station - Unit 1 at 8:30 a.m. to meet with Mr. Jim Vasselo. Were introduced to Mr. Vince Lack of Duquesne Light Company who was assigned as our co-ordinating engineer for the evaluation. We were given Health Physicist Training and issued photo identification badges enabling us access to the plant without unnecessary delays. The badges are in effect until April 30, 1978. Have been informed training will begin on May 8, 1978, therefore necessitating new badges prior to training. Began the area, by area evaluation of fire-protected and air protected areas. The results of this evaluation is attached.

3.0 Wednesday, March 15, 1978
Continued the area by area evaluation.

4.0 Thursday, March 16, 1978
Continued the area by area evaluation.

5.0 Friday, March 17, 1978
Finalize the evaluation and discussed pertinent details of the evaluation and training with Mr. Vassello. Departed Pittsburg on United No. 599 for Atlanta at 2:15 p.m. with final destination in Houston at 7:50 p.m.

6.0 Summary

Four calendar days, March 14, 15, 16 and 17 were utilized for this evaluation, therefore billing should consist of eight (8) man days.

L. Charles Spriggs
Quality Assurance Manager

LCS/me

TO: Harry Russell

FROM: L. Charles Spriggs DATE: March 21, 1978

RE: Beaver Valley Duquesne Evaluation-Findings

We were furnished a list of penetration discrepancies by Duquesne Light Company to check and confirm for sealing requirements. Instructions were also given authorizing us to evaluate and determine any other penetrations needing repair or sealing and any fire walls or areas requiring air seals.

The following is an area by area comparison of the penetration discrepancies determined by Duquesne Light Company and the discrepancies found by our Chemtrol evaluation:

		Duquesne	Chemtrol
1.0	Control Room (including computer room) Refer to Penetration Sealing Schedule attached and Duquesne Light Company Drawing 8700RE37BC for locations of these penetrations.	30	51
2.0	Battery Room (Elevation 713'6") Refer to Penetration Sealing Schedule and Chemtrol Sketch BV-07.	4	4
3.0	Relay Room (Elevation 713'6") Refer to Penetration Sealing Schedule and Chemtrol Sketch BV-04.	11	12
4.0	Reactor Trip Breakers & MG Set Room (Elev. 713'6") Refer to Penetration Sealing Schedule and Chemtrol Sketch BV-06.	1	11
5.0	4 KV Emerg. Bus IDF Room (Elevation 713'6") Refer to Penetration Sealing Schedule and Chemtrol Sketches BV-05 & BV-06.	8	11
6.0	Emerg. Shut Down Panel Room (Elev. 713'6") Refer to Penetration Sealing Schedule and Chemtrol Sketch BV-01.	1	3
7.0	Sequence of Events Recorder Room (Elev. 713'6") Refer to Penetration Sealing Schedule and Chemtrol Sketches BV-02 & BV-03.	9	10
8.0	Cable Tray Mezzanine (Elevation 725'6") Refer to Penetration Sealing Schedule and Chemtrol Sketch BV-14	2	6
9.0	West Cable Vault (Elevation 735'6") Refer to Penetration Sealing Schedule and Chemtrol Sketch BV-08.	0	23

		Duquesne	Chemtrol
10.0	East Cable Vault (Elevation 735'6") Refer to Penetration Sealing Schedule and Chemtrol Sketch BV-09.	0	49
11.0	Quench Spray Pump Room (Elevation 735'6") Refer to Penetration Sealing Schedule and Chemtrol Sketch BV-10. This one section requires the use of the majority of silicone foam required due to the large openings requiring sealing.	0	12
12.0	Ventilation Room Adjacent to the Quench Spray Pump Room Refer to Penetration Sealing Schedule and Chemtrol Sketch BV-11.	0	5
13.0	Diesel Generating Room (Elevation 735'6") Refer to Penetration Sealing Schedule and Chemtrol Sketch BV-12.	0	9
14.0	River Water Pump House Refer to Penetration Sealing Schedule and Chemtrol Sketch BV-13.	0	1

The above area by area penetration evaluation was a total of 67 penetrations requiring sealing from Duquesne and Chemtrol's list of 207. Due to the nature of the majority of these seals being repair penetrations, it is impossible to state that this is all of the penetrations that will need action. I would suggest that after training is accomplished, that Duquesne Light Company personnel proceed to these specific areas and other areas in the plant to seal all penetrations not previously sealed with cellular concrete. This evaluation represents a fairly accurate summary of the penetrations requiring immediate sealing.

A copy of the purchase order requisition from Mr. Jim Vassello to Mr. J. A. Werlin was given to me on the final day of the evaluation based upon quantities determine by this evaluation. A recap of these quantities as referred on the Purchase Order Requisition are as follows:

	Repairs	Training	Total
CT-18	1800 lbs.	900 lbs.	2700 lbs.
CT-23F	50 lbs.	25 lbs.	75 lbs.
CT-23FB	60 ft^2	150 ft^2	210 ft^2
CT-23B	2 rolls	2 rolls	4 rolls
CT-4C caulking	1 carton	0 carton	1 carton
Installation & tool kit	0	5	5

area and copies of the Penetration Sealing Schedule assigning a specific number to every penetration requiring sealing.

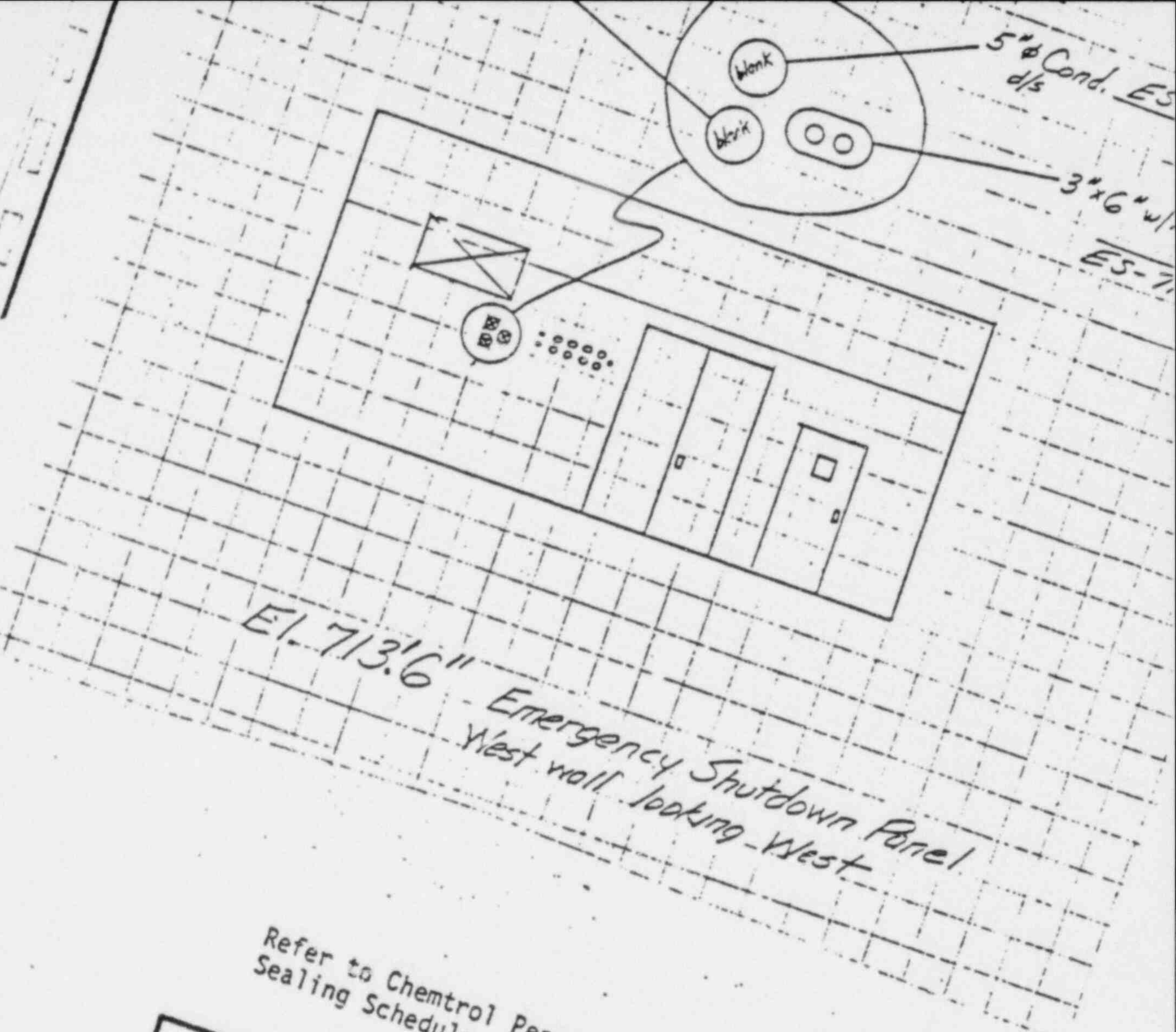
If you have questions regarding this evaluation summary, do not hesitate to contact me.

L. Charles Spriggs

L. Charles Spriggs
Quality Assurance Manager

LCS/me

Enclosure



El. 713'6" Emergency Shutdown Panel
West wall looking West

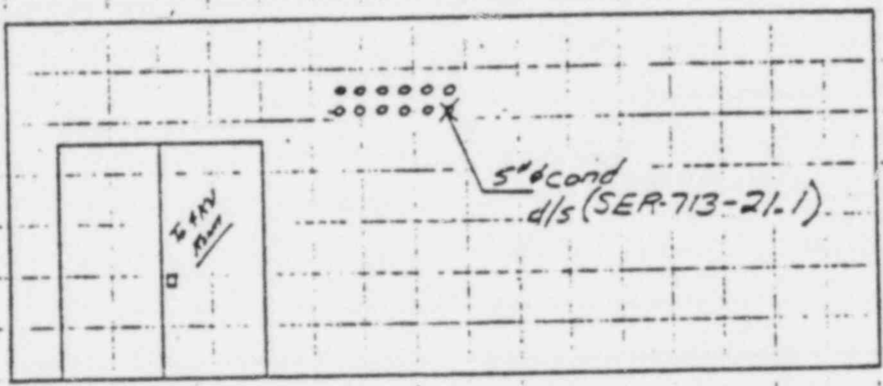
Refer to Chemtrol Penetration
Sealing Schedule Page 8 of

REVISIONS		
NO	DATE	BY
1		
2		
3		
4		
5		

CHEMTROL CORPORATION
Houston, Texas

Beaver Valley - Unit I
Penetration Sealing Evaluation

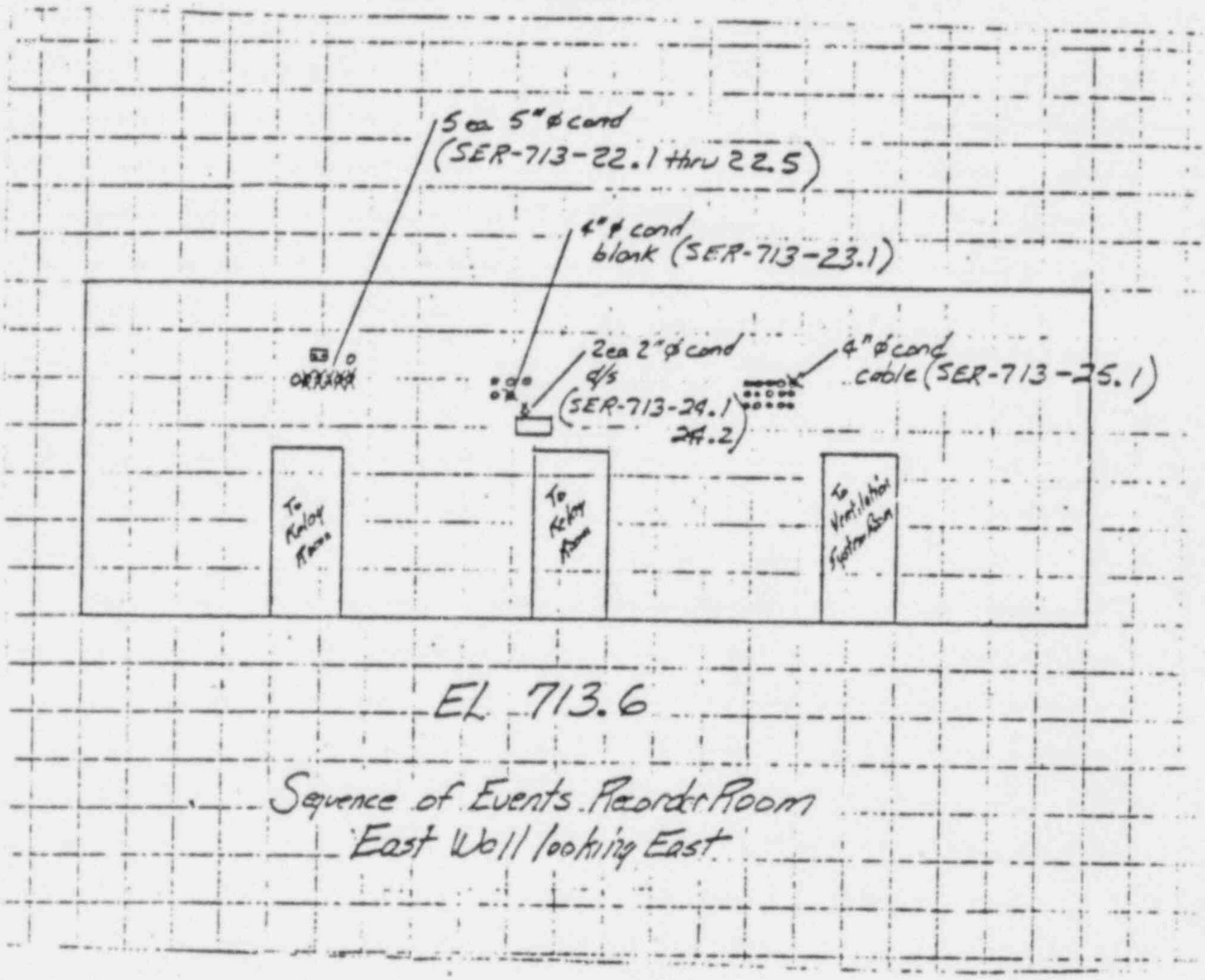
DRAWN BY LCS	SCALE NTS	MATERIAL
CHK'D	DATE 3/16/78	DRAWING NO. Sketch - BV-01
TRACED	APP'D	



EL. 713.6
S.E.R. Rack Room
West Wall looking West

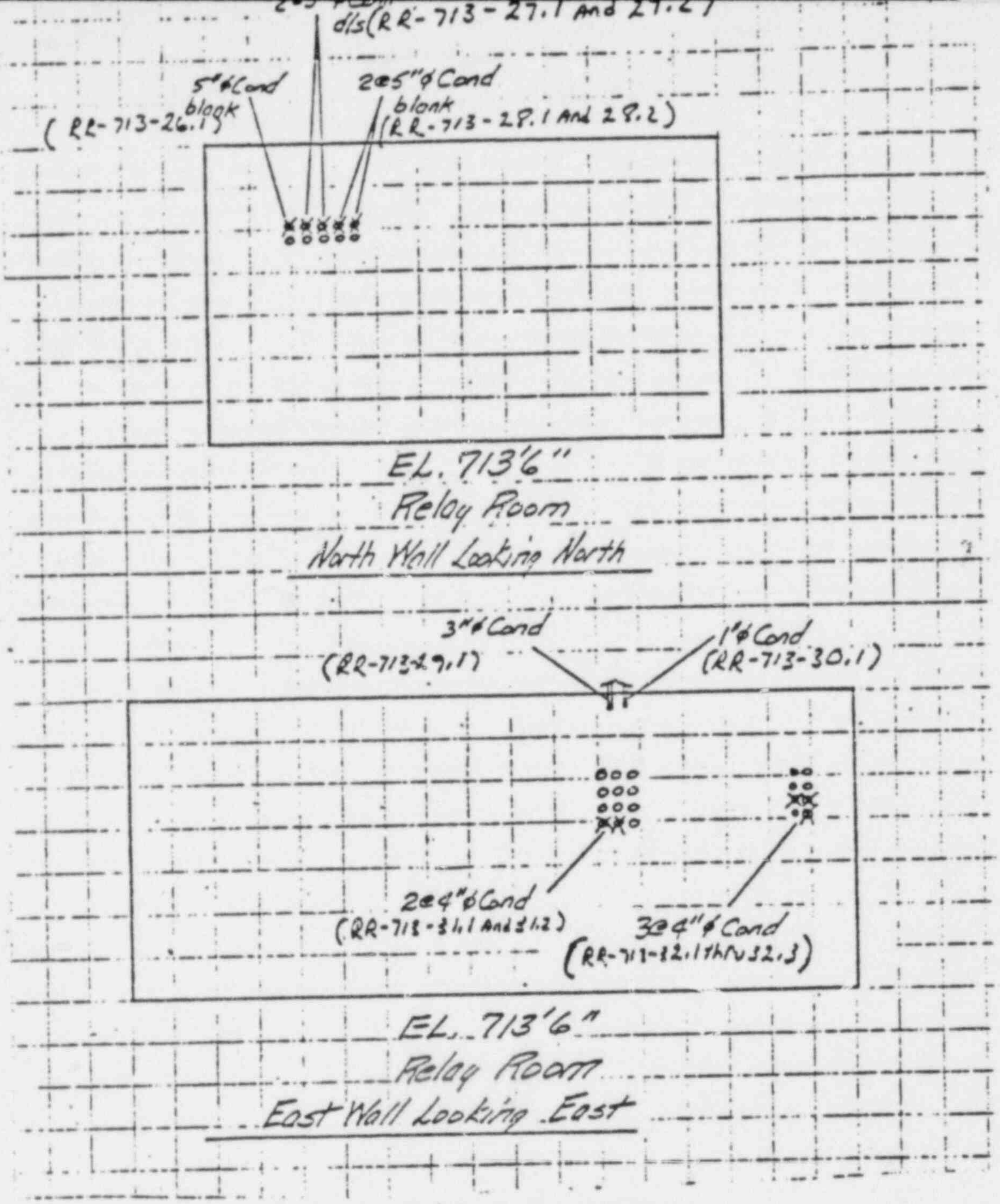
Refer to Chemtrol Penetration
Sealing Schedule Page 8 of

REVISIONS			CHEMTROL CORPORATION Houston, Texas		
NO	DATE	BY			
1			Beaver Valley - Unit I Penetration Sealing Evaluation		
2					
3			DRAWN BY LCS	SCALE NTS	MATERIAL
4			CHK'D	DATE 3/16/78	DRAWING NO. Sketch - BV-02
5			TRACED	APP'D	



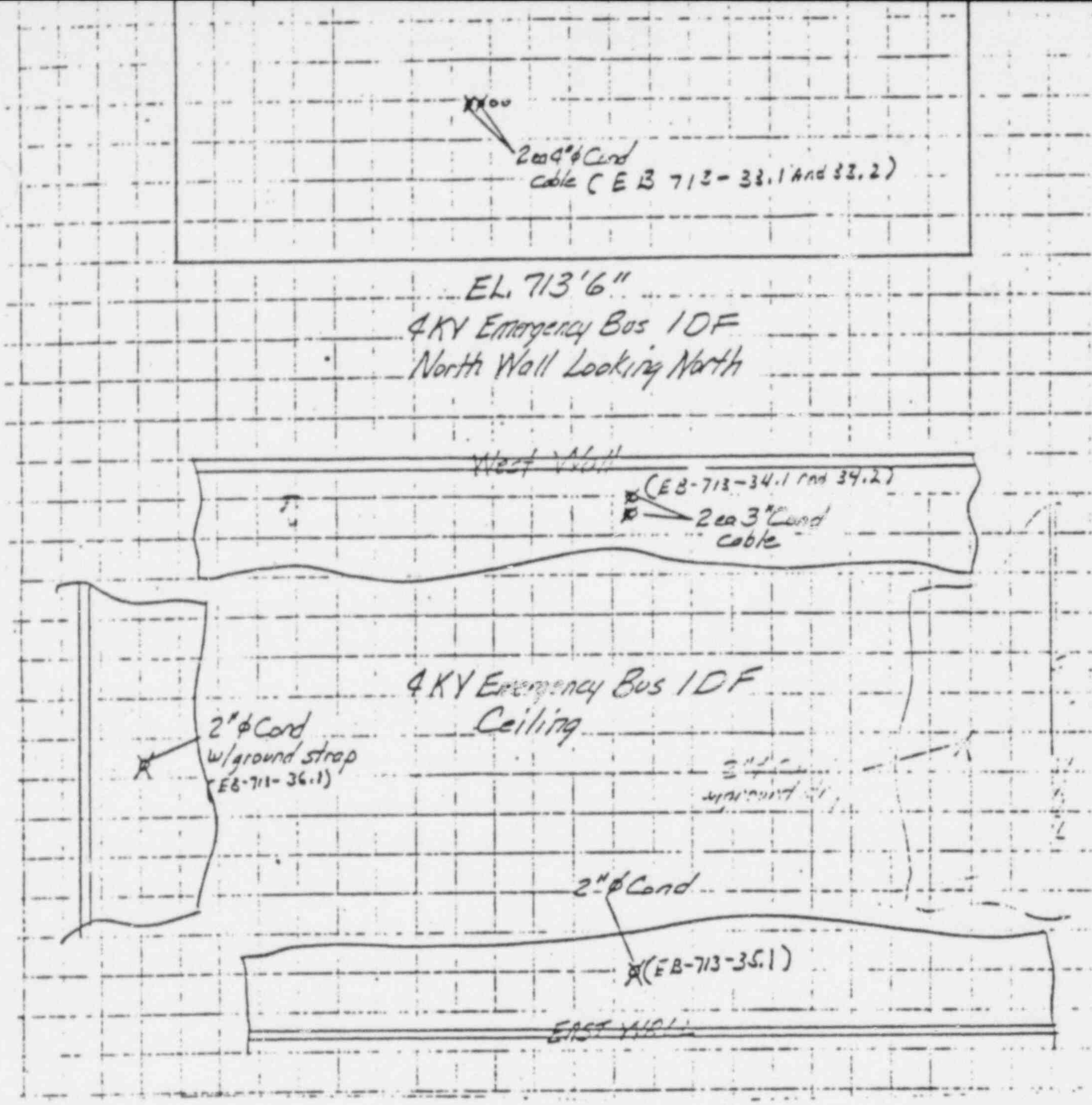
Refer to Chemtrol Penetration
Sealing Schedule Page 8 of

REVISIONS			CHEMTROL CORPORATION Houston, Texas		
NO	DATE	BY			
1			Beaver Valley - Unit I Penetration Sealing Evaluation		
2					
3			DRAWN BY LCS	SCALE NTS	MATERIAL
4			CHK'D	DATE 3/16/78	DRAWING NO. Sketch - BV-03
5			TRACED	APP'D	



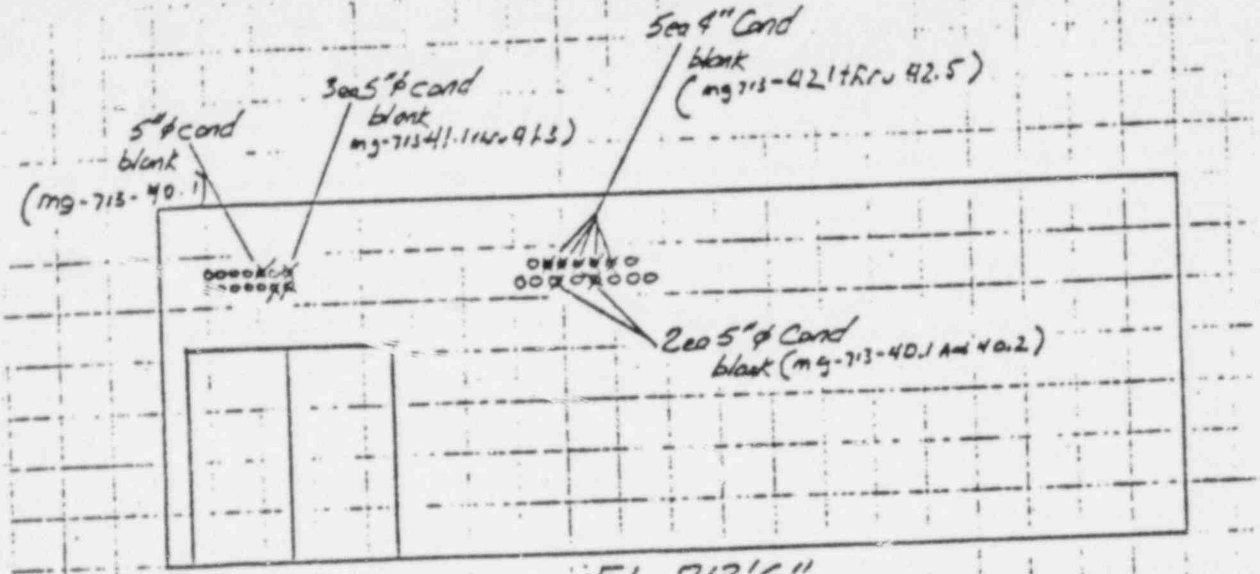
Refer to Chemtrol Penetration
Sealing Schedule Page 9 of

REVISIONS			CHEMTROL CORPORATION Houston, Texas		
NO	DATE	BY			
1			Beaver Valley - Unit I Penetration Sealing Evaluation		
2					
3			DRAWN BY LCS	SCALE NTS	MATERIAL
4			CHK'D	DATE 3/16/78	DRAWING NO.
5			TRACED	APP'D	Sketch - BV-04

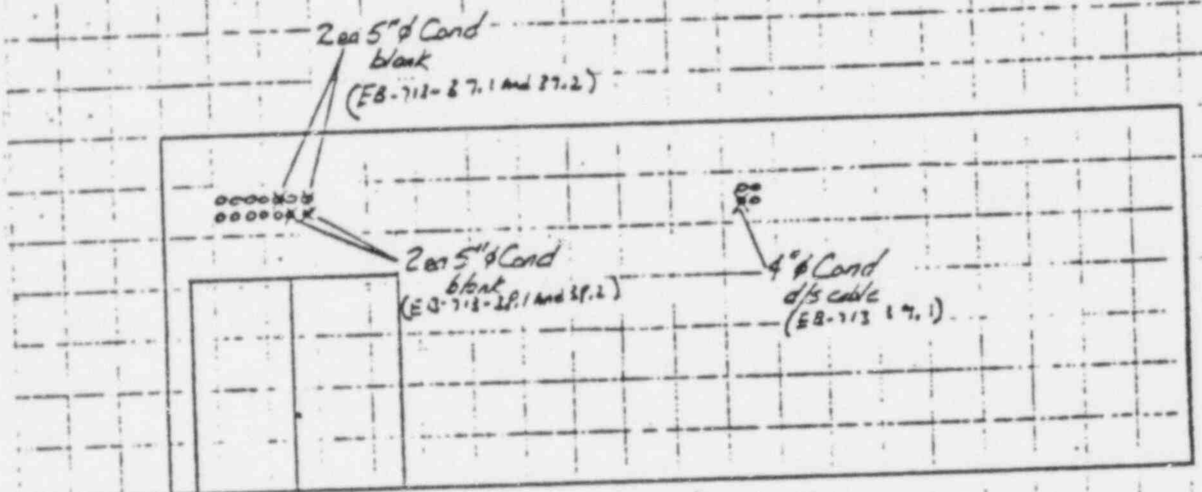


Refer to Chemtrol Penetration
Sealing Schedule Page 11 of

REVISIONS			CHEMTROL CORPORATION Houston, Texas		
NO	DATE	BY			
1			Beaver Valley - Unit I Penetration Sealing Evaluation		
2					
3			DRAWN BY LCS	SCALE NTS	MATERIAL
4			CHK'D	DATE 3/16/78	DRAWING NO. Sketch - BV-05
5			TRACED	APP'D	



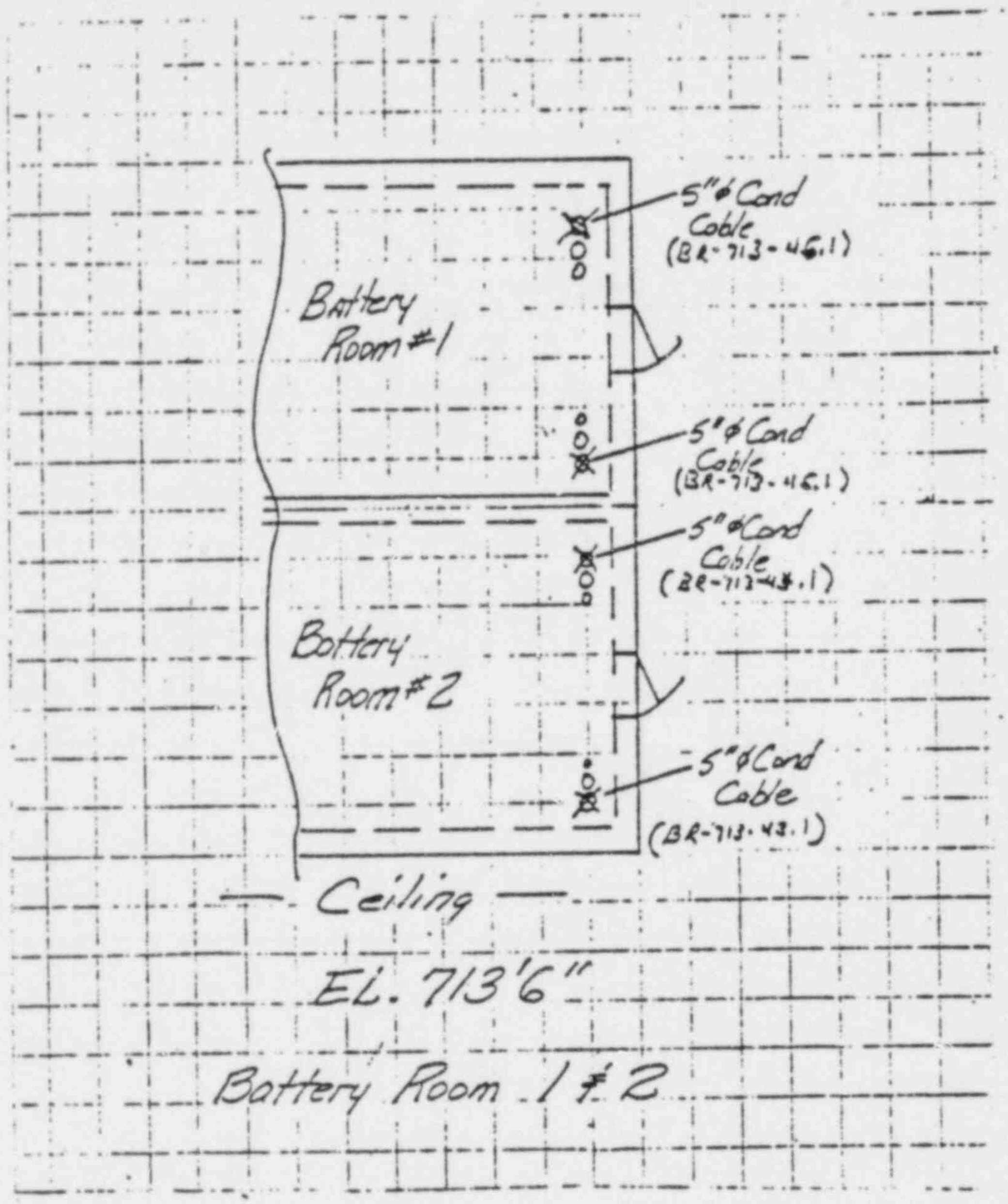
EL. 713'6"
M.G. Set Room
East Wall Looking West



EL 713'6"
4 K.V. IDF Room
East Wall Looking East

Refer to Chemtrol Penetration
Sealing Schedule Page 13 of

REVISIONS			CHEMTROL CORPORATION Houston, Texas		
NO	DATE	BY	Beaver Valley - Unit I Penetration Sealing Evaluation		
1					
2					
3			DRAWN BY LCS	SCALE NTS	MATERIAL
4			CHK'D	DATE 3/16/78	DRAWING NO. Sketch - BV-06
5			TRACED	APP'D	



Refer to Chemtrol Penetration
Sealing Schedule Page 14 of

REVISIONS			CHEMTROL CORPORATION Houston, Texas		
NO	DATE	BY			
1			Beaver Valley - Unit I Penetration Sealing Evaluation		
2					
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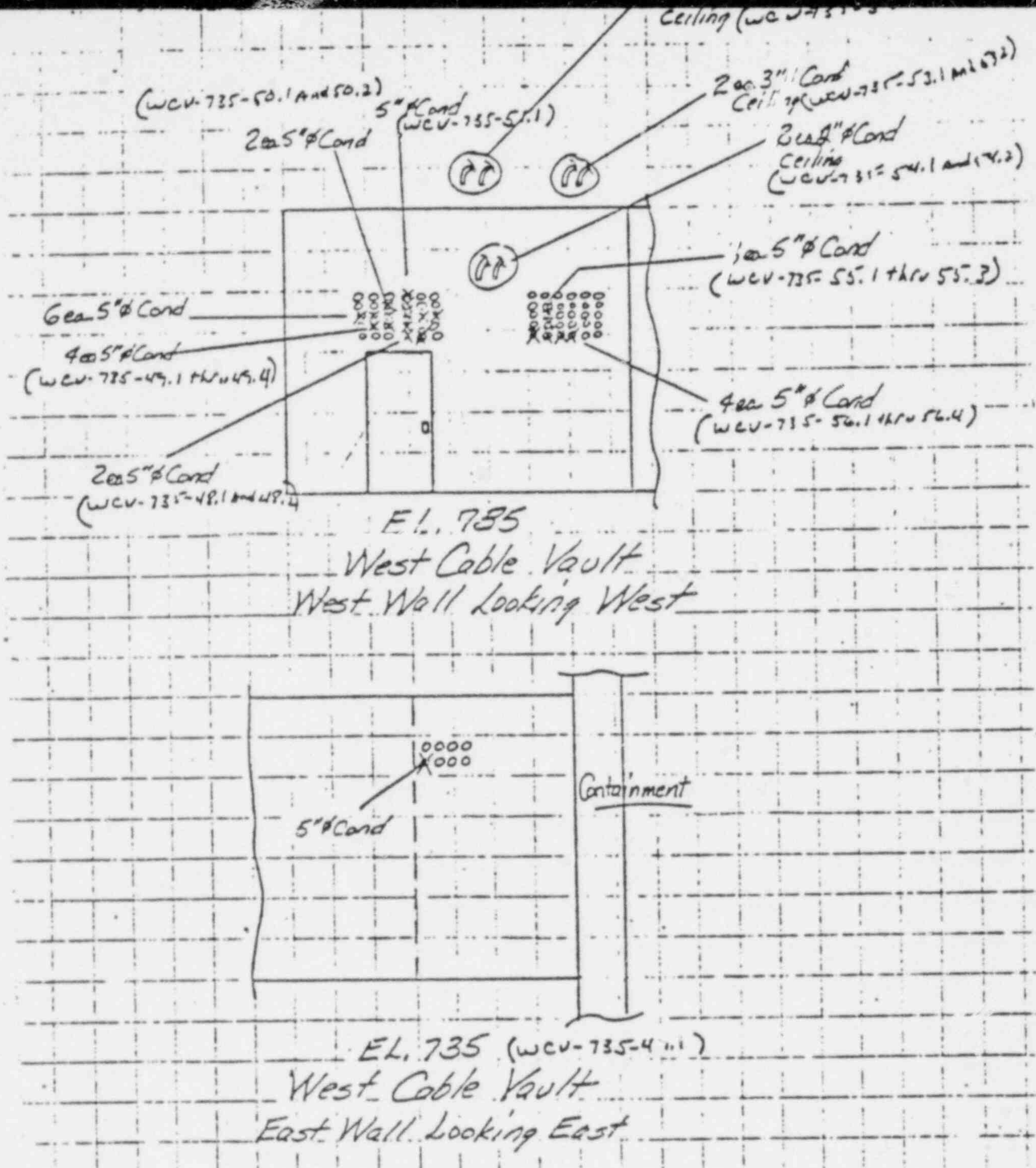
4			CHK'D	DATE 3/16/78	DRAWING NO.
5			TRACED	APP'D	Sketch - BV-07



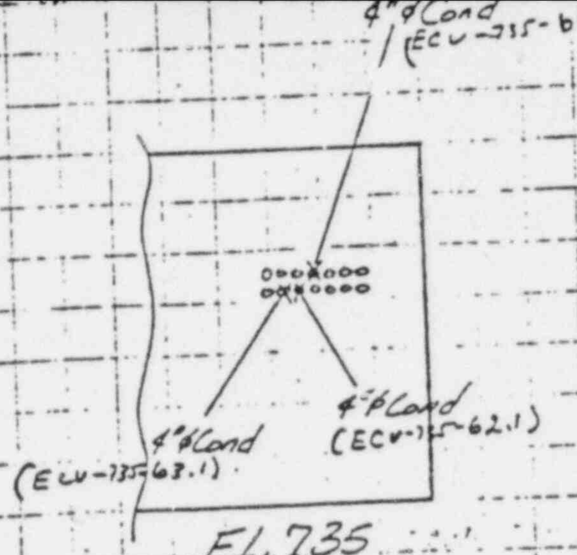
Refer to Chemtrol Penetration
Sealing Schedule Page 15 of

REVISIONS			CHEMTROL CORPORATION Houston, Texas		
NO	DATE	BY			
1			Beaver Valley - Unit I Penetration Sealing Evaluation		
2					
3			DRAWN BY LCS	SCALE NTS	MATERIAL
4			CHK'D	DATE 3/16/78	DRAWING NO.
5			TRACED	APP'D	Sketch - BV-08

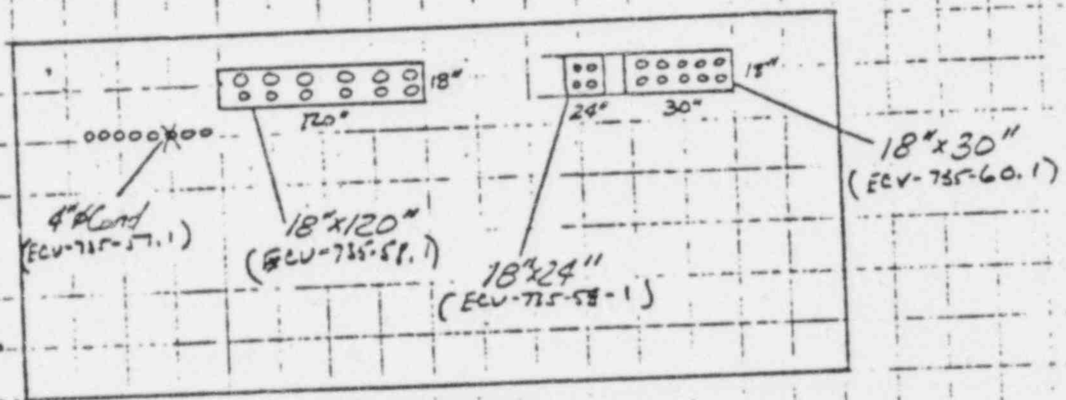
Ceiling Conduits

10 ea. 1"ø Cond
(ECU-735-62.1 thru 62.10)

26 ea 2"ø Cond
(ECU 735-63.1 - 63.26)



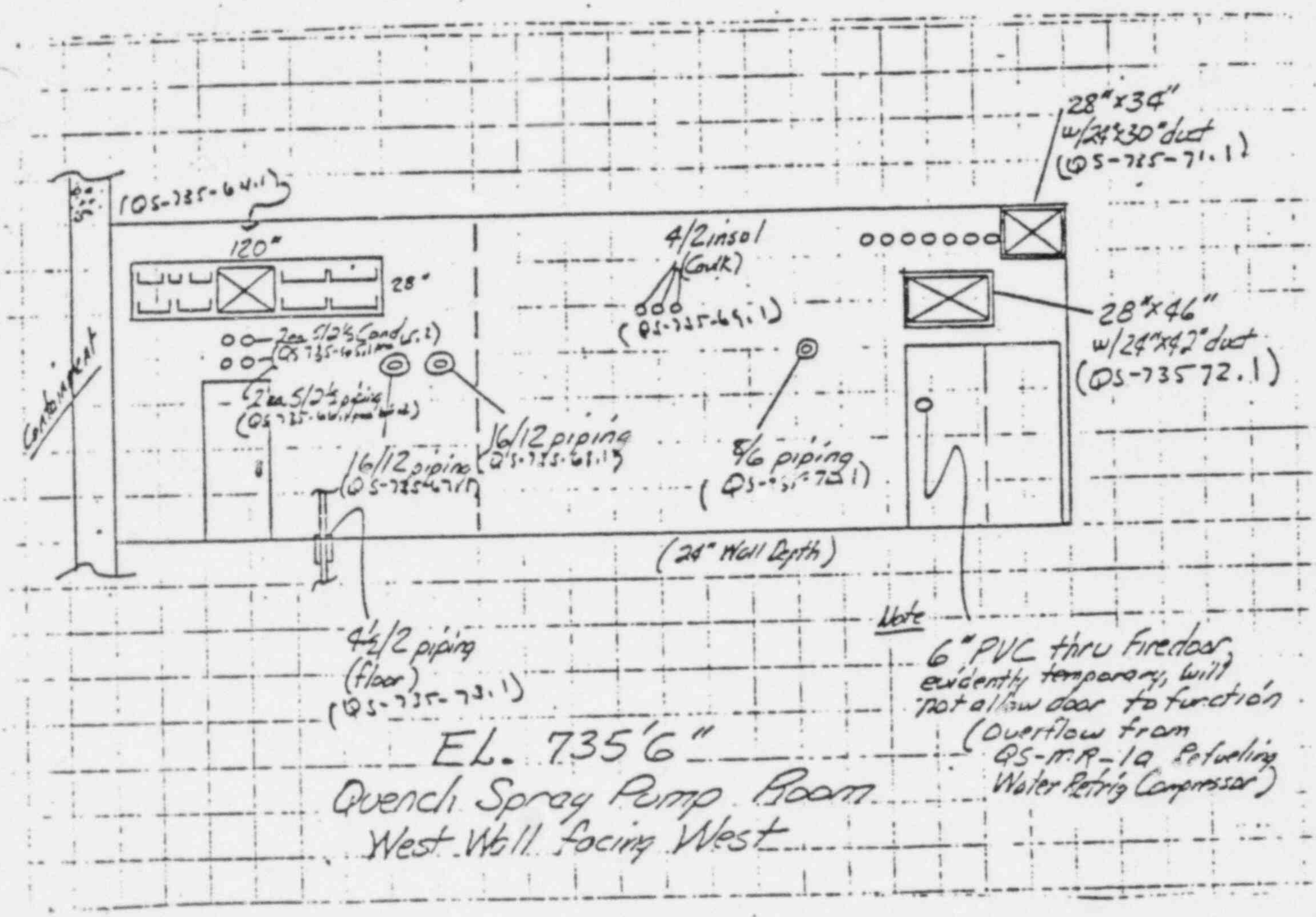
EL. 735
East Cable Vault
West Wall Looking West



EL. 735
East Cable Vault
East Wall Looking East

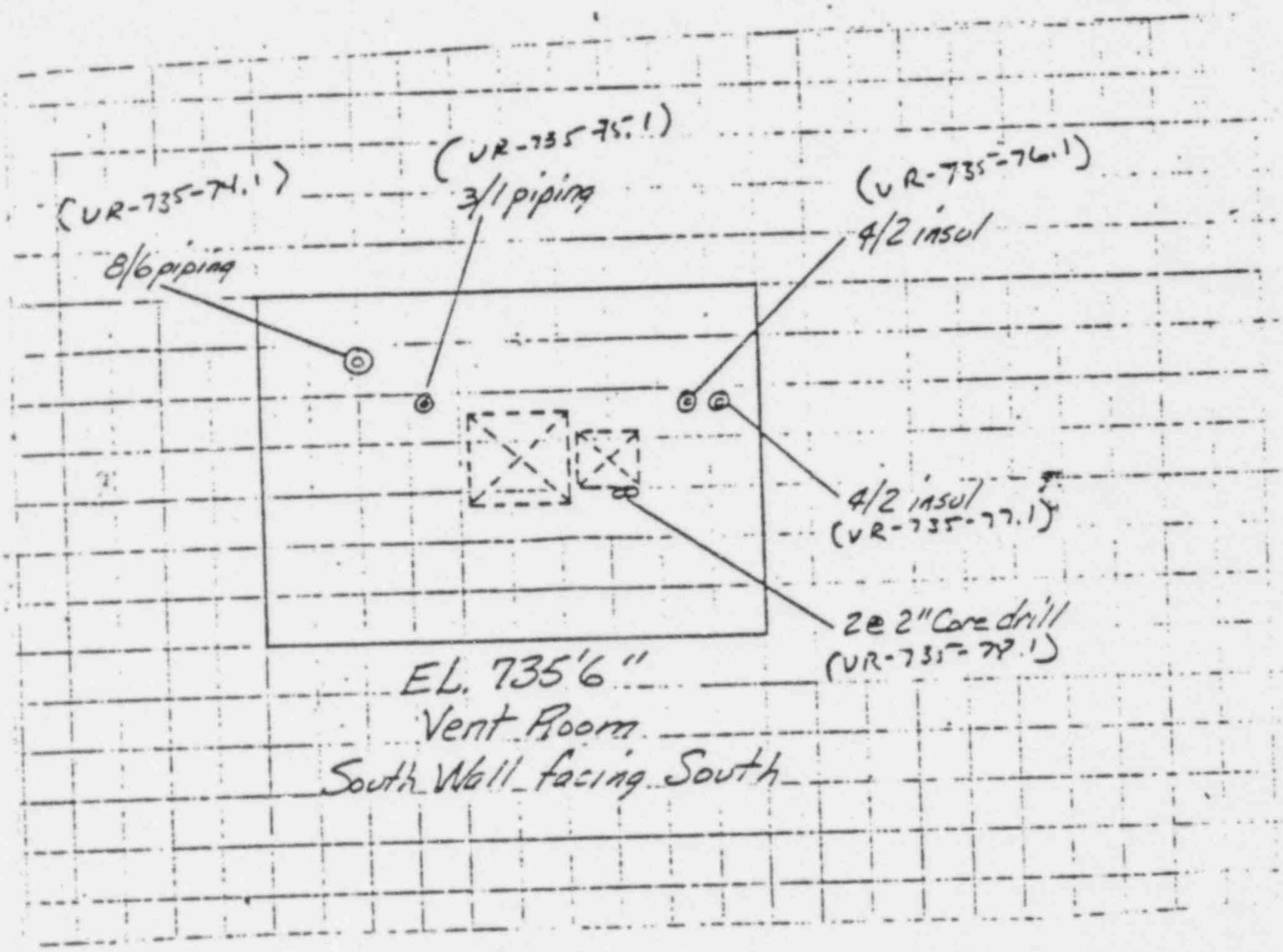
Refer to Chemtrol Penetration
Sealing Schedule Page 17 of

REVISIONS			CHEMTROL CORPORATION Houston, Texas		
NO	DATE	BY			
1			Beaver Valley - Unit I Penetration Sealing Evaluation		
2					
3			DRAWN BY LCS	SCALE NTS	MATERIAL
4			CHK'D	DATE 3/16/	DRAWING NO. Sketch - BV-09
5			TRACED	APP'D	



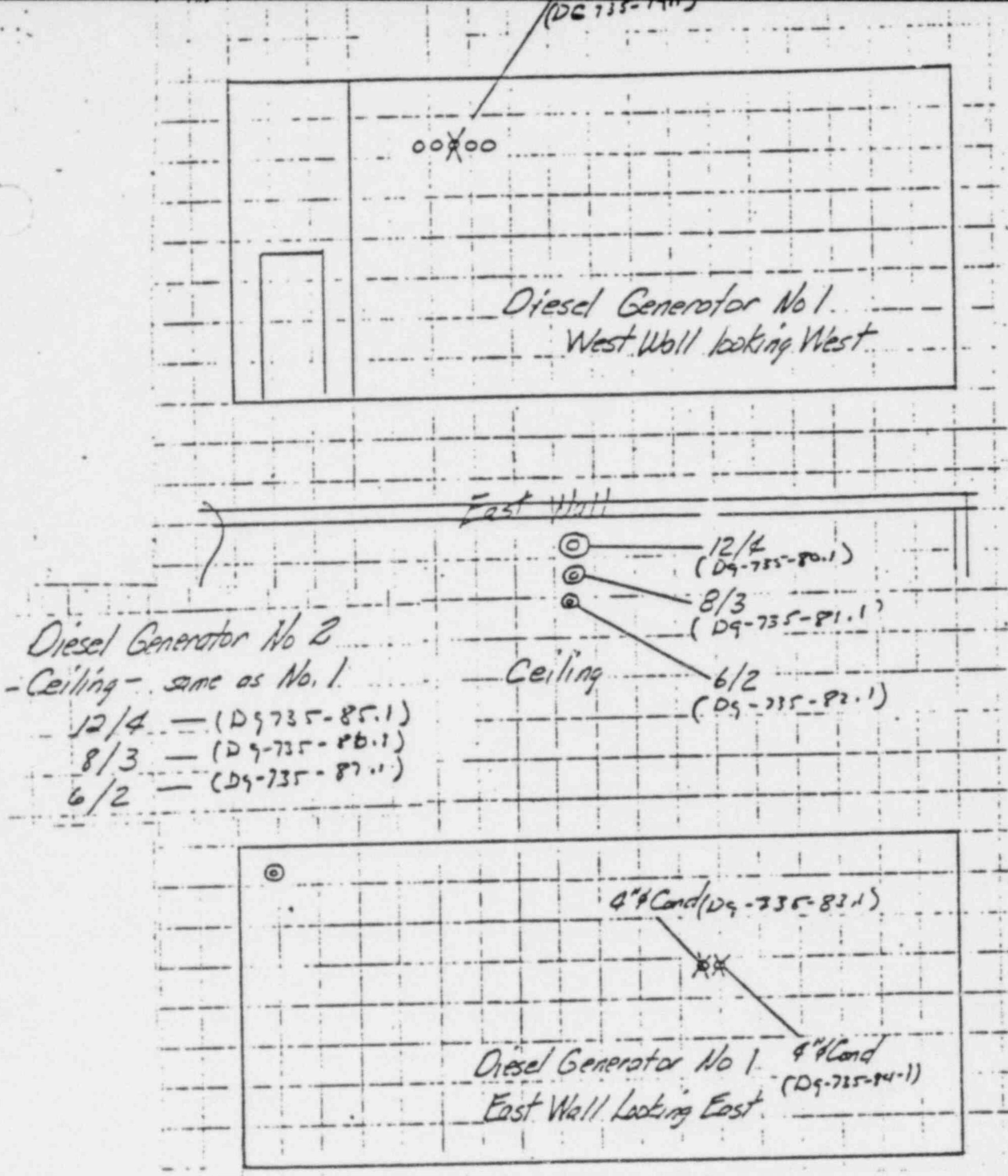
Refer to Chemtrol Penetration
Sealing Schedule Page 18 of

REVISIONS			CHEMTROL CORPORATION Houston, Texas		
NO	DATE	BY			
1			Beaver Valley - Unit I Penetration Sealing Evaluation		
2					
3			DRAWN BY LCS	SCALE NTS	MATERIAL
4			CHK'D	DATE 3/16/78	DRAWING NO. Sketch - BV-10
5			TRACED	APP'D	



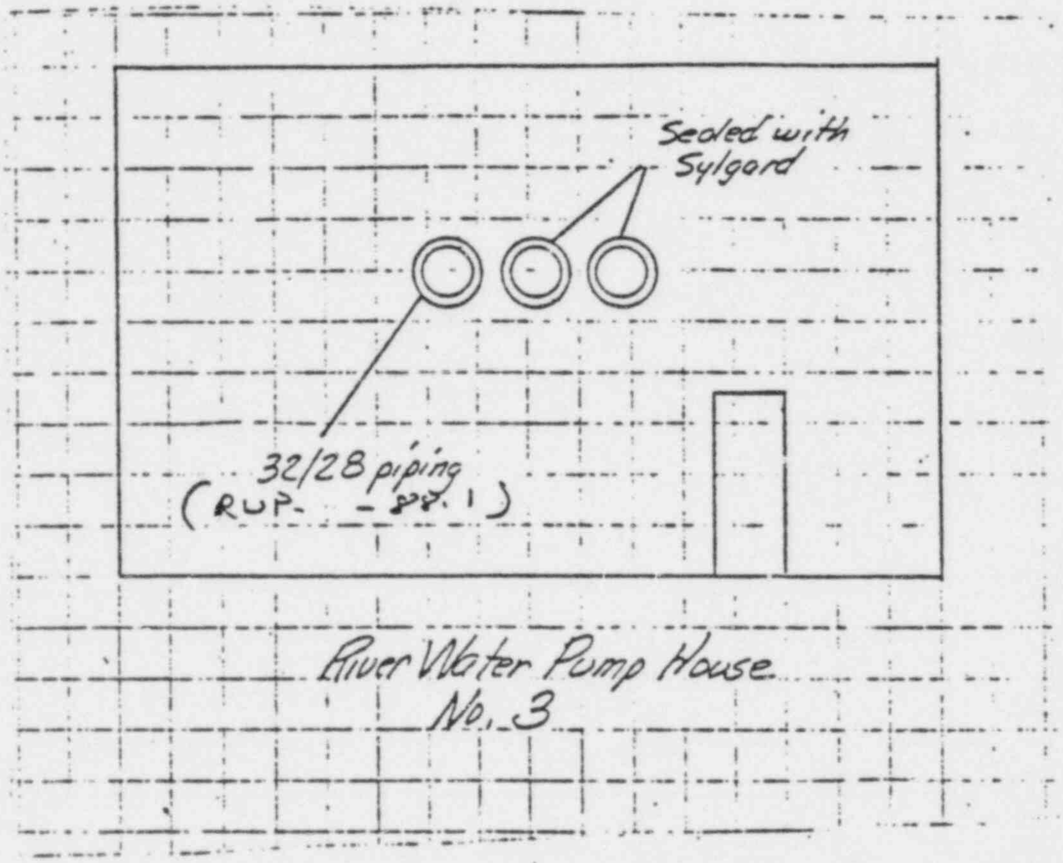
Refer to Chemtrol Penetration
Sealing Schedule Page 19 of

REVISIONS			CHEMTROL CORPORATION Houston, Texas		
NO	DATE	BY	Beaver Valley - Unit I Penetration Sealing Evaluation		
1					
2					
3			DRAWN BY LCS	SCALE NTS	MATERIAL
4			CHK'D	DATE 3/16/78	DRAWING NO.
5			TRACED	APP'D	Sketch BV-11



Refer to Chemtrol Penetration
Sealing Schedule Page 20 of

REVISIONS			CHEMTROL CORPORATION Houston, Texas		
NO	DATE	BY			
1			Beaver Valley - Unit I Penetration Sealing Evaluation		
2					
3			DRAWN BY LCS	SCALE NTS	MATERIAL
4			CHK'D	DATE 3/16/78	DRAWING NO. Sketch - BV-12
5			TRACED	APP'D	



Refer to Chemtrol Penetration
Sealing Schedule Page 21 of

REVISIONS			CHEMTROL CORPORATION Houston, Texas		
NO	DATE	BY			
1			Beaver Valley - Unit I Penetration Sealing Evaluation		
2					
3			DRAWN BY LCS	SCALE NTS	MATERIAL
4			CHK'D	DATE 3/16/78	DRAWING NO.
5			TRACED	APP'D	Sketch - BV-13

Project: Chemtrol #8010

Project Name: Beaver Valley #1

Project Location: Shippingport, PA

Chemtrol Corporation

PENETRATION SEALING SCHEDULE

Date 3/16/78

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
												QUANTITIES					
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENCE	REM
CR	735	01	1	PNL-DC 1	4" Cond.		12"	Cable	Air	CT-18	7"	88 in^3					
CR	735	01	2	PNL-DC 1	4" Cond.		12"	Cable	Air	CT-18	7"	88 in^3					
CR	735	01	3	PNL-DC 1	4" Cond.		12"	Cable	Air	CT-18	7"	88 in^3					
CR	735	02	1	PNL-DC 3 A	4" Cond.		12"	Cable	Air	CT-18	7"	88 in^3					
CR	735	02	2	PNL-DC 3 A	4" Cond.		12"	Cable	Air	CT-18	7"	88 in^3					
CR	735	02	3	PNL-DC 3 A	4" Cond.		12"	Cable	Air	CT-18	7"	88 in^3					
CR	735	02	4	PNL-DC 3 A	4" Cond.		12"	Cable	Air	CT-18	7"	88 in^3					

Project No.: Chemtrol #8010

Project Name: Beaver Valley #1

Project Location: Shippingport, PA

Chemtrol Corporation

PENETRATION SEALING SCHEDULE

Page 2 of

Date 3/16/78

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
												QUANTITIES					
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENCE	REM
CR	735	02	6	PNL-DC 3 B	4" Cond.		12"	Cable	Air	CT-18	7"	88 in^3					
CR	735	03	1	PNL-VITBUS-1	4" Cond.		12"	Cable	Air	CT-18	7"	88 in^3					
CR	735	03	2	PNL-VITBUS-1	4" Cond.		12"	Cable	Air	CT-18	7"	88 in^3					
CR	735	03	3	PNL-VITBUS-1	4" Cond.		12"	Cable	Air	CT-18	7"	88 in^3					
CR	735	04	1	PNL-VITBUS-3	4" Cond.		12"	Cable	Air	CT-18	7"	88 in^3					
CR	735	04	2	PNL-VITBUS-3	4" Cond.		12"	Cable	Air	CT-18	7"	88 in^3					
CR	735	04	3	PNL-VITBUS-3	4" Cond.		12"	Cable	Air	CT-18	7"	88 in^3					

Chemtrol #8010

Project Name: Beaver Valley #1

Project Location: Shippingport, PA

Chemtrol Corporation

PENETRATION SEALING SCHEDULE

Date 3/16/78

1 AREA	2 ELEVATION	3 PENE. NO.	4 PENE. SUB. NO.	5 LOCATION	6 SIZE	7 WALL DEPTH	8 FLOOR DEPTH	9 PENETRATING MEDIUM	10 TYPE SEAL	11 DISPOSITION	12 DEPTH SEAL	13 QUANTITIES SILICONE	14 CT-23	15 BOOT	16 CT-33	17 REFERENCE
CR	735	05	·	LTG-TRF-12	3" Cond.		12"	Cable	CT-18	Air	7"	49 in^3				
CR	735	06	1	LP-512	3" Cond.		12"	Cable	CT-18	Air	7"	49 in^3				
CR	735	06	2	LP-512	3" Cond.		12"	Cable	CT-18	Air	7"	49 in^3				
CR	735	06	3	LP-512	3" Cond.		12"	Cable	CT-18	Air	7"	49 in^3				
CR	735	06	4	LP-512	3" Cond.		12"	Cable	CT-18	Air	7"	49 in^3				
CR	735	07		LTG-TRF-511	3" Cond.		12"	Cable	CT-18	Air	7"	49 in^3				
CR	735	08	1	LP-511	3" Cond.		12"	Cable	CT-18	Air	7"	49 in^3				

Project No.: Chemtrol #8010

Project Name: Beaver Valley #1

Project Location: Shippingport, PA

Chemtrol Corporation

PENETRATION SEALING SCHEDULE

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
												QUANTITIES					
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENCE	REM
CR	735	08	3	LP-511	3" Cond.		12"	Cable	CT-18	Air	7"	49 in^3					
CR	735	08	4	LP-511	3" Cond.		12"	Cable	CT-18	Air	7"	49 in^3					
CR	735	09	1	Building Services Control Room	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3					
CR	735	09	2	Building Services Control Room	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3					
CR	735	09	3	Building Services Control Room	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3					
CR	735	10		Comm.-Con I	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3					
CR	735	11	1	Rad Monitor Panel	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3					

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Project Name: Beaver Valley #1

Project Location: Shippingport, PA

Chemtrol Corporation

PENETRATION SEALING SCHEDULE

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												QUANTITIES					
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENCE	REM
CR	735	11	3	Rad Monitor Panel	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3					
CR	735	12		Operator's Console Operator's Panel	6" Cond.		12"	Cable	CT-18	Air	7"	198 in^3					
CR	735	13	1	RK-Incor-Ins	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3					
CR	735	13	2	RK-Incor-Ins	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3					
CR	735	13	3	RK-Incor-Ins	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3					
CR	735	13	4	RK-Incor-Ins	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3					
CR	735	13	5	RK-Incor-Ins	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3					

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Project Name: Beaver Valley #1

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PENETRATION SEALING SCHEDULE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
												QUANTITIES					
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENCE	REMARKS
CR	735	14	2	RK-Nuc-Ins	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3					
CR	735	15	1	VERTBD C-12	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3					
CR	735	15	2	VERTBD A-17	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3					
CR	735	15	3	VERTBD A-35	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3					
CR	735	16	1	Computer Room West to East P-1	4" Cond.		12"	Blank	CT-18	Air	7"	88 in^3					
CR	735	16	2	Computer Room P-6	4" Cond.		12"	Blank	CT-18	Air	7"	88 in^3					
CR	735	16	3	Computer Room P-2	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3					

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
												QUANTITIES				
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENCE
CR	735	16	5	Computer Room P-5	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3				
CR	735	16	6	Computer Room P-10	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3				
CR	735	16	7	Computer Room W-1	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3				
CR	735	16	8	Computer Room W-3	4" Cond.		12"	Cable	CT-18	Air	7"	88 in^3				
CR	735	16	9	Computer Room W-2	4" Cond.		12"	Blank	CT-18	Air	7"	88 in^3				
CR	735	16	10	Computer Room W-4	4" Cond.		12"	Blank	CT-18	Air	7"	88 in^3 528 in^3				

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PENETRATION SEALING SCHEDULE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
												QUANTITIES					
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENCE	RE
ES	713	20	1	Emerg. Shut Down Panel West Wall	5" Cond.	18"		Blank	Fire	CT-18	7"	138 in^3				BV-01	
ES	713	20	2	Emerg. Shut Down Panel West Wall	5" Cond.	18"		Blank	Fire	CT-18	7"	138 in^3				BV-01	
ES	713	20	3	Emerg. Shut Down Panel West Wall	3" x 6"/ 2@ 1" Cond	18"		Cable	Fire	CT-18	7"	126 in^3				BV-01	
SER	713	21	1	S.E.R. Rack Room West Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138 in^3				BV-02	
SER	713	22	1	S.E.R. Rack Room East Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138 in^3				BV-03	
SER	713	22	2	S.E.R. Rack Room East Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138 in^3				BV-03	
SER	713	22	3	S.E.R. Rack Room East Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138 in^3				BV-03	
				S.E.R. Rack					[illegible]	CT-18	7"	138 in^3				BV-03	

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PENETRATION SEALING SCHEDULE

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												QUANTITIES				
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENC
SER	713	22	5	S.E.R. Rack Room East Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138 in^3				BV-03
SER	713	23	1	S.E.R. Rack Room East Wall	4" Cond.	18"		Cable	Fire	CT-18	7"	88 in^3				BV-03
SER	713	24	1	S.E.R. Rack Room East Wall	2" Cond.	18"		Cable	Fire	CT-18	7"	22 in^3				BV-03
SER	713	24	2	S.E.R. Rack Room East Wall	2" Cond.	18"		Cable	Fire	CT-18	7"	22 in^3				BV-03
SER	713	25	1	S.E.R. Rack Room East Wall	4" Cond.	18"		Cable	Fire	CT-18	7"	88 in^3				BV-03
RR	713	26	1	Relay Room North Wall	5" Cond.	18"		Blank	Fire	CT-18	7"	138 in^3				BV-04
RR	713	27	1	Relay Room North Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138 in^3				BV-04

Chemtrol Corporation

PENETRATION SEALING SCHEDULE

[illegible]: Chemtrol #801D

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												QUANTITIES					
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENCE	REM[illegible]
RR	713	28	1	Relay Room North Wall	5" Cond.	18"		Blank	Fire	CT-18	7"	138 in^3				BV-04	
RR	713	28	2	Relay Room North Wall	5" Cond.	18"		Blank	Fire	CT-18	7"	138 in^3				BV-04	
RR	713	29	1	Relay Room East Wall	3" Cond.	18"		Cable	Fire	CT-18	7"	49 in^3				BV-04	
RR	713	30	1	Relay Room East Wall	1" Cond.	18"		Cable	Fire	CT-18	7"	6 in^3				BV-04	
RR	713	31	1	Relay Room East Wall	4" Cond.	18"		Cable	Fire	CT-18	7"	88 in^3				BV-04	
RR	713	31	2	Relay Room East Wall	4" Cond.	18"		Cable	Fire	CT-18	7"	88 in^3				BV-04	
RR	713	32	1	Relay Room East Wall	4" Cond.	18"		Cable	Fire	CT-18	7"	88 in^3				BV-04	

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PENETRATION SEALING SCHEDULE

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												QUANTITIES				
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSI-TION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENCE
RR	713	32	3	Relay Room East Wall	4" Cond.	18"		Cable	Fire	CT-18	7"	88 in^3				BV-04
EB	713	33	1	4KV Em Bus IDF North Wall	3" Cond.	18"		Cable	Fire	CT-18	7"	49 in^3				BV-05
EB	713	33	2	4KV Em Bus IDF North Wall	3" Cond.	18"		Cable	Fire	CT-18	7"	49 in^3				BV-05
EB	713	34	1	4KV Emerg. Bus IDF Ceiling	3" Cond.	18"		Cable	Fire	CT-18	7"	49 in^3				BV-05
EB	713	34	2	4KV Emerg. Bus IDF Ceiling	3" Cond.	18"		Cable	Fire	CT-18	7"	49 in^3				BV-05
EB	713	35	1	4KV Emerg. Bus IDF Ceiling	2" Cond.	18"		Cable	Fire	CT-18	7"	22 in^3				BV-05
EB	713	36	1	4KV Emerg. Bus IDF Ceiling	2" Cond.	18"		Cable	Fire	CT-18	7"	22 in^3				BV-05

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PENETRATION SEALING SCHEDULE

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												QUANTITIES				
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENCE
EB	713	37	1	4KV-IDF Emerg. Room East Wall	5" Cond.	18"		Blank	Fire	CT-18	7"	138 in^3				
EB	713	37	2	4KV IDF Emerg. Room East Wall	5" Cond.	18"		Blank	Fire	CT-18	7"	138 in^3				
EB	713	38	1	4KV-IDF Emerg. Room East Wall	5" Cond.	18"		Blank	Fire	CT-18	7"	138 in^3				
EB	713	38	2	4KV IDF Emerg. Room East Wall	5" Cond.	18"		Blank	Fire	CT-18	7"	138 in^3				
EB	713	39	1	4KV IDF Emerg. Room East Wall	4" Cond.	18"		Cable	Fire	CT-18	7"	88 in^3				
MG	713	40	1	MG Set Room East Wall	5" Cond.	18"		Blank	Fire	CT-18	7"	138 in^3				
MG	713	41	1	MG Set Room East Wall	5" Cond.	18"		Blank	Fire	CT-18	7"	138 in^3				

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PENETRATION SEALING SCHEDULE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
												QUANTITIES				
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENCE
MG	713	41	3	MG Set Room East Wall	5" Cond.	18"		Blank	Fire	CT-18	7"	138 in^3				BV-06
MG	713	42	1	MG Set Room East Wall	5" Cond.	18"		Blank	Fire	CT-18	7"	138 in^3				BV-06
MG	713	42	2	MG Set Room East Wall	5" Cond.	18"		Blank	Fire	CT-18	7"	138 in^3				BV-06
MG	713	42	3	MG Set Room East Wall	5" Cond.	18"		Blank	Fire	CT-18	7"	138 in^3				BV-06
MG	713	42	4	MG Set Room East Wall	5" Cond.	18"		Blank	Fire	CT-18	7"	138 in^3				BV-06
MG	713	42	5	MG Set Room East Wall	5" Cond.	18"		Blank	Fire	CT-18	7"	138 in^3 828 in^3				BV-06

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PENETRATION SEALING SCHEDULE

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												QUANTITIES				
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENC
BR	713	43	1	Battery Rm 1 & 2 Ceiling	5" Cond.	18"		Cable	Fire	CT-18	7"	138 in^3				BV-07
BR	713	44	1	Battery Rm 1 & 2 Ceiling	5" Cond.	18"		Cable	Fire	CT-18	7"	138 in^3				BV-07
BR	713	45	1	Battery Room 1 & 2 Ceiling	5" Cond.	18"		Cable	Fire	CT-18	7"	138 in^3				BV-07
BR	713	46	1	Battery Room 1 & 2 Ceiling	5" Cond.	18"		Cable	Fire	CT-18	7"	138 in^3				BV-07
WCV	735	47	1	West Cable Vault East Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138 in^3				BV-08
WCV	735	48	1	West Cable Vault West Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138 in^3				BV-08
WCV	735	48	2	West Cable Vault West Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138 in^3				BV-08

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												QUANTITIES				
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENCE
WCV	735	49	2	West Cable Vault West Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138				BV-08
WCV	735	49	3	West Cable Vault West Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138				BV-08
WCV	735	49	4	West Cable Vault West Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138				BV-08
WCV	735	50	1	West Cable Vault West Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138				BV-08
WCV	735	50	2	West Cable Vault West Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138				BV-08
WCV	735	51	1	West Cable Vault West Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138				BV-08
WCV	735	52	1	West Cable Vault Ceiling	4" Cond.	18"		Cable	Fire	CT-18	7"	86				BV-08
				West Cable												

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
												QUANTITIES				
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENC
WCV	735	53	1	West Cable Vault Ceiling	3" Cond.	18"		Cable	Fire	CT-18	7"	49				BV-08
WCV	735	53	2	West Cable Vault Ceiling	3" Cond.	18"		Cable	Fire	CT-18	7"	49				BV-08
WCV	735	54	1	West Cable Vault Ceiling	2" Cond.	18"		Cable	Fire	CT-18	7"	22				BV-08
WCV	735	54	2	West Cable Vault Ceiling	2" Cond.	18"		Cable	Fire	CT-18	7"	22				BV-08
WCV	735	55	1	West Cable Vault West Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138				BV-08
WCV	735	55	2	West Cable Vault West Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138				BV-08
WCV	735	55	3	West Cable Vault West Wall	5"	18"		Cable	Fire	CT-18	7"	138				BV-08

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AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	QUANTITIES SILICONE	QUANTITIES CT-23	QUANTITIES BOOT	QUANTITIES CT-33	REFEREN
WCV	735	56	2	West Cable Vault West Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138 in^3				BV-08
WCV	735	56	3	West Cable Vault West Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138 in^3				BV-08
WCV	735	56	4	West Cable Vault West Wall	5" Cond.	18"		Cable	Fire	CT-18	7"	138 in^3				BV-08
ECV	735	57	1	East Cable Vault East Wall	4" Cond.	18"		Cable	Fire	CT-18	7"	88 in^3				BV-08
ECV	735	58	1	East Cable Vault East Wall	18"x120"	18"		Cond.	Fire	CT-18	11"	13.75ft^3				BV-09
ECU	735	59	1	East Cable Vault East Wall	18"x24"	18"		Cond.	Fire	CT-18	11"	2.75ft^3				BV-09
ECU	735	60	1	East Cable Vault East Wall	18"x30"	18"		Cond.	Fire	CT-18	11"	3.44ft^3				BV-09

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												QUANTITIES				
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENCE
ECV	735	62	1	East Cable Vault West Wall	4" Cond.	18"		Cable	Fire	CT-18	7"	88 in^3				BV-09
ECV	735	63	1	East Cable Vault West Wall	4" Cond.	18"		Cable	Fire	CT-18	7"	88 in^3				BV-09
ECV	735	62	1-10	East Cable Vault Ceiling	1" Cond.	18"		Cable	Fire	CT-18	7"	60 in^3				BV-09
ECV	735	63	1-26	East Cable Vault Ceiling	2" Cond.	18"		Cable	Fire	CT-18	7"	572 in^3				BV-09
QS	735	64	1	Quench Spray Pump Room West Wall	28"x120"	18"		Cable	Fire	CT-18	11"	21.4ft^3				BV-10
QS	735	65	1-2	Quench Spray Pump Room West Wall	5/2 1/2	18"		Cable	Fire	CT-18	7"	276 in^3				BV-10
QS	735	66.1	1-2	Quench Spray Pump Room West Wall	5/2 1/2	18"		Cable	Fire	CT-18	7"	276 in^3				BV-10

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
												QUANTITIES				
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENCE
QS	735	68	1	Quench Spray Pump Room	16/12	18"		Pipe	Fire	CT-18	11"	1.3 ft^3				BV-10
QS	735	69	1	Quench Spray Pump Room	4/2	18"		Pipe	Fire	CT-18	7"	88 in^3				BV-10
QS	735	70	1	Quench Spray Pump Room	8/6	18"		Pipe	Fire	CT-18	7"	.32 ft^3				BV-10
QS	735	71	1	Quench Spray Pump Room	28"x34" 24'x30" duct	18"		Duct	Fire	CT-18	11"	1.6 ft^3				BV-10
QS	735	72	1	Quench Spray Pump Room	28"x46" 24"x42" duct	18"		Duct	Fire	CT-18	11"	1.9 ft^3				BV-10
QS	735	73	1	Quench Spray Pump Room Floor	4 1/2/2"	18"		Piping	Fire	CT-18	7"	111 in^3				BV-10
VR	735	74	1	Vent Room South Wall	8/6	18"		Piping	Fire	CT-18	7"	.32 ft^3				BV-11

Project No.: Chemtrol #8010

Project Name: Beaver Valley #1

Project Location: Shippingport, PA

Chemtrol Corporation

PENETRATION SEALING SCHEDULE

Date 3/16/7

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
												QUANTITIES				
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFERENCE
VR	735	76	1	Vent Room South Wall	4/2	18"		Pipe	Fire	CT-18	7"	88 in^3				BV-11
VR	735	77	1	Vent Room South Wall	4/2	18"		Pipe	Fire	CT-18	7"	88 in^3				BV-11
VR	735	78	1	Vent Room South Wall	2" Core Bore	18"		Blank	Fire	CT-18	7"	22 in^3				BV-11
DG	735	79	1	Diesel Gen. Bldg. No. 1 West Wall	4" Cond.	18"		Cable	Fire	CT-18	7"	88 in^3				BV-12
DG	735	80	1	Diesel Gen. Bldg. No. 1 Ceiling	12/4	18"		Cable	Fire	CT-18	7"	.72 ft^3				BV-12
DG	735	81	1	Diesel Gen. Bldg. No. 1 Ceiling	8/3	18"		Cable	Fire	CT-18	7"	352 in^3				BV-12
DG	735	82	1	Diesel Gen. Bldg. No. 1 Ceiling	6/2	18"		Cable	Fire	CT-18	7"	197 in^3				BV-12

........: Chemtrol #8010

Project Name: Beaver Valley #1

Project Location: Shippingport, PA

Chemtrol Corporation

PENETRATION SEALING SCHEDULE

Date 3/16/7

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
												QUANTITIES				
AREA	ELEVATION	PENE. NO.	PENE. SUB. NO.	LOCATION	SIZE	WALL DEPTH	FLOOR DEPTH	PENETRATING MEDIUM	TYPE SEAL	DISPOSITION	DEPTH SEAL	SILICONE	CT-23	BOOT	CT-33	REFEREN
DG	735	84	1	Diesel Gen. East Wall	4" Cond.	18"		Cable	Fire	CT-18	7"	88 in^3				BV-12
DG	735	85	1	Diesel Gen. #2 Ceiling	12/4	18"		Cable	Fire	CT-18	7"	.72 ft^3				BV-12
DG	735	86	1	Diesel Gen. #2 Ceiling	8/3	18"		Cable	Fire	CT-18	7"	352 in^3				BV-12
DG	735	87	1	Diesel Gen. #2 Ceiling	6/2	18"		Cable	Fire	CT-18	7"	198 in^3				BV-12
RWP	735	88	1	River Water Pump House #3 East Wall	32/28	18"		Cable	Fire	CT-18	7"	1.2 ft^3				BV-13

PF-4

Fire Detector in Control Room Cabinets and Consoles (F-2)

Each of safety-related cabinets and consoles in the control room should be provided with a fire detector.

RESPONSE

The area is continuously manned and, therefore, it does not require fire detectors.

PF-5

Battery Room Ventilation Air Flow Monitor (F-7)

A ventilation air flow monitor should be installed in each of the station battery rooms to alarm and annunciate, in the control room, the loss of ventilation air flow.

RESPONSE

A position indication switch will be installed on each damper which would, when failed, cause loss of ventilation air to any one battery room. These switches will alarm and annunciate in the control room when any one ventilation path is lost. These fans have alarmed control room indicators for fan trip as well as indicating lights for fan running condition (see page 73 of the Fire Protection Program Review, Position F.7).

PCA Research Bulletin 223[(1)*]. Thermocouple locations were 1/4-, 1/2-, 1-, 2- and 3-in. from the heated surface. A Monfore-type humidity well[(2)] was located in the slab so that the moisture condition of the concrete could be determined at mid-depth.

Information on proportions of the concrete mix was furnished by the sponsor. These data are given in Table 1. All components of the concrete were supplied on site by the sponsor. During casting of the specimen, three 6-in. diameter by 12-in. high cylinders were made for strength determinations.

Forms were stripped from the specimen after one day. The concrete was moist-cured under damp burlap for 7 days. The slab specimen and cylinders were then protected with foamed plastic material and carefully crated for shipment. On October 4, 1975, they were shipped to the Portland Cement Association. In this case, a 6x12-in. cylinder was not supplied by the sponsor to Pittsburgh Testing Laboratory in Portland, Oregon, for an 8-day moist-cured compressive strength determination.

METHOD OF TEST

The slab specimen and cylinders were received at the PCA Fire Research Laboratory on October 16, 1975. After uncrating, the slab specimen along with the companion cylinders were placed in a room maintained at 70 to 80F and 30 to 40% relative humidity for drying. After 28 days of drying, compressive strength was determined from tests of 2 of the cylinders. The slab specimen and the remaining cylinder were dried until the relative humidity

*Superscript numbers in parentheses designate references on Page 19.