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HIGH ENERGY LINE BREAK (HELB)
EVALUATION REPORT
(EFFECT ON NONSAFETY-RELATED CONTROL COMPONENTS)

River Bend Station - Unit 1
Gulf States Utilities Company
West Feliciana Parish, Louisiana

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this study was to verify that the effects of any high energy line break (HELB) on any nonsafety-related control systems in River Bend Station (RBS) do not result in an event more severe than the events analyzed in Chapter 15 of the RBS Final Safety Analysis Report (FSAR).

1.2 SCOPE OF STUDY

The scope of this HELB analysis was restricted to HELBs and their impact on those components of nonsafety-related control systems which could initiate a reactor transient. A list of such components was developed based on the system elimination criteria presented in Section 2.1 and the component elimination criteria identified in Section 2.2 of this report. HELB zones containing both control systems components of interest and HELB locations were defined using the appropriate Environmental Design Criteria (EDC) zone maps as a guide, as described in Section 2.4 of this report. Each HELB zone was analyzed, the results summarized, and final conclusions and recommendations are presented in Section 3.0.

1.3 SUMMARY

A systematic study has been conducted to determine the consequences of postulated HELBs and their effects on nonsafety-related control system components located in the affected zone. The detailed analysis (Appendix D) describes each of the postulated HELB events and their limiting effects on the reactor parameters. The detailed analysis in Appendix D is summarized in Section 3.0. With the exception of the loss of feedwater heating exacerbated by a turbine trip, the effects of the postulated HELB/control systems failures events are less severe than the Unacceptable Results for Incidents of Moderate Frequency - Anticipated Operational Transients presented in FSAR Chapter 15. It is concluded that safe reactor shutdown is ensured for all events postulated herein, and the consequences of these events do not result in any significant risk to the health and safety of the public.

2.0 METHODOLOGY

The following criteria and assumptions were used to develop the scope of work for the subject HELB analysis:

1. Identify all nonsafety control systems and components which could impact the critical reactor parameters (e.g., water level, pressure, critical power ratio).

2. Identify high energy lines and their postulated break locations and evaluate consequences.

3. Identify the plant zones which contain both HELB locations and control systems components determined in Item 1 above.

4. Postulate pipe breaks in each of the zones defined, determine which control systems components are affected, and analyze the consequences of failure of the control systems components.

5. Combine the effects of the HELB with potential, simultaneous malfunctions of control systems components in the postulated HELB zone and determine the effects on the critical reactor parameters.

6. Verify that the effects on critical reactor parameters are enveloped by the analyses in Chapter 15 of the FSAR.

7. Identify any postulated events that are beyond Chapter 15 analyses and recommend corrective actions.

2.1 SYSTEM ELIMINATION

All nonsafety-related control grade systems which may affect the critical reactor parameters have been included in the HELB analysis, and the following elimination criteria were applied to exclude some of the systems. Some safety-related systems with a postulated HELB of QA Category I piping leading to failure of nonsafety grade control components, such as the residual heat removal system, have also been included in the analysis. The elimination criteria and bases identified for RBS are as follows:

Elimination Criteria	Basis
N1	Nonelectrical systems, i.e, mechanical and structural systems comprised only of structural steel, piping, tanks, cranes, and similar equipment.
N2	Instrumentation systems with no direct or indirect controlling function, such as the annunciator system. Instrumentation and dedicated inputs to the process computer, as well as the computer itself, are excluded.
N3	Control systems that interface or interact with the reactor operating system but have no direct or indirect effect on reactor parameters, such as ventilation systems.
N4	Control systems that do not interact or interface with reactor operation or reactor parameters either directly or indirectly, such as communications, lighting, etc.

N5 Systems which are used during shutdown or refueling mode.

N6 Electrical systems and components involved in power distribution or transformation the loss of which will not impact the reactor parameters or safety system performance.

N7 All safety-related systems, without high energy lines or with high energy lines away from control components.

A list of all systems with the elimination criteria identified is included in Appendix A.

2.2 COMPONENT ELIMINATION

Instruments and components for those systems which are eliminated under system elimination criteria are excluded from the list of plant components.

The following elimination criteria are applied to the remaining components to arrive at the final list of components considered in the detailed HELB analysis. The appropriate system piping and instrumentation diagrams and elementary diagrams have been used to aid in this elimination.

1. Mechanical components (e.g., structural steel, tanks, pipes, valves) are not considered control systems components subject to failure. However, instrument taps and tubing for components of interest, which may be physically located on mechanical components, are included.

2. Instruments and other dedicated inputs to the process computer are eliminated.

3. Components that provide only position status information and do not perform any control function are eliminated. This includes position switches on air- and motor-operated valves which are not interlocked with other equipment.

4. Components that provide only indication and/or inputs for alarms or recording devices are eliminated.

In general, initiating type control components, such as elements, switches, transmitters, controllers, and converters, are included in the detailed HELB analysis, along with their related taps and process tubing. Motor control centers (MCC) in the affected zones were considered as components subject to failure and were reviewed for MCC-mounted control components or power supply to components of interest. No nonsafety grade control system component in this analysis is mounted in or powered directly from an MCC, and MCCs were, therefore, eliminated.

A list of components which have been considered for analysis based on the above criteria and their control functions are included in Appendix B.

2.3 HIGH ENERGY PIPE CRITERIA

The criteria for determining high energy lines used in the study were based on criteria established in Section 3.6 of the RBS FSAR. High energy piping is defined as those fluid systems that during normal plant conditions, either are in operation or are maintained pressurized under conditions where either or both of the following are met:

1. Maximum operating temperature exceeds 200°F

2. Maximum operating pressure exceeds 275 psig

Those high energy lines that operate above these limits for less than 2 percent of the time and are required to perform their intended function are classified as moderate energy lines and, therefore, are excluded from the scope of this study. Piping whose diameter is 1-in. NPS or smaller is also excluded.

A list of all the high energy lines considered for this analysis is included in Appendix C.

2.4 ZONE DETERMINATION

For the purpose of this analysis, the EDC zone map was used for identifying normal operating environmental zones. These EDC zones were subdivided into HELB zones which are open areas bounded by walls, ceiling, floors, etc. Each HELB zone is uniquely identified. Certain HELB zones extend between elevations because some floor elevations consist of open grating or a hoist opening is common to all the floors.

Though the turbine enclosure is divided into discrete zones with unique identification, it was determined during plant walkdown that the doors are not sufficiently pressure tight. A HELB event in a small cubicle can conceivably blow out the door and the temperature transient may fail all nonsafety grade instruments in the adjoining larger volume zone. However, a pipe break in a large-volume zone will not impact its neighboring cubicled zone because the larger volume and more outlets associated with it provide easier alternate paths of energy dissipations. These considerations have been factored into this analysis by combining the following zones:

1. Zones XV and VIII combined for a break in Zone XV
2. Zones XVI and VIII combined for a break in Zone XVI
3. Zones XI and I combined for a break in Zone XI
4. Zones XII and I combined for a break in Zone XII
5. Zones V and VIII combined for a break in Zone V

6. Zones VI and VIII combined for a break in Zone VI
7. Zones XX and VIII combined for a break in Zone XX
8. Zones 13 and 15 combined for a break in Zone 13

Zone 16 with low temperature, high-pressure condensate (CND) and condensate demineralizer (CNM) system piping only will not similarly impact the adjoining Zone VIII and has, therefore, been excluded from the foregoing consideration. For the same reasons CND, CNM, and CNA (auxiliary condensate) system HELB events have been excluded from the zone interaction listed above.

The sacrificial approach used througout the analysis assumed that any HELB within a defined zone would impact all control system components in the zone. Because of the large area covered by Zones III and VIII, the potential impact of a line break was further analyzed to verify if a break at one end of the turbine building can realistically fail nonsafety grade components located at the other end with intervening barriers, such as pipes, walls, turbine casing, etc. It was determined that in the condenser and heater bay areas, a pipe break may affect the components in only a confined portion of an "architecturally" defined zone. While the distance between the postulated break on high energy line and control components precludes the possibility of physical damage to components due to pipe whip and jet impingement, the bays allow for the adverse environment associated with the break to spread throughout the condenser or heater bay, which is a large open zone, minimizing the environmental effects.

Therefore, even though no air/steam/water boundary exists in the condenser and heater bay areas, the above consideration has been used in the analysis of Zones III and VIII and the sacrificial approach applied within the confines of the zone determined above.

For the reactor enclosure, a list of the nonsafety components which affect the reactor parameters was made. The locations of the components were then checked to determine whether these components are affected by any HELB event in their vicinity, and the consequence of their failure was analyzed. The only high energy line which is found to affect any nonsafety grade control component belongs to the control rod drive system at the 114 ft 0 in. level, and based on the zone criteria outlined above, the reactor enclosure was divided into two zones, C1 and C2.

Reactor core isolation cooling (ICS) (steam side), reactor water cleanup (WCS), and residual heat removal (RHS) (steam condensing mode) system piping are the only sources of HELB events in the auxiliary building and are capable of producing temperature transients to fail all nonsafety grade instruments in the zones identified in the EDC report. A review of the relevant drawings identified six zones to be considered for analysis.

All areas of the radwaste, diesel generator enclosures, and control building were eliminated from analysis due to the absence of high energy lines in these areas. The main steam tunnel has also been excluded because it contains no nonsafety grade instruments. The auxiliary boiler enclosure has been eliminated because it contains auxiliary steam system components, and a HELB failure can lead to a single system failure only.

The fuel handling building has some control components at elevation 70 ft 0 in. in the vicinity of high energy piping associated with the control rod drive (CRD) system and are therefore subject to failure due to a HELB event in the CRD system. However, the control components also belong to the CRD system, and a HELB event will result in a single system failure. The fuel handling building has therefore been eliminated.

2.5 PIPE BREAK LOCATION AND EFFECTS

2.5.1 Pipe Break Location

The high energy pipes identified in Appendix C are assumed to break at all locations where control systems components of interest (as defined in Section 2.2) are physically located in the same zone as the high energy piping, unless piping runs subject to high stress have been specifically identified and analyzed as a result of the studies in FSAR Section 3.6. Piping evaluated by means of previous HELB studies (see FSAR Section 3.6) is considered to break as defined in those studies. Only one pipe break is postulated to occur at any time and only during normal plant conditions. As part of the detailed analysis described in Appendix D, the worst case combination of a specific HELB and consequential control systems failures is examined for the reactor in the limiting condition for that po-tulated event.

2.5.2 Pipe Break Effects

Pipe breaks and consequential control systems failures are evaluated considering the effects of pipe whip, jet impingement, and adverse environment on the control systems components. The effects associated with any adverse environment (increasing humidity, temperature, pressure, radiation) are enveloped by employing the sacrificial approach. The sacrificial approach assumes that any HELB within the defined zone would adversely impact all control systems components in the zone. Using this approach, environmental effects are enveloped in the detailed analysis presented in Appendix D.

The turbine generator electrohydraulic system (TMB) is a high pressure, low temperature system with a limited volume of EH liquid maintained in high pressure by a small capacity pump. It is inconceivable that a pipe break in this system will incapacitate all nonsafety grade instruments in the zones of TMB system pipe routing, and an exception to the sacrificial approach in this case is considered justified. Direct jet impingement or direct pipe whip will be considered as the only causes of failure for those nonsafety grade instruments that are within such bounds.

2.5.3 Pipe Whip Considerations

Movement of a circumferentially broken pipe is assumed to occur in the direction of the jet reaction while the pipe hinges at the nearest rigid support, anchor, or penetration, producing an arc of motion. The pipe is allowed to move in an arc with a radius from the break to the hinge point, and motion is assumed to be limited by pipes of equal or greater diameter or reinforced concrete walls, floors, or columns. The whipping pipe is assumed capable of incapacitating any control systems components within the arc of motion. The sacrificial approach envelops these pipe whip considerations.

2.5.4 Jet Impingement Considerations

Jet impingement is considered for both circumferential and longitudinal breaks. The basic approach assumed is that the jet from a postulated break is sufficient to fail all impacted components within the jet cone of influence, except in those areas where major structures provide natural barriers. The sacrificial approach used in this analysis envelops these jet impingement considerations.

2.6 PLANT WALKDOWN

Preliminary zone maps for the reactor, turbine enclosures, and auxiliary building were used for the walkdown. The plant walkdown was performed to accurately define appropriate zones, giving due consideration to wall heights, location of doors, wall openings, etc.

The present study is based on the assumption that the location of the control components and their associated taps, tubing, and the high energy lines are correctly represented in the referenced drawings. Field or subsequent design changes may affect locations of a small percentage of these components, and a second plant walkdown will be conducted to verify the assumption. This walkdown will also be used to establish those instruments which are affected by a HELB in the turbine generator EH fluid system referred to in Section 2.5.2. Any significant changes as a result of the walkdown will be incorporated in a later revision of the study.

2.7 HELB ZONE ANALYSIS

The detailed analysis was performed on a zone basis. The following description is representative of the analysis performed for each HELB zone. Appendix D, which presents the details of the analysis for each zone, follows this format.

1. High Energy Systems

Under each zone, the line for each system is listed based on its function. Each high energy line was reviewed to determine the effects of a piping failure upon its own system. This is done for each high energy line or group of lines having the same function independently, since only a single pipe break is postulated as the initiating event. The effect of the break itself on reactor parameters was examined and compared with the bounding FSAR Chapter 15, where appropriate.

Due consideration has been given to interactions between adjacent zones as explained in Section 2.4.

2. Control Systems

A list was made of all control systems components within the zone on a system basis. Where control components were grouped together, they have similar system failure effects. The failure mode(s) of each component or group of components and the effects of their failure on all controlled components were reviewed. Controlled components are assumed to operate in the worst possible mode as a result of single or group of components' failure, and this mode has been identified in the analysis. Where the worst mode is not readily discernible, all failure modes and their consequences have been analyzed.

3. Combined Effects

The postulated piping failure for each HELB in the zone was examined in combination with the resulting worst case failures of control systems components in the zone to determine whether any combination of possible failures could exacerbate the postulated HELB. The sacrificial approach was used, and the worst case combined HELB and possible consequential control systems failures were defined and analyzed. The consequences of these events were compared to the accident and transient analyses presented in FSAR Chapter 15, which include discussions of a single additional active component failure to ensure that they are less severe than the existing analyses.

3.0 CONCLUSIONS AND RECOMMENDATIONS

The detailed analysis of Appendix D presents a thorough discussion of the analysis performed for those zones of the Turbine Enclosure, Reactor Enclosure, and Auxiliary Building which required evaluation under the criteria set in Section 2.0. The sacrificial approach, as outlined in Section 2.7, with the exception noted in Section 2.5.2, has been strictly applied, and conservative assumptions have been made to all analyses of system failure. No credit has been taken for operator action in any event beyond those already assumed in the existing FSAR Chapter 15 analyses.

The worst case combined effects of the postulated HELB and consequential control systems failures have been examined and detailed in the Combined Effects section of Appendix D for each zone or related zones. In many cases, the postulated HELB is not exacerbated by any combination of control systems failures in the zones. In some cases, control system component failures had insignificant effect on the controlled system and no further analysis was made. The applicable bounding FSAR Chapter 15 event has been alluded to in the Combined Effects section of Appendix D for each zone where appropriate. These FSAR sections include the discussion of the effects of a single additional active component failure and conclude that the combined consequence of failure is less severe than the existing analysis (i.e., bounded events).

The following conditions as a result of pipe break are listed below. These conditions can occur individually or in combination as described under Combined Effects in Appendix D.

1. Turbine trip due to a loss of condenser vacuum.

2. Turbine trip due to high vibration.

3. Turbine trip due to a high water level in the moisture separator.

4. Loss of feedwater flow due to a gradual loss of condensate inventory.

5. Complete loss of feedwater.

6. Loss of one or more reactor feed pumps.

7. Partial loss of feedwater heating.

8. Loss of RCIC pump.

9. Loss of one RCS pump.

10. Combination of hypothesized conditions.

Each of these conditions is analyzed below to determine the overall consequences on reactor parameters.

1. A loss of main condenser vacuum could possibly result either from a break in a high energy line leading to the condenser or steam jet air ejector or from a break in one of the turbine sealing steam supply lines, allowing air leakage at the low-pressure turbine shaft seals. A loss of sealing steam would produce a much more gradual loss of condenser vacuum than would a break in a line from the condenser.

Both conditions would lead to a turbine trip situation, which is bounded by Chapter 15.2.5 of the FSAR.

2. A turbine trip due to high vibration as a result of water induction could also lead to a "turbine trip with bypass" situation, since the bypass would not be affected and would operate as required.

3. A turbine trip could occur as a result of a high level signal from the moisture separator. This could occur either as a result of an actual high level or from a malfunctioning of the moisture separator high level switches. This would also result in a turbine trip with bypass situation.

4. A loss of feedwater flow could result when a gradual loss of condensate occurs. Any high energy steam or water line break which could result in a loss of condensate at a rate which would exceed the maximum available condensate makeup is assumed to result in a gradual reduction in condensate inventory. The low hotwell level could ultimately trip feedwater pumps on low suction pressure.

5. A complete loss of feedwater would result when one of the main condensate or feedwater lines is assumed to rupture. The feedwater pumps would no longer be able to feed the reactor vessel, which would quickly lead to a reactor scram on low water level. This loss of feedwater accident (LOCA event) is bounded by Chapter 15.2.7 of the FSAR.

6. A loss of one reactor feedwater pump would result in no adverse consequences on reactor parameters. The remaining RFP would automatically operate to supply 70 percent of the normal feedwater flow to the reactor. The reactor recirculation pumps and the main turbine would receive a signal to run back at this time. Steam flow and power output would be reduced to the 70-percent level.

7. A partial loss of feedwater heating could occur when:

   a. Steam extraction lines to heater are broken.

   b. Drain lines are ruptured.

   c. Heater controls are adversely affected.

   d. Feedwater/condensate is bypassed around heater.

   e. A heater string of one train is isolated.

   The largest possible reduction in feedwater temperature postulated assumes that the first through sixth feedwater heaters of one train and the first point heater of the other train are out of service, resulting in loss of feedwater heating energy. The reduction in feedwater temperature up to 100°F would cause a gradual increase in reactor power level, which failing operator action, could eventually lead to a reactor trip.

8. Loss of reactor core isolation cooling pump can result due to a break in the RCIC steam piping, but the break is automatically isolated by resultant high ambient temperature sensors, which are not postulated to fail (QA Category I).

9. Tripping a single reactor recirculation pump due to a failure of instrumentation requires no safeguard or protection system operation as analyzed in FSAR Chapter 15.3.

10. The worst hypothesized combination of the above conditions can occur from a pipe break within the turbine building, which may simultaneously cause a partial loss of feedwater heating (condition 7) and a turbine trip (condition 1 or 2) if the appropriate controls are disabled, leading to improper valve positioning.

    The reduction in feedwater inlet temperature causes a gradual rise in reactor power, and depending upon the specific timing of the event, the turbine trip may occur at a reactor power elevated between the operating value and the trip level. It has been concluded that the occurrence of this event is highly unlikely. This conclusion is based in part on consideration of the probability that a combination of the following worst case conditions occurs concurrently:

    a. The worst case pipe segment breaks on the most important line.

    b. Pipe whip of jet impingement can strike all targets in an area and cause failures in worst case modes.

    c. Breaks occur at worst case locations.

    d. Both turbine trip and reactor high power-level trip occur at appropriate (i.e., worst cases) times.

Should the unlikely worst case combined sequence occur, the reactor may experience for a short time a change in critical power ratio (CPR), which is not covered under existing FSAR Chapter 15 analyses for the Unacceptable Results for Incidents of Moderate Frequency - Anticipated Operational Transients. This transient condition will be analyzed and the results included in a later revision of this report.

All other combinations of the first nine conditions result in effects which are bounded by previously reported transient conditions as analyzed in FSAR Chapter 15 and noted in Appendix D. It is concluded that the hypothesized HELB, with resulting effects on control systems, poses no significant risk to the health and safety of the public.

Therefore, no further accident analysis or any design modification is necessary.

4.0 REFERENCE DOCUMENTS

1. Environmental Design Criteria for River Bend Station, Revision 2

2. U.S. Nuclear Regulatory Commission, IE Information Notice 79-22, Qualification of Control Systems

3. U.S. Nuclear Regulatory Commission Safety Evaluation Report for River Bend Station dated May 1984, Chapter 7.7.2.1

4. U.S. Nuclear Regulatory Commission, Standard Review Plan Determination of Break Locations and Dynamic Effects Associated With the Postulated Rupture of Piping, Section 3.6.2, Branch Technical Position MEB 3-1, 1981

5. Stone & Webster Engineering Corporation and GE documents

   a. Flow Diagram List (attached)

   b. Logic Diagram List (attached)

   c. Elementary Diagram List (attached)

   d. Loop Diagram List (attached)

   e. Piping Drawing List (attached)

   f. Instrument Drawing List (attached)

APPENDIX A 1.8

SYSTEMS LIST 1.10

APPENDIX A

System Code	System Number	*Elimination Criteria	System Description	
			BOP SYSTEMS	
ABD	10-6	N4	Auxiliary Boiler Blowdown	1.35
ABF	10-2	N4	Auxiliary Boiler FDW and CNDS	1.36
ABH	13-11	N4	Chemical Feed - Auxiliary Boiler	1.37
ABM	10-1	N4	Auxiliary Boiler Steam	1.38
ANN	-	N2	ANN Input	1.39
ARC	5-1	-	Condenser Air Removal	1.40
ASR	3-10	N3	Auxiliary Steam - Radwaste	1.41
BCS	9-8	-	Bearing Cooling Water System	1.42
BYS	24-13	-	Battery System	1.43
CCP	9-1	-	Reactor Plant Component Cooling Water	1.44
CCS	9-7	-	Turbine Plant Component Cooling Water	1.45
CEC	-	N6	Electrical Equipment - Control Room	1.46
CES	-	N6	Electrical Equipment - Local	2.5
CMS	33-2	N2	Containment Atmosphere Monitoring	2.6
CNA	4-4	-	Auxiliary Condensate	2.7
CND	4-7	-	Condensate Demineralizer	2.8
CNM	4-1	-	Condensate	2.9
CNS	4-3	-	Condensate Makeup/Drawoff	2.10
CPM	27-24	N7	Hydrogen Mixing	2.11

*More than one criteria may be applicable in some cases.

System Code	System Number	*Elimination Criteria	System Description	
CPP	27-21	N7	Containment Hydrogen Purge	2.12
CRS	3-2	-	Cold Reheat	2.13
CSH	27-4	N7	High-Pressure Core Spray (E22)	2.14
CSL	27-5	N7	Low-Pressure Core Spray (E21)	2.15
CWS	2-1	-	Circulating Water	2.16
DED	32-10	N4	Radwaste Building Equipment Drains	2.17
DER	32-9	N4	Reactor Building Equipment Drains	2.18
DET	32-11	N4	Turbine Building Equipment Drains	2.19
DFA	23-13	N4	Fuel Building Floor Drains	2.20
DFD	23-11	N4	Standby Diesel Gen Building Floor Drains	2.21
DFM	23-12	N4	Miscellaneous Building Floor Drains	2.22
DFR	23-6	N4	Reactor Building Floor Drains	2.23
DFT	23-7	N4	Turbine Building Floor Drains	2.24
DFW	23-10	N4	Radwaste Building Floor Drains	2.25
DRS	22-22	-	Drywell Cooling	2.26
DSM	32-7	-	Moisture Separator Vents and Drain	2.27
DSR	32-6	-	Moisture Separator RHTR Vents and Drains	2.28
DTM	32-5	-	Turbine Building Miscellaneous Drains	2.29
DWS	23-1	N4	Domestic Water	2.30
EGA	12-4	N7	Standby Diesel Generator Air Startup	2.31
EGF	8-9	N7	Standby Diesel Generator Fuel	2.32
EGO	24-9	N7	Standby Diesel Generator Lube Oil System	2.33

System Code	System Number	*Elimination Criteria	System Description	
EGS	24-9	N7	Standby Diesel Generator Protection	2.34
EGT	24-9	N7	Standby Diesel Generator Jacket Water	2.35
EJS	24-11	N7	Standby Station Service Substation	2.36
ENB	24-13	N7	Standby Battery System	2.37
ENS	24-9	N7	Standby Station Service Supply Breakers	2.38
ESS	3-4	-	Extraction Steam	2.39
EXS	-	N6	Main Generator Excitation System	2.40
FOF	8-10	N4	Engine Driven Fire Pump Fuel Oil	2.41
FPG	15-5	N4	Fire Protection - Halon	2.42
FPH	15-2	N4	Fire Protection - High-Pressure Carbon Dioxide	2.43
FPL	15-3	N4	Fire Protection - Low-Pressure Carbon Dioxide	2.44
FPW	15-1	N4	Fire Protection - Water	2.45
FWL	7-3	-	FDW Pump and Drive Lube Oil	2.46
FWR	6-3	-	FDW Pump Recirculation	2.47
FWS	6-1	-	Feedwater System	2.48
GMC	16-8	-	Generator Stator Cooling Water	2.49
GMH	16-7	-	Generator Hydrogen and Carbon Dioxide	2.50
GML	16-10	-	Generator Leads Cooling	2.51
GMO	16-6	-	Generator Seal Oil	2.52
GSN	14-1	N4	Nitrogen	2.53
GTS	27-15	N7	Standby Gas Treatment	2.54
HCS	27-13	N7	DBA Hydrogen Recombiner, Hydrogen Ignitors	2.55

System Code	System Number	*Elimination Criteria	System Description	
HDH	6-6	-	High-Pressure FDW Heater Drain	2.56
HDL	4-2	-	Low-Pressure FDW Heater Drain	2.57
HRS	3-3	-	Hot Reheat	2.58
HVC	22-9	N3	Control Building Air-Conditioning	3.1
HVF	22-6	N3	Fuel Building Ventilation	3.2
HVI	22-29	N3	Auxiliary Boiler Room Ventilation	3.3
HVJ	22-30	N3	Water Treatment Building Ventilation	3.4
HVK	22-12	N7	Control Building Chilled Water	3.5
HVL	22-11	N3	Service Building A/C, Warehouse Extension, PAP	3.6
HVN	22-14	N3	Ventilation Chilled Water	3.7
HVO	22-10	N3	Office Building A/C	3.8
HVP	22-7	N3	Standby Diesel Gen Building Ventilation	3.9
HVR	22-1	N3	Reactor Building Ventilation	3.10
HVS	22-39	N3	Auxiliary Control Bldg - Air-Conditioning	3.11
HVT	22-3	N3	Turbine Building Ventilation	3.12
HVW	22-5	N3	Radwaste Building Ventilation	3.13
HVY	22-8	N3	Yard Structure Ventilation	3.14
IAS	12-1	-	Instrument Air	3.15
ICS	27-6	-	Reactor Core Isolation Cooling (E51)	3.16
IHA	-	N2	Annunciator System	3.17
IHC	-	N2	Information System-Computer	3.18
IHS	24-13	N2	Information Batt System	3.19

System Code	System Number	*Elimination Criteria	System Description	
ISC	27-30	N7	BOP LOCA Initiation/Isolation	3.20
JRB	-	N4	Personnel Air Locks	3.21
LMS	33-1	N4	Containment Leakage Monitoring	3.22
LOS	16-3	N4	Turb Gen Oil Conditioning and Storage	3.23
LPM	-	N4	Loose Parts Monitoring System	3.24
LSV	27-29	N7	Penetration Valve Leakage Control	3.25
LWS	31-1	N4	Radioactive Liquid Waste	3.26
MSI	27-20	N7	Main Steam Line Isolation Valve Seal (E33)	3.27
MSS	3-1	-	Main Steam	3.28
MTX	-	N6	Main Transformer Auxiliaries	3.29
MWS	9-15	N3	Makeup Water	3.30
NJS	24-10	N6	Normal Station Service - Substation	3.31
NNS	24-8	N6	Normal Station Service - 4-kV Supply	3.32
NPS	24-8	N6	Normal Station Service - 13.8-kV Supply	3.33
OFG	31-4	-	Off-Gas (N64)	3.34
PBS	23-3	N4	Sanitary Drains	3.35
RCS	25-1	-	Reactor Coolant Recirculation (B33)	3.36
RDS	36-1	-	Control Rod Drive	3.37
RHS	27-7	-	Residual Heat Removal (E12)	3.38
RMS	-	N2	Radiation Monitor	3.39
RSS	-	N7	Remote Shutdown System (C61)	3.40
SAS	12-2	-	Service Air	3.41

System Code	System Number	*Elimination Criteria	System Description	
SCC	-	N2	Bypass and Inoperative Indication	3.42
SCM	-	N2	Post Accident Monitoring	3.43
SFC	34-2	N4	Fuel Pool Cooling and Purification	3.44
SFT	34-4	N5	Fuel Transfer System	3.45
SLS	27-16	-	Standby Liquid Control (C41)	3.46
SPF	24-5	N6	Res Stn Serv XFMR Hi-Side Line Protection	3.47
SPG	1-5	N6	Generator Trips	3.48
SPG	24-2	-	Main Generator Protection	3.49
SPI	-	N2	Station Gross and Net Generator Indication	3.50
SPL	-	N6	Main XFMR High Side Line Protection	3.51
SPM	24-3	N6	Main XFMR Protection	3.52
SPR	24-5	N6	Reserve Station Service XFMR Protection	3.53
SPS	24-4	N6	Normal Station Service XFMR Protection	3.54
SPU	24-1	N6	Unit Protection	3.55
SPX	24-6	N6	Station Auxiliary Power XFMR Protection	3.56
SRR	23-2	N4	Roof Drainage	3.57
SRW	23-4	N4	Storm and Waste Water	3.58
SSR	21-2	N2	Reactor Plant Sampling System	4.1
SST	21-1	N2	Turbine Plant Sampling System	4.2
SSW	21-4	N2	Radwaste Building Sampling System	4.3
SUM	-	N2	Supervisory System	4.4
SVH	32-14	-	FDW Heater Relief Drains and Vents	4.5

System Code	System Number	*Elimination Criteria	System Description	
SVV	32-8	N7	Mn Stm Safety Valves - Vents and Drains	4.6
SWP	9-10	N7	Service Water	4.7
SYD	24-12	N6	Synchronizing - Standby Station Service	4.8
SYG	24-12	N6	Synchronizing - Main Generator	4.9
SYL	24-12	N6	Synchronizing - Line	4.10
SYS	24-12	N6	Synchronizing - Normal Station Service	4.11
TMA	1-4	-	Turbine Trips	4.12
TMB	16-5.2	-	Turbine Generator EH Fluid System	4.13
TME	16-1	-	Turbine Generator Gland Seal and Exhaust	4.14
TMG	16-4	N5	Turbine Generator Turning Gear	4.15
TMI	-	N2	Turbine Generator Supervisory Instrument	4.16
TML	16-2	-	Turbine Generator Lube Oil	4.17
TMR	16-5.5	-	Unit Runback	4.18
TMS	16-9	-	Turbine Generator Exhaust Hood Spray	4.19
VNT	32-12	N4	Reactor and Turbine Building Vents	4.20
VPS	5-2	-	Vacuum Priming System	4.21
VTP	32-18	N4	Turbine Plant Equipment Vents	4.22
WCS	26-3	-	Reactor Water Cleanup (G33)	4.23
WOS	16-12	N4	Waste Oil Disposal	4.24
WSS	31-3	N4	Radioactive Solid Waste	4.25
WTA	13-20	N4	Chemical Feed - Acid	4.26
WTH	13-4	N4	Chemical Feed - Hypochlorite	4.27

System Code	System Number	*Elimination Criteria	System Description	
WTL	13-16	N4	Clarifier System	4.28
WTS	13-1	N4	Water Treating - Raw Water	4.29
WTW	13-3	N4	Water Treating - Waste Water	4.30
YWC	24-7	N6	230-kV Switchyard Control	4.31
-	-	N4	Plant Communications	4.32
-	-	N4	Personnel Access Hatch	4.33
-	-	N4	Station Grounding - Instruments & Controls	4.34
-	-	N2	Vibration & Loose Parts Monitoring	4.35
			NSSS SYSTEMS	4.37
-	C71	-	Reactor Protection System (RPS)	4.40
-	C33	-	Feedwater Control System	4.41
-	B33	-	Reactor Recirculation System (RCS)	4.42
-	B21	-	Nuclear Boiler System	4.43
-	B21	-	Nuclear Boiler Process Instrumentation	4.44
-	B33	-	Jet Pump Instrumentation	4.45
-	C41	-	Standby Liquid Control System [illegible]LS)	4.46
-	G33	-	Reactor Water Cleanup (RWCU) (WCS)	4.47
-	G36	-	Reactor Water Cleanup Filter Demin (RWCU/FD)	4.48
-	C31	-	Neutron Monitoring System (NMS)	4.49
-	C11	-	Control Rod Drive (CRD)	4.50
-	D17	-	Process Radiation Monitoring System	4.51

System Code	System Number	*Elimination Criteria	System Description	
-	B21	N7	Automatic Depressurization System (ADS)	4.52
-	E21	N7	Low-Pressure Core Spray (LPCS) (CSC)	4.53
-	E12	-	Residual Heat Removal System (RHR) (RHS)	4.54
-	E51	-	Reactor Core Isol and Cooling System (RCIC)	4.55
-	C61	N7	Remote Shutdown System (RSS)	4.56
-	E31	N7	Leak Detection System	4.57
-	E22	N7	High-Pressure Core Spray System (CSH)	4.58
-	E22	N7	High-Pressure Core Spray Power Supply System	5.1
-	B21	N7	Main Steam Isolation Valve	5.2
-	C31	-	Traversing In-Core Probe (TIP)	5.3
-	N64	-	Off-Gas System	5.4
-	F11	N1	Fuel Handling Platform and Jib Crane	5.5
-	F13	N1	Refueling Platform and Auxiliary Platform	5.6
-	F42	N5	Inclined Fuel Transfer	5.7
-	E33	N7	MSIV Seal System	5.8
-	C85	-	Steam Bypass and Regulation	5.9

APPENDIX B

CONTROL COMPONENT LIST AND FUNCTIONS

Notes: 1. Unless otherwise noted, all solenoid valves are mounted on the valve.

2. Instruments marked with an asterisk (*) in tag number are Seismic Category I, but are functionally QA Category II.

3. Zones VII, XII, XX, 9 through 12, and 16 have no nonsafety grade control components.

CONTROL COMPONENTS

Zone No. I

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
ARC	1ARC-AOV3A 1ARC-SOV3A	Air Removal Pump 1ARC-P1A Suction Valve
ARC	1ARC-AOV3B 1ARC-SOV3B	Air Removal Pump 1ARC-P1B Suction Valve
CCS	1CCS-TIC104	Turbine Plant Component Cooling Water Heat Exchanger Outlet Temperature Indicating Controller Modulates 1CCS-TV104
CCS	1CCS-TV104	Turbine Plant Component Cooling Water Heat Exchanger Outlet Temperature Control Valve Maintains CC System Temperature
CNM	1CNM-FT112	Air Ejector Inter Condenser Outlet Flow Transmitter
CNM	1CNM-FT114	Condensate Recirculation Flow Transmitter Modulates Valve 1CNM-FV114 to Maintain Minimum Recirculation Flow and Provides Alarm and Indication Signal
CNM	1CNM-FV112	Air Ejector Bypass Valve
CNM	1CNM-I/P112	I/P Converter for Air Ejector Bypass Valve 1CNM-FV112 Control
DSR	1DSR-LIC68A	Reheater Drain Receiver 1DSR-TK1A High Water Level Drain Control Valve 1DSR-LV68A Controller
GMH	1GMH-RTDGTG-3A	Main Alternator Cold Air Temperature Sensor Operates Service Water Control Valve 1SWP-TV101 for Generator Hydrogen Coolers 1GMH-E1A through D
GMH	1GMH-RTD105	Main Alternator Cold Air Temperature Sensor Operates Service Water Return Control Valve 1SWP-TV113 for Generator Hydrogen Cooler 1GMH-E2.
HRS	1HRS-PT108	Inlet Steam Pressure to Low Pressure Turbine Provides Controlling Signal for Main Steam Supply Valves to Moisture Separators
MSS	1MSS-PIC144 1MSS-PV144	Main Steam to Air Ejector Pressure Regulating Valve 1MSS-PV144 Pressure Indicating Controller

Zone No. I

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
SVH	1SHV-AOV36B 1SVH-SOV36B	Feedwater Heater 1CNM-E5B Vent Valve
SVH	1SVH-AOV37B 1SVH-SOV37B	Feedwater Heater 1CNM-E5B Vent Valve
SVH	1SVH-AOV38B 1SVH-SOV38B	Feedwater Heater 1CNM-E6B Vent Valve
SVH	1SVH-AOV39B 1SVH-SOV39B	Feedwater Heater 1CNM-E6B Vent Valve
OFG	1N64-LVF016A 1N64-SOVF016A	Condenser Drain A Valve and Solenoid Modulated by Off-Gas Condenser IN64-B002 Drain Controller IN64-LCR005A
OFG	1N64-LVF016B 1N64-SOVF016B	Condenser Drain B Valve and Solenoid Modulated by Off-Gas Condenser IN64-B002 Drain Controller IN64-LCR005B
TMS	1TMS-P/IX129	Low Pressure Turbine A Temp Converter for Exhaust Hood Spray Valve 1TMS-TVAOVWSV
TMS	1TMS-P/IY129	Low Pressure Turbine B Temp Converter for Exhaust Hood Spray Valve 1TMS-TVAOVWSV
TMS	1TMS-TVAOVWSV	Low Pressure Turbine Exhaust Hood Spray Valve
TMS	1TMS-TTX129	Low Pressure Turbine Exhaust Hood Spray Temperature Transmitter
TMS	1TMS-TTY129	Low Pressure Turbine Exhaust Hood Spray Temperature Transmitter

CONTROL COMPONENTS

Zone No. III

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
ARC	1ARC-AOV1A 1ARC-SOV1A	Air Ejector 1ARC-J1A, J2A Suction Valve
ARC	1ARC-AOV1B 1ARC-SOV1B	Air Ejector 1ARC-J1B, J2B Suction Valve
CRS	LS5TM2-M101S1	Moisture Separator 1CRS-MSR1 Level Switch-Provides 2 of 3 Logic Signals for Turbine Trip
CRS	LS5TM2-M101S2	Moisture Separator 1CRS-MSR1 Level Switch-Provides 2 of 3 Logic Signals for Turbine Trip
CRS	LS5TM2-M101S3	Moisture Separator 1CRS-MSR1 Level Switch-Provides 2 of 3 Logic Signals for Turbine Trip
CRS	LS5TM2-M201S1	Moisture Separator 1CRS-MSR2 Level Switch-Provides 2 of 3 Logic Signals for Turbine Trip
CRS	LS5TM2-M201S2	Moisture Separator 1CRS-MSR2 Level Switch-Provides 2 of 3 Logic Signals for Turbine Trip
CRS	LS5TM2-M201S3	Moisture Separator 1CRS-MSR2 Level Switch-Provides 2 of 3 Logic Signals for Turbine Trip
DSM	1DSM-LT75A	Moisture Separator Drain Receiver 1DSM-TK1A Level Transmitter Inputs to "Normal" Level Control Valve 1DSM-LV75A
DSM	1DSM-LT78A	Moisture Separator Drain Receiver 1DSM-TK1A Level Transmitter Inputs to "High" Level Control Valve 1DSM-LV78A
DSM	1DSM-LS77A	Moisture Separator Drain Receiver 1DSM-TK1A Level Switch Opens 1DSM-LV78A on Extremely High Level in Tank
DSM	1DSM-LT75B	Moisture Separator Drain Receiver 1DSM-TK1B Level Transmitter Functions Same as 75A for Tank B
DSM	1DSM-LT78B	Moisture Separator Drain Receiver 1DSM-TK1B Level Transmitter Functions Same as 78A for Tank B
DSM	1DSM-LS77B	Moisture Separator Drain Receiver 1DSM-TK1B Level Switch Functions Same as 77A for Tank B
DSM	1DSM-LIC78A	Moisture Separator Drain Receiver 1DSM-TK1A High Water Level Drain Control Valve 1DSM-LV78A Controller

Zone No. III

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
DSM	1DSM-LV78A 1DSM-SOV78A	Moisture Separator Drain Receiver 1DSM-TK1A High Water Level Drain Control Valve With Solenoid - Valve Normally Closed-Open on High Level
DSM	1DSM-LV78B 1DSM-SOV78B	Moisture Separator Drain Receiver 1DSM-TK1B High Water Level Drain Control Valve With Solenoid - Valve Normally Closed-Open on High Level
DSR	1DSR-LT65A	Reheater Drain Receiver Tank 1DSR-TK1A Level Transmitter Functions Similar to DSM Tanks Level Switch
DSR	1DSR-LT68A	Reheater Drain Receiver Tank 1DSR-TK1A Level Transmitter Functions Similar to DSM Tanks Level Switch
DSR	1DSR-LS67A	Reheater Drain Receiver Tank 1DSR-TK1A Level Switch Functions Similar to DSM Tanks Level Switch
DSR	1DSR-LT65B	Reheater Drain Receiver Tank 1DSR-TK1B Level Transmitter Functions Similar to DSM Tanks Level Switch
DSR	1DSR-LT68B	Reheater Drain Receiver Tank 1DSR-TK1B Level Transmitter Functions Similar to DSM Tanks Level Switch
DSR	1DSR-LS67B	Reheater Drain Receiver Tank 1DSR-TK1B Level Switch Functions Similar to DSM Tanks Level Switch
DSR	1DSR-LV68A 1DSR-SOV68A	Reheater Drain Receiver 1DSR-TK1A High Water Level Drain Control Valve With Solenoid
DSR	1DSR-LV68B 1DSR-SOV68B	Reheater Drain Receiver Tank 1DSR-TK1B High Water Level Drain Control Valve With Solenoid
DTM	1DTM-AOV5A 1DTM-SOV5A	Turbine Bypass Chest Drain Valve
DTM	1DTM-AOV32A 1DTM-SOV32A	Fourth Point Heater Extraction Line Drain Control Valve

Zone No. III

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
DTM	1DTM-AOV35A 1DTM-SOV35A	Third Point Heater Extraction Line Drain Control Valve
DTM	1DTM-AOV5B 1DTM-SOV5B	Turbine Bypass Chest Drain Valve
DTM	1DTM-AOV32B 1DTM-SOV32B	Fourth Point Heater Extraction Line Drain Control Valve
DTM	1DTM-AOV35B 1DTM-SOV35B	Third Point Heater Extraction Line Drain Control Valve
DTM	1DTM-AOV41A 1DTM-SOV41A	First Point Heater 1FWS-E1A Extraction Line Drain Control Valve
DTM	1DTM-AOV41B 1DTM-SOV41B	First Point Heater 1FWS-E1B Extraction Line Drain Control Valve
DTM	1DTM-AOV118 1DTM-SOV118	Steam Seal Evaporator (and Radwaste Reboiler) Extraction Line Drain Control Valve
DTM	1DTM-LS187	1DTM-TK1 High Level Switch Opens 1DTM-LVX187 on High Level in Tank
DTM	1DTM-LT187	Radwaste Reboiler Drain Receiver 1DTM-TK1 Level Transmitter Modulates 1DTM-LVX187
DTM	1DTM-LVX187 1DTM-SOVX187	Radwaste Reboiler Drain Receiver 1DTM-TK1 High Water Level Control Valve (FO) With Solenoid Valves Opens to Condenser at High Level in Tank
DTM	1DTM-LVY187 1DTM-SOVY187	Radwaste Reboiler Drain Receiver 1DTM-TK1 Normal Water Level Control Valve (FC) With Solenoid; Valve Modulates to Maintain Normal Water Level in Tank and Closes on High Level in Fourth Point Heater 1CNM-E4A
DTM	1DTM-LS189	1DTM-TK2 High Level Switch Opens 1DTM-LVX189 or High Water Level in Tank

CONTROL COMPONENTS

Zone No. III

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
DTM	1DTM-LVX189 1DTM-SOX189	Steam Seal Evaporator Drain Receiver 1DTM-TK2 High Water Level Control Valve (FO) With Solenoid; Valve Opens to Condenser at High Level in Tank
DTM	1DTM-LVY189 1DTM-SOVY189	Steam Seal Evaporator Drain Receiver 1DTM-TK2 Normal Water Level Control Valve (FC) With Solenoid Valve; Modulates to Maintain Normal Water Level in Tank and Closes on High Level in Fourth Point Heater 1CNM-E4A.
DTM	1DTM-LT189	Steam Seal Evaporator Drain Receiver 1DTM-TK2 Level Transmitter Modulates 1DTM-LVY189
ESS	1ESS-NRV16A 1ESS-SOVX16A 1ESS-SOVY16A	Fourth Point Heater Extraction Line Nonreturn Valve When Closed Prevents Overspeeding of Turbine Due to Flashing on Turbine Trip
ESS	1ESS-NRV23A 1ESS-SOVX23A 1ESS-SOVY23A	Third Point Heater 1CNM-E3A Extraction Line Nonreturn Valve-Functions Similar to NRV16A
ESS	1ESS-NRV29A 1ESS-SOVX29A 1ESS-SOVY29A	Second Point Heater 1CNM-E2A Extraction Line Nonreturn Valve-Functions Similar to NRV16A
ESS	1ESS-NRV34A 1ESS-SOVX34A 1ESS-SOVY34A	First Point Heater 1FWS-E1A Extraction Line Nonreturn Valve-Functions Similar to NRV16A
ESS	1ESS-NRV16B 1ESS-SOVX16B 1ESS-SOVY16B	Fourth Point Heater 1CNM-E4B Extraction Line Nonreturn Valve-Functions Similar to NRV16A
ESS	1ESS-NRV23B 1ESS-SOVX23B 1ESS-SOVY23B	Third Point Heater 1CNM-E3B Extraction Line Nonreturn Valve-Functions Similar to NRV16A

Zone No. III

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
ESS	1ESS-NRV34B 1ESS-SOVX34B 1ESS-SOVY34B	First Point Heater 1FWS-E1B Extraction Line Nonreturn Valve-Functions Similar to NRV16A
ESS	1ESS-PDT112	Third Point Extraction Steam and Main Steam Differential Pressure Transmitter-Allows Turbine Generator Seal Steam Flow Either From Extraction Steam or Main Steam System
ESS	1ESS-NRV115 1ESS-SOV115	Steam Seal Evaporator 1TME-EV1 Extraction Line Nonreturn Valve-Functions Same as NRV16A
ESS	1ESS-NRV116 1ESS-SOV116	Steam Seal Evaporator 1TME-EV1 Extraction Line Nonreturn Valve-Functions Same as NRV16A
FWL	1FWL-PS2A	Reactor Feed Pump 1FWS-P1A Speed Increaser Lube Oil Pressure Switch Trips Pump at Low Pressure
FWL	1FWL-PS3A	Reactor Feed Pump 1FWS-P1A Speed Increaser Lube Oil Pressure Switch Permits Pump to Start
FWL	1FWL-PS12A	Reactor Feed Pump 1FWS-P1A Lube Oil Pressure Switch Trips Pump at Low Pressure
FWL	1FWL-PS13A	Reactor Feed Pump 1FWS-P1A Lube Oil Pressure Switch Permits Pump to Start
FWL	1FWL-PS2B	Reactor Feed Pump 1FWS-P1B Speed Increaser Lube Oil Pressure Switch Functions Similar to 1FWL-PS2A
FWL	1FWL-PS3B	Reactor Feed Pump 1FWS-P1B Speed Increaser Lube Oil Pressure Switch Functions Similar to 1FWL-PS3A
FWL	1FWL-PS12B	Reactor Feed Pump 1FWS-P1B Lube Oil Pressure Switch Functions Similar to PS12A
FWL	1FWL-PS13B	Reactor Feed Pump 1FWS-P1B Lube Oil Pressure Switch Functions Similar to PS13A
FWL	1FWL-PS2C	Reactor Feed Pump 1FWS-P1C Speed Increaser Lube Oil Pressure Switch Functions Similar to PS2A
FWL	1FWL-PS3C	Reactor Feed Pump 1FWS-P1C Speed Increaser Lube Oil Pressure Switch Functions Similar to PS3A
FWL	1FWL-PS12C	Reactor Feed Pump 1FWS-P1C Lube Oil Pressure Switch Functions Similar to PS12A

Zone No. III

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
FWL	1FWL-PS13C	Reactor Feed Pump 1FWS-P1C Lube Oil Pressure Switch Functions Similar to PS13A
FWR	1FWR-FV2A 1FWR-SOV2A	Feedwater Pump 1FWS-P1A Minimum Flow Recirculation Control Valve
FWR	1FWR-FV2B 1FWR-SOV2B	Feedwater Pump 1FWS-P1B Minimum Flow Recirculation Control Valve
FWR	1FWR-FV2C 1FWR-SOV2C	Feedwater Pump 1FWS-P1C Minimum Flow Recirculation Control Valve
HDL	1HDL-LS7A	Sixth Point Heater 1CNM-E6A Water Level Switch Isolates Heater String A on High Water Level, Opens Condensate Bypass Valve, and Provides Turbine RCIC Runback Signal
HDL	1HDL-LS8A	Fifth Point Heater 1CNM-E5A Water Level Switch Isolates Heater String A on High Water Level, Opens Condensate Bypass Valve, and Provides Turbine RCIC Runback Signal
HDL	1HDL-LS7B	Sixth Point Heater 1CNM-E6B Water Level Switch Isolates Heater String A on High Water Level, Opens Condensate Bypass Valve, and Provides Turbine RCIC Runback Signal
HDL	1HDL-LS8B	Fifth Point Heater 1CNM-E5B Water Level Switch Isolates Heater String A on High Water Level, Opens Condensate Bypass Valve, and Provides Turbine RCIC Runback Signal
MSS	1MSS-FTX13A	Steam Flow to Air Ejector Second Stage Flow Transmitter
MSS	1MSS-PT30A	Main Steam to Moisture Separator Reheater 1CRS-MSR1 Pressure Transmitter Modulates Reheater Steam Control Valves 1MSS-PVRSLLV1 and PVRSHLV1
MSS	1MSS-PT30B	Main Steam to Moisture Separator Reheater 1CRS-MSR2 Pressure Transmitter Modulates Reheater Steam Control Valves 1MSS-PVRSLLV2 and PVRSHLV2
SVH	1SVH-AOV36A 1SVH-SOV36A	Feedwater Heater 1CNM-E5A Vent Valve

Zone No. III

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
SVH	1SVH-AOV37A 1SVH-SOV37A	Feedwater Heater 1CNM-E5A Vent Valve
SVH	1SVH-AOV38A 1SVH-SOV38A	Feedwater Heater 1CNM-E6A Vent Valve
SVH	1SVH-AOV39A 1SVH-SOV39A	Feedwater Heater 1CNM-E6A Vent Valve
B21	1B21-AOVF069/ SOVF069	Steam Line Outboard Drain Valve
B21	1B21-AOVF033/ SOVF033	Steam Line Inboard Drain Valve
C85	1C85-PDSN002A	Main Condenser Absolute Pressure (Vacuum) Trips Turbine or Low Condenser Vacuum
C85	1C85-PDSN002B	Main Condenser Absolute Pressure (Vacuum) Trips Turbine or Low Condenser Vacuum

Zone No. V

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
DTM	1DTM-AOV223	Steam Seal Evaporator (1TME-EV1) Vent Valve With Solenoid
DTM	1DTM-SOV223	

Zone No. VI

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
DTM	1DTM-AOV222 1DTM-SOV222	Radwaste Reboiler (1ASR-SG1) Vent Valve With Solenoid

CONTROL COMPONENTS

Zone No. VIII

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
CCS	1CCS-PIC111	CSS Supply Header Valve 1CCS-PV111 Controller
CCS	1CCS-PV111	CCS Supply Header Valve
CNM	1CNM-FT68A	Reactor Feed Pump 1FWS-P1A Suction Flow Transmitter to Control Feedwater Flow Control Valve 1FWR-FV2A and Generate Turbine Runback Signal on Low Pressure
CNM	1CNM-PT70A	Reactor Feed Pump 1FWS-P1A Suction Pressure Transmitter Trips Pump on Low Pressure
CNM	1CNM-FT68B	Reactor Feed Pump 1FWS-P1B Suction Flow Transmitter Similar to 1CNM-FT68A
CNM	1CNM-PT70B	Reactor Feed Pump 1FWS-P1B Suction Pressure Transmitter Similar to 1CNM-PT70A
CNM	1CNM-FT68C	Reactor Feed Pump 1FWS-P1C Suction Flow Transmitter Similar to 1CNM-FT68A
CNM	1CNM-PT70C	Reactor Feed Pump 1FWS-P1C Suction Pressure Transmitter Similar to 1CNM-PT70A
CNM	1CNM-I/P114	I/P Converter for Minimum Flow Recirculation Control Valve 1CNM-FV114 Control
DSM	1DSM-LIC75A	Moisture Separator Drain Receiver 1DSM-TK1A Normal Water Level Control Valve 1DSM-LV75A Controller
DSM	1DSM-LV75A 1DSM-SOV75A	Moisture Separator Drain Receiver 1DSM-TK1A Normal Water Level Control Valve
DSM	1DSM-LIC75B	Moisture Separator Drain Receiver 1DSM-TK1B Normal Water Level Control Valve 1DSM-LV75B Controller
DSM	1DSM-LIC78B	Moisture Separator Drain Receiver 1DSM-TK1B High Water Level Drain Control Valve 1DSM-LV78B Controller
DSR	1DSR-LIC65A	Reheater Drain Receiver 1DSR-TK1A Normal Water Level Drain Control Valve 1DSR-LV65A Controller
DSR	1DSR-LIC65B	Reheater Drain Receiver 1DSR-TK1B Normal Water Level Drain Control Valve 1DSR-LV65B Controller

Zone No. VIII

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
DSR	1DSR-LV65B 1DSR-SOV65B	Reheater Drain Receiver 1DSR-TK1B Normal Water Level Drain Control Valve
DSR	1DSR-LIC68B	Reheater Drain Receiver 1DSR-TK1B High Water Level Drain Control Valve 1DSR-LV68B Controller
DSR	1DSR-LY68B	Reheater Drain Receiver 1DSR-TK1B I/P Converter for Indication
DTM	1DTM-AOV12A 1DTM-SOV12A	Main Steam Header Drain Bypass Valve With Solenoid Valve Normally Closed and Remotely Opened During Startup or Steam Lead Warmup
DTM	1DTM-AOV12B 1DTM-SOV12B	Main Steam Header Drain Bypass Valve With Solenoid Valve Normally Closed and Remotely Opened During Startup or Steam Lead Warmup
DTM	1DTM-LIC187	Radwaste Reboiler Drain Receiver 1DTM-TK1 Normal/High Water Level Control Valves 1DTM-LVY187/ 1DTM-LVX187 Controller
DTM	1DTM-LIC189	Steam Seal Evaporator Drain Receiver 1DTM-TK2 Normal/High Water Level Control Valves 1DTM-LVY189/1DTM-LVX189 Controller
ESS	1ESS-NRV29B 1ESS-SOVX29B 1ESS-SOVY29B	Second Point Nuclear Heater 1CNM-E2B Extraction Line Nonreturn Valve-Functions Similar to 1ESS-NRV16A in Zone III
FWR	1FWR-I/P2A	I/P Converter for Feedwater Pump 1FWS-P1A Minimum Flow Recirculation Control Valve
FWR	1FWR-I/P2B	I/P Converter for Feedwater Pump 1FWS-P1B Minimum Flow Recirculation Control Valve
FWR	1FWR-I/P2C	I/P Converter for Feedwater Pump 1FWS-P1C Minimum Flow Recirculation Control Valve
GMC	1GMC-PS63-P96	Stator Windings Cooling Water Inlet Pressure Switch Controls Generator Stator Cooling
GMC	1GMC-TS63-T86	Stator Cooling Water Inlet Temperature Switch Controls Generator Stator Cooling
HDH	1HDH-LIC6A	First Point Heater 1FWS-E1A Normal Water Level Drain Control Valve 1HDH-LV6A Controller

Zone No. VIII

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
HDH	1HDH-LIC26A	First Point Heater 1FWS-E1A High Water Level Drain Control Valve 1HDH-LV26A Controller
HDH	1HDH-LIC6B	First Point Heater 1FWS-E1B Normal Water Level Drain Control Valve 1HDH-LV6A Controller
HDH	1HDH-LIC26B	First Point Heater 1FWS-E1B High Water Level Drain Control Valve 1HDH-LV26A Controller
HDL	1HDL-LT2A	Fifth Point Heater Drain Receiver Tank 1HDL-TK1A Level Transmitter Controls "Normal" Water Level Valve 1HDL-LV2A
HDL	1HDL-LS22A	Fifth Point Heater Drain Receiver Tank 1HDL-TK1A Level Switch Opens "High" Level Control Valve 1HDL-LV22A
HDL	1HDL-LT22A	Fifth Point Heater Drain Receiver Tank 1HDL-TK1A Level Transmitter Controls 1HDL-LV22A
HDL	1HDL-LT2B	Fifth Point Heater Drain Receiver Tank 1HDL-TK1B Level Transmitter Similar to 2A
HDL	1HDL-LS22B	Fifth Point Heater Drain Receiver Tank 1HDL-TK1B Level Switch Similar to 22A
HDL	1HDL-LT22B	Fifth Point Heater Drain Receiver Tank 1HDL-TK1A Level Transmitter Similar to 22A
HDL	1HDL-LIC2A	Fifth Point Heater Drain Receiver 1HDL-TK1A Normal Water Level Drain Control Valve 1HDL-LV2A Controller
HDL	1HDL-LV2A	Fifth Point Heater Drain Receiver 1HDL-TK1A Normal Water Level Drain Control Valve Modulated by 1HDL-TK1A Normal Water Level Signal
HDL	1HDL-LIC3A	Fourth Point Heater 1CNM-E4A Normal Water Level Drain Control Valve 1HDL-LV3A Controller
HDL	1HDL-LIC2B	Fifth Point Heater Drain Receiver 1HDL-TK1B Normal Water Level Drain Control Valve 1HDL-LV2B Controller
HDL	1HDL-LV2B	Fifth Point Heater Drain receiver 1HDL-TK1B Normal Water Level Drain Control Valve Modulated by 1HDL-TK1B Normal Water Level Control
HDL	1HDL-LIC3B	Fourth Point Heater 1CNM-E4B Normal Water Level Drain Control Valve 1HDL-LV3B Controller

Zone No. VIII

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
HDL	1HDL-LIC4A	Third Point Heater 1CNM-E3A Normal Water Drain Control Valve 1HDL-LV2A Controller
HDL	1HDL-LIC4B	Third Point Heater 1CNM-E3B Normal Water Drain Control Valve 1HDL-LV2B Controller
HDL	1HDL-LIC5A	Second Point Heater 1CNM-E2A Normal Water Level Drain Control Valve 1HDL-LV5A Controller
HDL	1HDL-I/P20A	I/P Converter For Third Point Heater 1CNM-E3A Drain Pump 1HDL-P1A Minimum Flow Recirculation Valve
HDL	1HDL-LIC5B	Second Point Heater 1CNM-E2B Normal Water Level Drain Control Valve 1HDL-LV5B Controller
HDL	1HDL-I/P20B	I/P Converter for Third Point Heater 1CNM-E3B Drain Pump 1HDL-P1B Minimum Flow Recirculation Valve
HDL	1HDL-LIC22A	Fifth Point Heater Drain Receiver 1HDL-TK1A High Water Level Drain Control Valve 1HDL-LV22A Controller
HDL	1HDL-LIC23A	Fourth Point Heater 1CNM-E4A High Water Level Drain Control Valve 1HDL-LV23A Controller
HDL	1HDL-LIC22B	Fifth Point Heater Drain Receiver 1HDL-TK1B High Water Level Drain Control Valve 1HDL-LV22B Controller
HDL	1HDL-LIC23B	Fourth Point Heater 1CNM-E4B High Water Level Drain Control Valve 1HDL-LV23B Controller
HDL	1HDL-LIC24A	Third Point Heater 1CNM-E3A High Water Level Drain Control Valve 1HDL-LV24A Controller
HDL	1HDL-LIC25A	Second Point Heater 1CNM-E2A High Water Level Drain Control Valve 1HDL-LV25A Controller
HDL	1HDL-LIC24B	Third Point Heater 1CNM-E3B High Water Level Drain Control Valve 1HDL-LV24B Controller
HDL	1HDL-LIC25B	Second Point Heater 1CNM-E2B High Water Level Drain Control Valve 1HDL-LV25B Controller
IAS	1IAS-TS2A	Instrument Air Compressor 1IAS-C1A First Stage Air Temperature Switch
IAS	1IAS-TS3A	Instrument Air Compressor 1IAS-C1A Lube Oil Temperature Switch

Zone No. VIII

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
IAS	1IAS-PS4A	Instrument Air Compressor 1IAS-C1A Lube Oil Pressure Switch
IAS	1IAS-TS6A	Instrument Air Compressor 1IAS-C1A Cooling Water Jacket Temperature Switch
IAS	1IAS-TS2B	Instrument Air Compressor 1IAS-C1B First Stage Air Temperature Switch
IAS	1IAS-TS3B	Instrument Air Compressor 1IAS-C1B Lube Oil Temperature Switch
IAS	1IAS-PS4B	Instrument Air Compressor 1IAS-C1B Lube Oil Pressure Switch
IAS	1IAS-TS6B	Instrument Air Compressor 1IAS-C1B Cooling Water Jacket Temperature Switch
IAS	1IAS-TS2C	Instrument Air Compressor 1IAS-C1C First Stage Air Temperature Switch
IAS	1IAS-TS3C	Instrument Air Compressor 1IAS-C1C Lube Oil Temperature Switch
IAS	1IAS-PS4C	Instrument Air Compressor 1IAS-C1C Lube Oil Pressure Switch
IAS	1IAS-TS6C	Instrument Air Compressor 1IAS-C1C Cooling Water Jacket Temperature Switch
IAS	1IAS-TS10A	Instrument Air Compressor 1IAS-C1A Aftercooler Air Discharge Temperature Switch
IAS	1IAS-TS20A	Instrument Air Dryer 1A Heater Temperature Switch
IAS	1IAS-TS10B	Instrument Air Compressor 1IAS-C1B Aftercooler Air Discharge Temperature Switch
IAS	1IAS-TS20B	Instrument Air Dryer 1B Heater Temperature Switch
IAS	1IAS-TS10C	Instrument Air Compressor 1IAS-C1C Aftercooler Air Discharge Temperature Switch
IAS	1IAS-TS20C	Instrument Air Dryer 1C Heater Temperature Switch
MSS	1MSS-FTX13B	Air Ejector Second Stage Steam Flow Transmitter

Zone No. VIII

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
SVH	1SHV-AOV25A 1SVH-SOV25A	Feedwater Heater 1CNM-E3A Vent Valve
SVH	1SVH-AOV25B 1SVH-SOV25B	Feedwater Heater 1CNM-E3B Vent Valve
C33	1C33-LVF002 1C33-SOVF002	Startup Flow Control Feedwater Valve
C33	1C33-I/PF002	I/P Converter for Reactor Flow Control Valve 1C33-LVF002
C33	C33-FTN002A	Feedwater Flow Input to Summer. Recirc NPSH Interlock and Recirc LFHG Transfer Inputs from FW Control System
C33	C33-FTN002B	Feedwater Flow Input to Summer. Recirc NPSH Interlock and Recirc LFHG Transfer Inputs from FW Control System
C85	1C85-PTN001A	Main Steam Pressure - Regulation Input Pressure to Regulator A
C85	1C85-PTN001B	Main Steam Pressure - Regulation Input Pressure to Regulator B
TME	1TME-PVSSAFV	Steam Seal Header Backup Pressure Control Valve
TME	1TME-PCW2	Steam Seal Evaporator Outlet Header Pressure. Modulates Valve 1TME-PVSSAFV

Zone No. XI

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
DTM	1DTM-AOV55A 1DTM-SOV55A	Air Ejector Inter Condenser 1ARC-E2A Isolation Valve

Zone No. XII

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
DTM	1DTM-AOV55B 1DTM-SOV55B	Air Ejector Inter Condenser 1ARC-E2B Isolation Valve

Zone No. XIII

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
TML	1TML-PSPS1	TG Main Shaft Lube Oil Pump Suction Pressure
TML	1TML-PSPS2A	TG Main Shaft Lube Oil Pump Discharge Pressure
TML	1TML-PSPS2B	TG Bearing Oil Header Pressure
TML	1TML-PSPS3	TG Main Shaft Lube Oil Pump Discharge Pressure
TML	1TML-PSPS4	TG Turning Gear Oil Pump Discharge Pressure

Zone No. XV

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
DSR	1DSR-LV65A 1DSR-SOV65A	Reheater Drain Receiver 1DSR-TK1A Normal Water Level Drain Control Valve
DTM	1DTM-LVY187 1DTM-SOVY187	Radwaste Reboiler Drain Receiver 1DTM-TK1 Normal Water Level Control Valve
HDH	1HDH-LT6A	First Point Heater 1FWS-E1A Water Level Transmitter Controls "Normal" Level Control Valve 1HDH-LV6A
HDH	1HDH-LS7A	First Point Heater 1FWS-E1A Water Level Switch Closes Extraction Steam Valve 1ESS-MOV3A and Nonreturn Valve 1ESS-NRV34A and Opens Extraction Steam Bypass Valve on High Level
HDH	1HDH-LS26A	First Point Heater 1FWS-E1A Water Level Switch Opens "High" Level Control Valve 1HDL-LV26A
HDH	1HDH-LT26A	First Point Heater 1FWS-E1A High Water Level Transmitter
HDH	1HDH-LV6A 1HDH-SOV6A	First Point Heater 1FWS-E1A Normal Water Level Drain Control Valve
HDL	1HDL-LT3A	Fourth Point Heater 1CNM-E4A Normal Water Level Transmitter-Functions Similar to 1HDH-LT6A
HDL	1HDL-LT4A	Third Point Heater 1CNM-E3A Water Level Transmitter-Functions Similar to 1HDH-LT6A
HDL	1HDL-LT5A	Second Point Heater 1CNM-E2A Water Level Transmitter-Functions Similar to 1HDH-LT6A
HDL	1HDL-LS6A	Third Point Heater 1CNM-E3A Water Level Switch Stops Heater Drain Pump at Low Level
HDL	1HDL-LS10A	Third Point Heater 1CNM-E3A Level Switch Closes Extraction Steam Isolation Valve and Nonreturn Valve on High Level
HDL	1HDL-LS9A	Fourth Point Heater 1CNM-E4A Level Switch Closes Extraction Steam Isolation Valve and Nonreturn Valve on High Level
HDL	1HDL-LS11A	Second Point Heater 1CNM-E2A Level Switch Closes Extraction Steam Isolation Valve and Nonreturn Valve on High Level

Zone No. XV

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
HDL	1HDL-LV4A	Third Point Heater 1CNM-E3A Normal Water Drain Control Valve Closes Extraction Steam Isolation Valve Nonreturn on High Level
HDL	1HDL-LV5A 1HDL-SOV5A	Second Point Heater 1CNM-E2A Normal Water Level Drain Control Valve With Solenoid
HDL	1HDL-FV20A 1HDL-SOV20A	Third Point Heater 1CNM-E3A Drain Pump 1HDL-P1A Minimum Flow Recirculation Valve With Solenoid
HDL	1HDL-FT20A	Third Point Heater Drain Pumps 1HDL-P1A, P1B Flow Transmitter
HDL	1HDL-LS23A	Fourth Point Heater 1CNM-E4A High Water Level Switch Opens Heater Drain to Condenser
HDL	1HDL-LT23A	Fourth Point Heater 1CNM-E4A High Water Level Transmitter
HDL	1HDL-LS24A	Third Point Heater 1CNM-E3A Water Level Switch Similar to LS23A
HDL	1HDL-LT24A	Third Point Heater 1CNM-E3A Water Level Switch Similar to LT23A
HDL	1HDL-LS25A	Second Point Heater 1CNM-E2A Water Level Switch Similar to LSL3A
HDL	1HDL-LT25A	Second Point Heater 1CNM-E2A Water Level Transmitter Similar to LT23A
SVH	1SVH-AOV26A 1SVH-SOV26A	Feedwater Heater 1CNM-E3A Vent Valve
SVH	1SVH-AOV31A 1SVH-SOV31A	Feedwater Heater 1CNM-E4A Vent Valve
SVH	1SVH-AOV32A 1SVH-SOV32A	Feedwater Heater 1CNM-E5A Vent Valve
SVH	1SVH-AOV40A 1SVH-SOV40A	Drain Cooler 1CNM-DCL2A Vent Valve

Zone No. XV

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
SVH	1SVH-AOV41A 1SVH-SOV41A	Drain Cooler 1CNM-DCL1A Vent Valve
SVH	1SVH-AOV42A 1SVH-SOV42A	Drain Cooler 1CNM-DCL1A Vent Valve
SVH	1SVH-AOV43A 1SVH-SOV43A	Drain Cooler 1CNM-DCL2A Vent Valve
SVH	1SVH-AOV45A 1SVH-SOV45A	Feedwater Heater 1FWS-E1A Vent Valve
SVH	1SVH-AOV46A 1SVH-SOV46A	Feedwater Heater 1FWS-E1A Vent Valve
SVH	1SVH-AOV51A 1SVH-SOV51A	Feedwater Heater 1CNM-E2A Vent Valve
SVH	1SVH-AOV52A 1SVH-SOV52A	Feedwater Heater 1CNM-E2A Vent Valve

Zone No. XVI

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
DSM	1DSM-LV75B 1DSM-SOV75B	Moisture Separator Drain Receiver 1DSM-TK1B Normal Water Level Control Valve
HDH	1HDH-LT6B	First Point Heater 1FWS-E1B Water Level Transmitter
HDH	1HDH-LS7B	First Point Heater 1FWS-E1B Water Level Switch
HDH	1HDH-LS26B	First Point Heater 1FWS-E1B Water Level Switch
HDH	1HDH-LT26B	First Point Heater 1FWS-E1B Water Level Transmitter
HDH	1HDH-LV6B 1HDH-SOV6B	First Point Heater 1FWS-E1B Normal Water Level Drain Control Valve
HDH	1HDH-LV26B 1HDH-SOV26B	First Point Heater 1FWS-E1B High Water Level Drain Control Valve
HDL	1HDL-LT3B	Fourth Point Heater 1CNM-E4B Water Level Transmitter
HDL	1HDL-LT4B	Third Point Heater 1CNM-E3B Water Level Transmitter
HDL	1HDL-LT5B	Second Point Heater 1CNM-E2B Water Level Transmitter
HDL	1HDL-LS6B	Third Point Heater 1CNM-E3B Water Level Switch
HDL	1HDL-LS10B	Third Point Heater 1CNM-E3B Level Switch
HDL	1HDL-LS9B	Fourth Point Heater 1CNM-E4B Level Switch
HDL	1HDL-LS11B	Second Point Heater 1CNM-E2B Level Switch
HDL	1HDL-LV4B	Third Point Heater 1CNM-E3B Normal Water Drain Control Valve

NOTE: All HDL System B instruments have similar functions as System A instruments in Zone XV.

Zone No. XVI

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
HDL	1HDL-LV5B 1HDL-SOV5B	Second Point Heater 1CNM-E2B Normal Water Level Drain Control Valve
HDL	1HDL-FV20B 1HDL-SOV20B	Third Point Heater 1CNM-E3B Drain Pump 1HDL-P1B Minimum Flow Recirculation Valve
HDL	1HDL-FT20B	Third Point Heater Drain Pumps 1HDL-PIC/PID Flow Transmitter
HDL	1HDL-LS23B	Fourth Point Heater 1CNM-EB Water Level Switch
HDL	1HDL-LT23B	Fourth Point Heater 1CNM-E4B Water Level Transmitter
HDL	1HDL-LS24B	Third Point Heater 1CNM-E3B Water Level Switch
HDL	1HDL-LT24B	Third Point Heater 1CNM-E3B Water Level Transmitter
HDL	1HDL-LS25B	Second Point Heater 1CNM-E2B Water Level Switch
HDL	1HDL-LT25B	Second Point Heater 1CNM-E2B Water Level Transmitter
SVH	1SVH-AOV26B 1SVH-SOV26B	Feedwater Heater 1CNM-E3B Vent Valve
SVH	1SVH-AOV31B 1SVH-SOV31B	Feedwater Heater 1CNM-E4B Vent Valve
SVH	1SVH-AOV32B 1SVH-SOV32B	Feedwater Heater 1CNM-E5B Vent Valve
SVH	1SVH-AOV40B 1SVH-SOV40B	Drain Cooler 1CNM-DCL2B Vent Valve
SVH	1SVH-AOV41B 1SVH-SOV41B	Drain Cooler 1CNM-DCL1B Vent Valve

Zone No. XVI

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
SVH	1SVH-AOV42B 1SVH-SOV42B	Drain Cooler 1CNM-DCL1B Vent Valve
SVH	1SVH-AOV43B 1SVH-SOV43B	Drain Cooler 1CNM-DCL2B Vent Valve
SVH	1SVH-AOV45B 1SVH-SOV45B	Feedwater Heater 1FWS-E1B Vent Valve
SVH	1SVH-AOV46B 1SVH-SOV46B	Feedwater Heater 1FWS-E1B Vent Valve
SVH	1SVH-AOV51B 1SVH-SOV51B	Feedwater Heater 1CNM-E2B Vent Valve
SVH	1SVH-AOV52B 1SVH-SOV52B	Feedwater Heater 1CNM-E2B Vent Valve

Zone No. XIX

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
CNM	1CNM-FV114 1CNM-SOVX114 1CNM-SOVY114	Condensate Minimum Flow Recirculation Control Valve
DTM	1DTM-AOVSPDV3 1DTM-SOV20DV3	Main Steam Control Valve 1MSS-HYVCVB Drain Valve
HDH	1HDH-LV26A 1HDH-SOV26A	First Point Heater 1FWS-E1A High Water Level Drain Control Valve
HDL	1HDL-LV2A	Fifth Point Heater Drain Receiver 1HDL-TK1A Normal Water Level Drain Control Valve
HDL	1HDL-LV3A	Fourth Point Heater 1CNM-E4A Normal Water Level Drain Control Valve
HDL	1HDL-LV22A 1HDL-SOV22A	Fifth Point Heater Drain Receiver 1HDL-TK1A High Water Level Drain Control Valve
HDL	1HDL-LV23A 1HDL-SOV23A	Fourth Point Heater 1CNM-E4A High Water Level Drain Control Valve
HDL	1HDL-LV22B 1HDL-SOV22B	Fifth Point Heater Drain Receiver 1HDL-TK1B High Water Level Drain Control Valve
HDL	1HDL-LV23B 1HDL-SOV23B	Fourth Point Heater 1CNM-E4B High Water Level Drain Control Valve
HDL	1HDL-LV24A 1HDL-SOVX24A 1HDL-SOVY24A	Third Point Heater 1CNM-E3A High Water Level Drain Control Valve
HDL	1HDL-LV25A 1HDL-SOVX25A 1HDL-SOVY25A	Second Point Heater 1CNM-E2A High Water Level Drain Control Valve

Zone No. XIX

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
HDL	1HDL-LV24B 1HDL-SOVX24B 1HDL-SOVY24B	Third Point Heater 1CNM-E3B High Water Level Drain Control Valve
HDL	1HDL-LV25B 1HDL-SOVX25B 1HDL-SOVY25B	Second Point Heater 1CNM-E2B High Water Level Drain Control Valve
TMB	1TMB-TSTC01	Fan 1TMB-HF1-H1 Thermal Cutout
TMB	1TMB-TSTC02	Fan 1TMB-HF2-H2 Thermal Cutout
TMB	1TMB-TS23HF	Turbine Generator EH Fluid Reservoir Temperature Switch
TMB	1TMB-TS23HFX	Turbine Generator EH Fluid Heater Monitor
TMB	1TMB-PSPS102	Turbine Generator EH Fluid Discharge Pressure Switch. At Low Pressure Allows Automatic Start of TG EH Fluid Pumps 1HFPM-A and 1HFPM-B
TMB	1TMB-PSPS103	Turbine Generator EH Fluid Discharge Pressure Switch. At Low Pressure Allows Automatic Start of TG EH Fluid Pumps 1HFPM-A and 1HFPM-B

Zone No. 13

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
N64	1N64-I/PK001A	I/P Converter to R005A for Off-Gas Condenser Shell Side Drain Valve 1N64-LVF016A
N64	1N64-I/PK001B	I/P Converter to R005B for Off-Gas Condenser Shell Side Drain Valve 1N64-LVF016B
N64	1N64-LTN007A	Off-Gas Cond CNDB002 Drain Valve N64-F016A Control
N64	1N64-LTN007B	Off-Gas Cond CNDB002 Drain Valve N64-F016B Control
N64	1N64-TEN020A	Moist Separator D010A Outlet Temp Detector
N64	1N64-TEN020B	Moist Separator D010B Outlet Temp Detector
N64	1N64-PVF009A	Off-Gas Preheater Supply Valve A
N64	1N64-PIC48A	Pressure Control for Off-Gas Preheater Supply Valve
N64	1N64-PVF009B	Off-Gas Preheater Supply Valve B
N64	1N64-PIC48B	Pressure Control for Off-Gas Preheater Supply Valve

Zone No. 15

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
N64	1N64-LCR005A	Controller R005A to Drain Valve LVF016A
N64	1N64-LCR005B	Controller R005A to Drain Valve LVF016B
N64	1N64-LISN008A	Level Indicator Switch Associated with Drain Valve LVF016A
N64	1N64-LISN008B	Level Indicator Switch Associated with Drain Valve LVF016B

CONTROL COMPONENTS

Zone Nos. C1

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
B21	1B21*PTN058B	Reactor Vessel Pressure to ATWS Trip Circuit
B21	1B21*PTN058F	Reactor Vessel Pressure to ATWS Trip Circuit
B21	1B21*LTN099B	Reactor Vessel Level to ATWS Trip Circuit
B21	1B21*LTN099F	Reactor Vessel Level to ATWS Trip Circuit
B33	1B33*FTN011A	Recirculation Flow Input to Flow Control Valve
B33	1B33*FTN011B	Recirculation Flow Input to Flow Control Valve
B33	1B33*PTN040	Steam Dome Pressure
B33	1B33-PTN005B	RCS Pump B Seal Cavity No. 2 (Upper) Pressure Transmitter
C11	1C11-FCR600	Flow Controller to Control Valves 1C11-F002A and F002B
C11	1C11-FTN004	Control Rod Drive Cooling Water Flow Input to D009A and D009B Manual/Auto Stations for Flow Valves F002A and F002B
C11	1C11-HSSD009A	Manual/Auto Station for Flow Control Valve F002A
C11	1C11-HSSD009B	Manual/Auto Station for Flow Control Valve F002B
C11	1C11-I/PK001	Current to Pneumatic Converter to Flow Control Valves F002A and F002B via Manual/Auto Stations D009A and D009B
C33	1C33*PTN008B	Steam Dome to Pump Suction ΔT Recirc Pump Interlock
C33	1C33*FTN003B	Reactor Steam Flow Sensor to Summer for 3 Element Flow Control
C33	1C33*FTN003D	Reactor Steam Flow Sensor to Summer for 3 Element Flow Control

CONTROL COMPONENTS

Zone Nos. C2

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
B21	1B21*PTN058A	Reactor Vessel Pressure to ATWS Trip Circuit
B21	1B21*PTN058E	Reactor Vessel Pressure to ATWS Trip Circuit
B21	1B21*LTN099A	Reactor Vessel Level to ATWS Trip Circuit
B21	1B21*LTN099E	Reactor Vessel Level to ATWS Trip Circuit
C33	1C33*FTN003A	Reactor Steam Flow Sensor to Summer for 3 Element Flow Control
C33	1C33*FTN003C	Reactor Steam Flow Sensor to Summer for 3 Element Flow Control
C33	1C33*LTN004A	Reactor Level Sensor to Summer. High Level Trip Logic "A" RFP Turbines and Main Turbine Trip on 2/3
C33	1C33*LTN004B	Reactor Level Sensor to Summer. High Level Trip Logic "B" RFP Turbines and Main Turbine Trip on 2/3
C33	1C33*LTN004C	Reactor Level Sensor to Summer. High Level Trip Logic "C" RFP Turbines and Main Turbine Trip on 2/3
C33	1C33*PTN005	Reactor Vessel Dome Pressure "B" Transmitter Input to Recirculation System Thermal Shock Interlocks
C33	1C33*PTN008A	Steam Dome to Pump Suction ΔT Recirc Pump Interlock

Zone Nos. AB-070-8, AB-095-8, AB-114-6

System Code	Instrument/ Device ID No.	Instrument/Device Description/Function
CCP	1CCP-LT120	Reactor Plant Component Cooling Water Surge Tank Level
CCP	1CCP-I/P128	Reactor Plant Component Cooling Water Supply Header
CCP	1CCP-TVX128	Reactor Plant Component Cooling Water Supply Header Valve
CCP	1CCP-TVY128	Reactor Plant Component Cooling Water Supply Header Valve
CCP	1CCP-PT127	Reactor Plant Component Cooling Water Pumps Combined Discharge

APPENDIX C

LIST OF HIGH ENERGY LINES

NOTES:

1. Zone 15 has no high energy lines but has nonsafety grade components.

2. Zones XII, XX, and 9 through 12 have high energy lines but no control components.

3. All lines of control rod drive (RDS, 36-1) systems are considered high energy lines. No separate listing has therefore been made in Appendix C.

4. High energy piping in the auxiliary building is limited to the systems identified in the auxiliary building zone analysis, and no separate listing has been made.

5. Zone VII has no high energy line.

APPENDIX C

Zone I

Line No.

1-CND-006-221-4

1-CNM-002-32-4
1-CNM-002-33-4
1-CNM-003-151-4
1-CNM-003-153-4
1-CNM-004-152-4
1-CNM-004-173-4
1-CNM-018-42-4
1-CNM-020-36-4
1-CNM-020-37-4
1-CNM-020-38-4
1-CNM-020-39-4
1-CNM-020-50-4
1-CNM-020-52-4
1-CNM-024-24-4
1-CNM-024-30-4
1-CNM-024-43-4
1-CNM-024-44-4
1-CNM-024-54-4
1-CNM-024-115-4
1-CNM-034-173-4
1-CNM-034-177-4

1-DTM-002-360-4
1-DTM-002-389-4
1-DTM-002-390-4
1-DTM-002-391-4
1-DTM-002-392-4
1-DTM-002-393-4
1-DTM-002-394-4
1-DTM-002-395-4
1-DTM-002-624-4
1-DTM-003-359-4
1-DTM-004-361-4
1-DTM-004-625-4

1-MSS-002-39-4
1-MSS-002-40-4
1-MSS-003-25-4
1-MSS-006-32-4
1-MSS-006-34-4
1-MSS-006-35-4
1-MSS-006-41-4
1-MSS-006-49-4
1-MSS-006-50-4
1-MSS-008-33-4

APPENDIX C

Zone III

Line No.	Line No.
1-CNM-020-61-4	1-DSM-014-53-4
1-CNM-020-62-4	1-DSM-014-54-4
1-CNM-020-63-4	1-DSM-018-5-4
1-CNM-020-69-4	1-DSM-018-7-4
1-CNM-020-70-4	1-DSM-018-20-4
1-CNM-020-71-4	1-DSM-018-22-4
	1-DSM-018-31-4
1-DSM-002-8-4	1-DSM-018-32-4
1-DSM-002-9-4	
1-DSM-002-23-4	1-DSR-002-7-4
1-DSM-002-24-4	1-DSR-002-8-4
1-DSM-002-37-4	1-DSR-002-16-4
1-DSM-002-38-4	1-DSR-002-17-4
1-DSM-002-39-4	1-DSR-004-9-4
1-DSM-002-40-4	1-DSR-004-18-4
1-DSM-002-41-4	1-DSR-006-6-4
1-DSM-002-42-4	1-DSR-006-15-4
1-DSM-002-43-4	1-DSR-006-31-4
1-DSM-002-44-4	1-DSR-008-22-4
1-DSM-002-45-4	1-DSR-008-23-4
1-DSM-002-46-4	1-DSR-008-24-4
1-DSM-002-47-4	1-DSR-008-25-4
1-DSM-002-48-4	1-DSR-008-28-4
1-DSM-002-49-4	1-DSR-012-2-4
1-DSM-002-50-4	1-DSR-012-11-4
1-DSM-002-51-4	1-DSR-014-4-4
1-DSM-002-52-4	1-DSR-014-5-4
1-DSM-004-10-4	1-DSR-014-13-4
1-DSM-004-25-4	1-DSR-014-14-4
1-DSM-004-33-4	1-DSR-014-26-4
1-DSM-004-34-4	1-DSR-014-27-4
1-DSM-004-35-4	1-DSR-024-1-4
1-DSM-004-36-4	1-DSR-024-10-4
1-DSM-006-15-4	
1-DSM-006-26-4	1-DTM-150-42-4
1-DSM-012-1-4	1-DTM-150-43-4
1-DSM-012-2-4	1-DTM-150-245-4
1-DSM-012-3-4	1-DTM-150-246-4
1-DSM-012-4-4	1-DTM-150-316-4
1-DSM-012-6-4	1-DTM-150-317-4
1-DSM-012-11-4	1-DTM-150-357-4
1-DSM-012-16-4	1-DTM-150-608-4
1-DSM-012-17-4	1-DTM-150-609-4
1-DSM-012-18-4	1-DTM-002-45-4
1-DSM-012-19-4	1-DTM-002-58-4
1-DSM-012-21-4	1-DTM-002-125-4
1-DSM-012-27-4	1-DTM-002-126-4
1-DSM-014-13-4	1-DTM-002-129-4
1-DSM-014-14-4	1-DTM-002-130-4
1-DSM-014-29-4	1-DTM-002-231-4
1-DSM-014-30-4	1-DTM-002-232-4

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Zone III

Line No.	Line No.
1-DTM-002-233-4	1-DTM-004-266-4
1-DTM-002-238-4	1-DTM-004-269-4
1-DTM-002-239-4	1-DTM-004-278-4
1-DTM-002-240-4	1-DTM-004-295-4
1-DTM-002-322-4	1-DTM-004-298-4
1-DTM-002-323-4	1-DTM-004-422-4
1-DTM-002-324-4	1-DTM-004-424-4
1-DTM-002-326-4	1-DTM-004-433-4
1-DTM-002-327-4	1-DTM-004-435-4
1-DTM-002-428-4	1-DTM-004-443-4
1-DTM-002-430-4	1-DTM-006-35-4
1-DTM-002-432-4	1-DTM-006-50-4
1-DTM-002-437-4	1-DTM-006-150-4
1-DTM-002-438-4	1-DTM-006-166-4
1-DTM-002-440-4	1-DTM-006-187-4
1-DTM-002-441-4	1-DTM-006-197-4
1-DTM-002-444-4	1-DTM-006-259-4
1-DTM-002-461-4	1-DTM-006-425-4
1-DTM-002-656-4	1-DTM-006-455-4
1-DTM-025-46-4	1-DTM-006-456-4
1-DTM-025-368-4	1-DTM-006-457-4
1-DTM-025-369-4	1-DTM-006-458-4
1-DTM-025-370-4	1-DTM-008-227-4
1-DTM-025-371-4	1-DTM-008-294-4
1-DTM-025-431-4	1-DTM-008-325-4
1-DTM-003-1-4	1-DTM-008-347-4
1-DTM-003-2-4	1-DTM-008-363-4
1-DTM-003-4-4	1-DTM-008-364-4
1-DTM-003-5-4	1-DTM-008-372-4
1-DTM-003-6-4	1-DTM-008-373-4
1-DTM-003-7-4	1-DTM-008-421-4
1-DTM-003-8-4	1-DTM-010-203-4
1-DTM-003-37-4	1-DTM-010-206-4
1-DTM-003-38-4	1-DTM-010-237-4
1-DTM-003-39-4	1-DTM-010-244-4
1-DTM-003-47-4	1-DTM-012-318-4
1-DTM-003-48-4	1-DTM-012-365-4
1-DTM-003-49-4	1-DTM-014-25-4
1-DTM-003-60-4	1-DTM-014-40-4
1-DTM-003-79-4	1-DTM-020-631-4
1-DTM-003-81-4	1-DTM-024-434-4
1-DTM-003-110-4	
1-DTM-003-188-4	1-ESS-008-63-4
1-DTM-003-198-4	1-ESS-010-1-4
1-DTM-003-199-4	1-ESS-010-2-4
1-DTM-003-204-4	1-ESS-010-3-4
1-DTM-003-360-4	1-ESS-010-62-4
1-DTM-003-530-4	1-ESS-012-6-4
1-DTM-003-650-4	1-ESS-012-7-4
1-DTM-003-653-4	1-ESS-012-10-4
1-DTM-004-151-4	1-ESS-012-13-4

Zone III

Line No.	Line No.
1-ESS-012-14-4	1-MSS-010-66-4
1-ESS-012-71-4	1-MSS-010-67-4
1-ESS-012-72-4	1-MSS-010-68-4
1-ESS-012-73-4	1-MSS-010-69-4
1-ESS-012-74-4	1-MSS-012-17-4
1-ESS-016-4-4	1-MSS-012-18-4
1-ESS-016-5-4	1-MSS-016-56-4
1-ESS-016-105-4	1-MSS-017-57-4
1-ESS-016-106-4	1-MSS-024-13-4
1-ESS-018-8-4	1-MSS-024-14-4
1-ESS-018-9-4	1-MSS-024-15-4
1-ESS-018-11-4	1-MSS-024-16-4
1-ESS-018-12-4	1-MSS-024-45-4
1-ESS-018-15-4	1-MSS-024-46-4
1-ESS-020-17-4	1-MSS-024-47-4
1-ESS-020-21-4	1-MSS-024-48-4
1-ESS-020-75-4	1-MSS-042-12-4
1-ESS-020-76-4	
1-ESS-020-77-4	1-SVH-002-75-4
1-ESS-020-78-4	1-SVH-002-77-4
1-ESS-028-18-4	1-SVH-002-78-4
1-ESS-028-19-4	1-SVH-002-80-4
1-ESS-028-22-4	1-SVH-002-82-4
1-ESS-028-38-4	1-SVH-002-93-4
1-ESS-028-39-4	1-SVH-002-94-4
	1-SVH-002-95-4
1-FWR-010-2-4	1-SVH-002-96-4
1-FWR-010-4-4	1-SVH-002-98-4
1-FWR-010-6-4	1-SVH-002-100-4
	1-SVH-002-168-4
1-HDL-016-54-4	1-SVH-003-73-4
1-HDL-016-69-4	1-SVH-003-74-4
	1-SVH-003-76-4
1-HRS-150-13-4	1-SVH-003-81-4
1-HRS-150-16-4	1-SVH-003-91-4
1-HRS-024-2-4	1-SVH-003-92-4
1-HRS-024-4-4	1-SVH-003-99-4
1-HRS-026-1-4	1-SVH-003-101-4
1-HRS-026-3-4	1-SVH-003-132-4
	1-SVH-003-133-4
1-MSS-002-39-4	1-SVH-003-148-4
1-MSS-002-40-4	1-SVH-003-149-4
1-MSS-003-21-4	1-SVH-003-151-4
1-MSS-004-22-4	1-SVH-003-152-4
1-MSS-004-51-4	1-SVH-003-154-4
1-MSS-006-24-4	1-SVH-003-156-4
1-MSS-008-33-4	1-SVH-006-79-4
1-MSS-010-9-4	1-SVH-006-97-4
1-MSS-010-10-4	1-SVH-006-150-4
1-MSS-010-11-4	1-SVH-006-153-4
1-MSS-010-19-4	

Zone III

Line No.

1-TME-003-1-4
1-TME-004-4-4
1-TME-004-5-4
1-TME-006-6-4
1-TME-010-2-4
1-TME-010-3-4
1-TME-010-13-4
1-TME-010-14-4

Zone V

<u>Line No.</u>

1-CNA-002-2-4
1-CNA-002-3-4
1-CNA-002-4-4
1-CNA-002-5-4
1-CNA-002-6-4
1-CNA-002-7-4
1-CNA-002-8-4
1-CNA-002-31-4
1-CNA-002-34-4

1-DTM-004-435-4
1-DTM-006-427-4

1-MSS-006-24-4

1-TME-003-1-4
1-TME-010-2-4
1-TME-010-3-4
1-TME-010-13-4
1-TME-010-14-4

Zone VI

Line No.

1-CNA-002-2-4
1-CNA-002-10-4
1-CNA-002-30-4
1-CNA-025-9-4
1-CNA-025-35-4
1-CNA-003-1-4
1-CNA-003-32-4

1-DTM-002-444-4
1-DTM-004-432-4
1-DTM-004-433-4
1-DTM-004-443-4
1-DTM-008-421-4

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Zone VIII

Line No.

1-CNM-002-45-4
1-CNM-002-46-4
1-CNM-002-109-4
1-CNM-002-156-4
1-CNM-003-146-4
1-CNM-003-147-4
1-CNM-003-148-4
1-CNM-003-153-4
1-CNM-003-159-4
1-CNM-003-160-4
1-CNM-003-161-4
1-CNM-003-162-4
1-CNM-016-64-4
1-CNM-016-65-4
1-CNM-016-66-4
1-CNM-016-88-4
1-CNM-016-180-4
1-CNM-016-181-4
1-CNM-018-49-4
1-CNM-020-14-4
1-CNM-020-15-4
1-CNM-020-16-4
1-CNM-020-38-4
1-CNM-020-47-4
1-CNM-020-50-4
1-CNM-020-67-4
1-CNM-020-76-4
1-CNM-020-80-4
1-CNM-020-82-4
1-CNM-020-83-4
1-CNM-020-84-4
1-CNM-024-17-4
1-CNM-024-54-4
1-CNM-030-81-4
1-CNM-030-85-4
1-CNM-030-87-4

1-CNS-004-9-4
1-CNS-006-7-4
1-CNS-006-8-4

1-DTM-002-511-4
1-DTM-002-512-4
1-DTM-002-513-4
1-DTM-002-514-4
1-DTM-002-541-4
1-DTM-002-542-4
1-DTM-002-543-4
1-DTM-002-544-4
1-DTM-002-656-4
1-DTM-003-79-4

Line No.

1-DTM-003-110-4
1-DTM-004-151-4
1-DTM-004-176-4
1-DTM-004-177-4
1-DTM-004-625-4

1-FWR-008-1-4
1-FWR-008-3-4
1-FWR-008-5-4

1-FWS-002-73-4
1-FWS-003-70-4
1-FWS-003-71-4
1-FWS-003-72-4
1-FWS-003-74-4
1-FWS-003-75-4
1-FWS-003-76-4
1-FWS-003-79-4
1-FWS-012-12-4
1-FWS-012-13-4
1-FWS-016-11-4
1-FWS-016-81-4
1-FWS-016-82-4
1-FWS-020-1-4
1-FWS-020-2-4
1-FWS-020-3-4
1-FWS-020-5-4
1-FWS-020-6-4
1-FWS-020-7-4
1-FWS-020-8-4
1-FWS-020-9-4
1-FWS-020-10-4
1-FWS-020-21-4
1-FWS-020-22-4
1-FWS-020-25-4
1-FWS-020-26-4
1-FWS-020-29-4
1-FWS-020-30-4
1-FWS-020-31-4
1-FWS-020-32-4
1-FWS-020-46-4
1-FWS-020-80-4
1-FWS-030-20-4
1-FWS-030-27-4
1-FWS-030-28-4
1-FWS-030-61-4

1-HDH-016-6-4
1-HDH-016-13-4
1-HDL-002-52-4
1-HDL-002-53-4

Zone VIII

Line No.

1-HDL-002-67-4
1-HDL-002-68-4
1-HDL-004-66-4
1-HDL-004-96-4
1-HDL-010-24-4
1-HDL-010-46-4
1-HDL-010-55-4
1-HDL-010-70-4
1-HDL-012-58-4
1-HDL-012-73-4
1-HDL-014-110-4
1-HDL-014-115-4
1-HDL-016-54-4
1-HDL-016-69-4
1-HDL-018-6-4
1-HDL-020-16-4
1-HDL-020-41-4

1-SVH-025-46-4
1-SVH-025-64-4
1-SVH-003-76-4
1-SVH-003-101-4

Zone XI

Line No.

1-ARC-006-060-4

1-CNM-003-149-4
1-CNM-020-35-4
1-CNM-020-36-4

1-DTM-150-174-4
1-DTM-002-540-4
1-DTM-002-543-4
1-DTM-002-544-4
1-DTM-004-176-4

1-MSS-002-36-4
1-MSS-002-37-4
1-MSS-003-38-4
1-MSS-006-35-4

1-OFG-016-3-4

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Zone XII

<u>Line No.</u>

1-ARC-006-061-4

1-CNM-003-150-4
1-CNM-020-35-4
1-CNM-020-37-4
1-CNM-020-40-4
1-CNM-024-17-4

1-DTM-150-173-4
1-DTM-002-381-4
1-DTM-002-541-4
1-DTM-002-542-4
1-DTM-004-177-4

1-MSS-002-42-4
1-MSS-002-43-4
1-MSS-003-44-4
1-MSS-006-34-4

1-OFG-016-4-4

Zone XIII

Line No.

1-DTM-002-656-4
1-DTM-004-151-4

Zone XV

Line No.	Line No.
1-CNA-003-1-4	1-HDH-002-1-4
1-CNA-004-26-4	1-HDH-002-2-4
	1-HDH-004-3-4
1-CNM-150-91-4	1-HDH-010-4-4
1-CNM-003-155-4	1-HDH-010-5-4
1-CNM-003-158-4	1-HDH-016-6-4
1-CNM-016-65-4	
1-CNM-016-66-4	1-HDL-002-1-4
1-CNM-020-67-4	1-HDL-002-8-4
1-CNM-020-68-4	1-HDL-002-9-4
1-CNM-020-69-4	1-HDL-002-18-4
1-CNM-020-70-4	1-HDL-002-20-4
1-CNM-020-71-4	1-HDL-003-135-4
1-CNM-020-72-4	1-HDL-003-136-4
1-CNM-020-77-4	1-HDL-004-3-4
1-CNM-020-78-4	1-HDL-004-10-4
1-CNM-020-80-4	1-HDL-004-19-4
	1-HDL-006-13-4
1-DSM-012-11-4	1-HDL-006-15-4
1-DSM-012-12-4	1-HDL-008-21-4
	1-HDL-008-43-4
1-DSR-012-2-4	1-HDL-010-55-4
1-DSR-012-3-4	1-HDL-010-99-4
	1-HDL-010-108-4
1-DTM-002-428-4	1-HDL-012-4-4
1-DTM-002-432-4	1-HDL-012-5-4
1-DTM-002-444-4	1-HDL-014-110-4
1-DTM-025-429-4	1-HDL-016-125-4
1-DTM-004-422-4	1-HDL-016-126-4
1-DTM-004-433-4	1-HDL-018-6-4
1-DTM-004-435-4	1-HDL-018-12-4
1-DTM-004-443-4	1-HDL-018-98-4
1-DTM-006-426-4	1-HDL-020-11-4
1-DTM-006-427-4	1-HDL-020-16-4
1-DTM-008-421-4	1-HDL-020-100-4
1-DTM-008-445-4	1-HDL-020-102-4
1-ESS-010-3-4	1-SVH-150-1-4
1-ESS-010-107-4	1-SVH-150-37-4
1-ESS-016-4-4	1-SVH-002-3-4
1-ESS-016-5-4	1-SVH-002-5-4
1-ESS-018-9-4	1-SVH-002-12-4
1-ESS-028-18-4	1-SVH-002-14-4
	1-SVH-002-38-4
1-FWS-003-78-4	1-SVH-002-41-4
1-FWS-020-22-4	1-SVH-002-48-4
1-FWS-020-24-4	1-SVH-002-50-4
1-FWS-020-26-4	1-SVH-002-109-4
1-FWS-026-83-4	1-SVH-002-110-4
1-FWS-026-84-4	1-SVH-002-115-4
	1-SVH-002-117-4

Zone XV

Line No.	Line No.
1-SVH-025-46-4	
1-SVH-003-10-4	

Zone XVI

Line No.

1-CNM-150-92-4
1-CNM-003-154-4
1-CNM-003-157-4
1-CNM-020-59-4
1-CNM-020-60-4
1-CNM-020-61-4
1-CNM-020-62-4
1-CNM-020-63-4
1-CNM-020-64-4
1-CNM-020-73-4
1-CNM-020-74-4
1-CNM-020-76-4
1-CNM-024-24-4
1-CNM-024-54-4

1-ESS-010-2-4
1-ESS-010-108-4
1-ESS-016-4-4
1-ESS-018-15-4
1-ESS-028-22-4

1-FWS-003-77-4
1-FWS-020-21-4
1-FWS-020-23-4
1-FWS-020-25-4
1-FWS-026-85-4
1-FWS-026-86-4

1-HDH-002-8-4
1-HDH-002-9-4
1-HDH-004-10-4
1-HDH-010-11-4
1-HDH-010-12-4
1-HDH-016-13-4

1-HDL-002-26-4
1-HDL-002-27-4
1-HDL-002-33-4
1-HDL-002-34-4
1-HDL-002-49-4
1-HDL-002-50-4
1-HDL-003-137-4
1-HDL-003-138-4
1-HDL-004-28-4
1-HDL-004-35-4
1-HDL-004-48-4
1-HDL-006-38-4
1-HDL-006-39-4
1-HDL-010-46-4
1-HDL-010-70-4
1-HDL-010-92-4

Line No.

1-HDL-012-29-4
1-HDL-012-30-4
1-HDL-014-115-4
1-HDL-016-123-4
1-HDL-016-124-4
1-HDL-018-31-4
1-HDL-018-37-4
1-HDL-018-91-4
1-HDL-020-36-4
1-HDL-020-41-4
1-HDL-020-89-4
1-HDL-020-93-4

1-OFG-016-3-4
1-OFG-016-4-4

1-SVH-150-1-4
1-SVH-150-19-4
1-SVH-150-37-4
1-SVH-150-55-4
1-SVH-002-5-4
1-SVH-002-14-4
1-SVH-002-21-4
1-SVH-002-23-4
1-SVH-002-30-4
1-SVH-002-32-4
1-SVH-002-38-4
1-SVH-002-41-4
1-SVH-002-50-4
1-SVH-002-57-4
1-SVH-002-59-4
1-SVH-002-66-4
1-SVH-002-68-4
1-SVH-002-112-4
1-SVH-002-114-4
1-SVH-002-118-4
1-SVH-002-120-4
1-SVH-025-46-4
1-SVH-003-10-4
1-SVH-003-28-4

Zone XIX

Line No.

1-CNM-020-50-4

1-DTM-002-56-4
1-DTM-002-511-4
1-DTM-002-512-4
1-DTM-002-541-4
1-DTM-002-542-4
1-DTM-002-543-4
1-DTM-002-544-4
1-DTM-004-176-4
1-DTM-004-177-4
1-DTM-004-625-4
1-DTM-006-454-4
1-DTM-008-175-4

1-HDL-008-154-4
1-HDL-010-24-4
1-HDL-010-25-4
1-HDL-010-46-4
1-HDL-010-47-4
1-HDL-010-55-4
1-HDL-010-152-4
1-HDL-012-58-4
1-HDL-012-59-4
1-HDL-012-73-4
1-HDL-012-74-4
1-HDL-014-110-4
1-HDL-014-115-4
1-HDL-014-156-4
1-HDL-014-158-4
1-HDL-018-6-4
1-HDL-018-31-4
1-HDL-018-32-4
1-HDL-020-16-4
1-HDL-020-17-4
1-HDL-020-41-4
1-HDL-020-42-4
1-HDL-020-148-4
1-HDL-020-150-4

1-SVH-025-46-4
1-SVH-025-64-4
1-SVH-025-144-4
1-SVH-025-145-4
1-SVH-003-76-4
1-SVH-003-101-4

Zone XX

Line No.

1-FWS-020-31-4
1-FWS-020-32-4

Zone 9

Line No.

1-OFG-006-73-4
1-OFG-006-74-4
1-OFG-006-77-4
1-OFG-006-78-4

Zone 10

<u>Line No.</u>

1-OFG-006-83-4
1-OFG-006-84-4
1-OFG-006-87-4
1-OFG-006-88-4

Zone 11

<u>Line No.</u>

1-OFG-006-83-4
1-OFG-006-84-4
1-OFG-006-87-4
1-OFG-006-88-4

Zone 12

Line No.

1-0FG-006-73-4
1-0FG-006-74-4
1-0FG-006-77-4
1-0FG-006-78-4

Zone 13

Line No.

1-CND-006-221-4

1-CNM-024-24-4
1-CNM-024-44-4
1-CNM-024-115-4

1-DTM-002-384-4
1-DTM-002-385-4
1-DTM-002-389-4
1-DTM-002-390-4
1-DTM-002-392-4
1-DTM-002-394-4
1-DTM-002-636-4
1-DTM-002-637-4

1-MSS-002-39-4
1-MSS-002-40-4

1-OFG-016-3-4
1-OFG-016-4-4
1-OFG-016-12-4
1-OFG-016-13-4
1-OFG-016-14-4
1-OFG-016-15-4
1-OFG-016-16-4

Zone 16

Line No.

1-CND-006-221-4

1-CNM-024-24-4
1-CNM-024-44-4

APPENDIX D

DETAILED ANALYSIS

APPENDIX D

The format followed throughout this appendix is described in Section 2.7.

Turbine Enclosure

The turbine enclosure was divided into 20 zones: I, III, V, VI, VII, VIII, XI, XII, XIII, XV, XVI, XIX, XX, 9, 10, 11, 12, 13, 15, and 16, following the zone determination criteria described in Section 2.4. These zones are represented in Figures 1, 2, and 3 (attached). Zones VII, 9 through 12, and 16 are eliminated from the detailed analysis for at least one of the following two reasons:

1. No high energy lines are routed through these zones.

2. No applicable control systems components reside within these zones.

Reactor Enclosure

The HELB analysis was limited to el 114 ft 0 in. of the containment area of the reactor enclosure. Drywell and other areas/elevations of the reactor enclosure do not have any nonsafety grade control systems components and have therefore been eliminated.

Auxiliary Building

The EDC zone map identifies various zones affected by temperature transients severe enough to fail nonsafety grade instruments due to accidents including HELB, but only six areas marked in HELB zone maps have been considered for analysis as explained in Section 2.4.

APPENDIX D

ZONE I

Building: Turbine Building
Locations: El 95 ft and 123 ft 6 in.

HIGH ENERGY LINE BREAK ANALYSIS

	HELB System		Control System
1. a) CND (4-7)	Condensate Demineralizer	2. a) CCS (9-7)	Turbine Plant Component Cooling Water
b) CNM (4-1)	Condensate	b) CNM (4-1)	Condensate
c) DTM (32-5)	Turbine Plant Miscellaneous Drains	c) HRS (3-3)	Hot Reheat
d) MSS	Main Steam	d) MSS (3-1)	Main Steam
		e) TMS (16-9)	Turbine Generator Hood Spray
		f) DSR (32-6)	Moisture Separator Reheater Vents and Drains
		g) ARC (5-1)	Condenser Air Removal
		h) OFG (31-4)	Off-Gas
		i) SVH (32-14)	Feedwater Heater Relief Vents and Drips
		j) GMH (16-7)	Generator Hydrogen and Carbon Dioxide

1. The following is a list of high energy lines analyzed on a system basis:

   a. <u>Condensate Demineralizer (CND, 4-7)</u>

      Line No. 1CND-006-221-4

      <u>Function</u>

      This line recycles polished condensate to main condenser after treatment by condensate demineralizer system.

Failure Effect

Reduced feedwater flow. Loss of condensate inventory. Loss of main condenser vacuum leading to turbine trip.

b. Condensate (CNM, 4-1)

1) Line Nos. 1CNM-020-36-4, 020-37-4, 020-52-4, 024-30-4, 024-24-4, 024-43-4, 024-115-4, 034-177-4, 020-38-4, 020-39-4, and 018-42-4

Function

Condensate for air ejector intercondensers (1ARC-E2A or 1ARC-E2B) and gland steam condenser (1TME-CND1), and also condensate to condenser demineralizers for polishing.

Failure Effect

Loss of condensate flow.

2) Line No. 1CNM-024-44-4

Function

Condensate header supplying condensate to condensate polishing demineralizers.

Failure Effect

Loss of condensate flow.

3) Line No. 1CNM-024-54-4

Function

Supplies polished condensate to condensate/feedwater heater trains.

Failure Effect

Loss of condensate flow.

4) Line No. 1CNM-020-50-4

Function

Supplies polished condensate to low-pressure turbine exhaust sprays, condensate recirculation to condenser, loop seal fill for low-pressure feedwater heater drains through manually operated valves, and condensate makeup and drawoff system through control valve 1CNM-FV114.

Failure Effect

Loss of condensate flow.

5) Line No. 1CNM-003-153-4, 003-151-4, 004-152-4, and 004-173-4

Function

Condensate isolation valve bypass lines and condensate to moisture separator reheater drain tank sparger.

Failure Effect

Failure of this line will result in gradual loss of condensate.

6) Line Nos. 1CNM-002-32-4 and 002-33-4

Function

Supplies condensate to low-pressure turbine exhaust sprays through normally closed manual valves.

Failure Effect

Same as b.5) above.

c. Turbine Plant Miscellaneous Drains (DTM, 32-5)

1) Line Nos. 1DTM-002-391-4, 002-392-4, 002-393-4, 002-394-4, and 002-395-4

Function

Off-gas condenser CNDB002 drains to main condenser.

Failure Effect

Loss of main condenser vacuum.

2) Line Nos. 1DTM-002-389-4 and 002-390-4

Function

Off-gas preheater EB001A or 1B drain to main condenser.

Failure Effect

Same as c.1) above.

3) Line Nos. 1DTM-003-359-4, 004-360-4, 004-361-4, 002-624-4, and 004-625-4

Function

Gland steam condenser 1TME-CND1 vents and drains to main condenser.

Failure Effect

Same as c.1) above.

d. Main Steam System (MSS, 3-1)

1) Line Nos. 1MSS-003-25-4, 006-32-4, 008-33-4, 006-34-4, 006-35-4, 006-41-4, 006-49-4, and 006-50-4

Function

Main steam to intercondensers 1ARC-E2A and 2B and steam jet air ejectors 1ARC-J3A and 3B.

Failure Effect

Loss of main condenser air removal capability ultimately affecting condenser vacuum.

2) Line Nos. 1MSS-002-39-4 and 002-40-4

Function

Off-gas preheater EB001A or 1B relief lines to main condenser.

Failure Effect

Loss of main condenser vacuum.

2. The following is the list of nonsafety-related control components that are affected by a high energy line break on any of the lines listed in Item 1. The consequence of failure of each control components is analyzed. Refer to Appendix B for function of individual components.

These control components are also subject to failure due to a high energy line break in Zones XI or XII, and the consequences of failure discussed under Zones XI or XII have been combined with those in Zones XI or XII.

a. Turbine Plant Component Cooling Water (CCS, 9-7)

1CCS-TIC104 and 1CCS-TV104

Failure Effect

1CCS-TV104 fails open bypassing turbine plant component cooling water heat exchangers, resulting in higher component cooling water temperature.

b. Condensate (CNM, 4-1)

1) 1CNM-FT112, 1CNM-FV112, and 1CNM-I/P112

Failure Effect

If 1CNM-FV112 fails closed, closing the bypass line around ejector intercondenser, condensate flow will then exceed desired limit. If 1CNM-FV112 fails open, cooling of air ejector intercondenser will be reduced but will have no significant effect on the system.

2) 1CNM-FT114

Failure Effect

Failure of this instrument may cause 1CNM-FV114 (Zone XIX) to fail open, resulting in reduced condensate flow.

c. Hot Reheat (HRS, 3-3)

1HRS-PT108

Failure Effect

1HRS-PT108 failure will cause closure of moisture separator main steam supply valves 1MSS-PVRHLV1, 1MSS-PVRSLLV1, 1MSS-PVRSHLV2, and 1MSS-PVRSLLV2 resulting in total loss of hot reheat for low-pressure turbines. Turbine efficiency will be reduced.

d. Main Steam System

1MSS-PV144 and 1MSS-PIC144

Failure Effect

If 1MSS-PV144 fails closed, the condenser air removal capabilities are lost.

e. Turbine Generator Hood Spray (TMS, 16-9)

1TMS-P/IX129, 1TMS-P/IY129, 1TMS-TTX129, and 1TMS-TTY129, ITMS-TVAOVWSV

Failure Effect

If temperature valve 1TMS-TVWSV fails closed, high turbine hood temperature can result which can result in turbine trip.

f. Moisture Separater Reheater Vents and Drains

1DSR-LIC68A

Failure Effect

If level valve 1DSR-LV68A fails closed, reheater drain receiving tank 1DSR-TK1A loses capability to drain condensate to condenser on high tank level. If the valve fails open, it will drain the tank water to condenser. This will result in partial loss of feedwater heating at the first-point heater, 1FWS-E1A.

g. Condenser Air Removal (ARC, 5-1)

1ARC-AOV3A, 1ARC-SOV3A, 1ARC-AOV3B, and 1ARC-SOV3B

Failure Effect

If either valve fails open or closed, there are no adverse effects. These valves are used for startup only.

h. Off-Gas (OFG, 31-4)

1N64-LVF016A, 1N64-LVF016B, 1N64-SOVF016A, and 1N64-SOVF016B

Failure Effect

If the valves fail closed, condensate level in off-gas condenser CNDB002 may rise, affecting the moisture removal capability and the efficiency of the system.

i. Feedwater Heater Relief Vents and Drips (SVH, 32-14)

1SVH-AOV36B, SOV36B, AOV37B, SOV37B, AOV38B, SOV38B, AOV39B, and SOV39B.

Failure Effect

No significant impact.

j. Generator Hydrogen and Carbon Dioxide (GMH, 16-7)

1GMH-RTD105 and 1GMH-RTDGTG-3A.

Failure Effect

Failure of these instruments may cause service water control valve 1SWP-TV113 for hydrogen cooler 1GMH-E2 and generator casing hydrogen coolers 1GMH-E1A through D to close, resulting in partial loss of generator cooling. Various protective sensors will shut down the generator when temperature exceeds the setpoint.

3. Combined Effects

   a. A break in the condensate demineralizer high energy line in this zone will result in loss of main condenser vacuum bounded by FSAR Chapter 15.2.5 analyses. The failure of any control components in this zone does not exacerbate this event.

   b. A break in any of the condensate energy lines in this zone (Items 1.b-1 through 1.b-4) will result in total loss of feedwater to reactor. Feedwater pumps will trip on low suction pressure. A break in any of the condensate high energy lines in this zone (Items 1.b.5 and 1.b.6) will result in gradual reduction in feedwater flow, reduced condensate inventory, and generator load reduction. Reactor feedwater pumps will trip ultimately on low suction pressure. The above events are breaks in feedwater line outside containment and are bounded by FSAR Chapter 15.6.6 analyses. The failure of any control components on this zone does not exacerbate these events.

   c. A break in any of the turbine plant miscellaneous drains' high energy lines in this zone will result in loss of main condenser vacuum as bounded by FSAR Chapter 15.2.5 analyses. The failure of any control systems components in this zone does not exacerbate this event.

   d. Breaks in any of the main steam high energy lines in this zone will result in loss of main condenser vacuum as bounded by FSAR Chapter 15.2.5 analyses. The failure of any control components in this zone does not exacerbate this event.

APPENDIX D

ZONE III

Building: Turbine Building
Locations: El 95 ft and 123 ft 6 in.

HIGH ENERGY LINE BREAK ANALYSIS

HELB System			Control System		
1. a)	CNM (4-1)	Condensate	2. a)	ARC (5-1)	Condenser Air Removal
b)	DSM (32-7)	Moisture Separator Vents and Drains	b)	CRS (3-2)	Cold Reheat
c)	DSR (32-6)	Moisture Separator Reheater Vents and Drains	c)	DSM (32-7)	Moisture Separator Vents and Drains
d)	DTM (32-5)	Turbine Plant Miscellaneous Drains	d)	DSR (32-6)	Moisture Separator Reheat Vents and Drains
e)	ESS (3-4)	Extraction Steam	e)	DTM (32-5)	Turbine Plant Miscellaneous Drains
f)	FWR (6-3)	FDW Pump Recirculation	f)	ESS (3-4)	Extraction Steam
g)	HDL (4-2)	Low-Pressure FDW Heater Drains	g)	FWL (7-3)	Feedwater Pump and Drive Lube Oil
h)	HRS (3-3)	Hot Reheat	h)	FWR (6-3)	Feedwater Pump Recirculation
i)	MSS (3-1)	Main Steam System	i)	HDL (4-2)	Low-Pressure Feedwater Heater Drains
j)	SVH (32-14)	Feedwater Heater Relief Drains and Valves	j)	MSS (3-1)	Main Steam System
k)	TME (16-1)	Turbine Generator Gland Seal and Exhaust	k)	C85	Steam Bypass and Regulation
			l)	B21	Nuclear Boiler Instrumentation
			m)	SVH (32-14)	Feedwater Heater Relief Vents and Drips

1. The following is a list of high energy lines analyzed on a system basis.

a. Condensate (CNM, 4-1)

1) Line Nos. 1CNM-020-69-4, 020-70-4, and 020-71-4

Function

Carry condensate/feedwater from fourth point heater drain cooler 1CNM-DCL2A to sixth point heater 1CNM-E6A to fifth point heater 1CNM-E5A to fourth point heater 1CNM-E4A.

Failure Effect

Loss of condensate/feedwater from heater train A.

2) Line Nos. 1CNM-020-61-4, 020-62-4, and 020-63-4

Function

Carry condensate/feedwater from fourth point heater drain cooler 1CNM-DCL2B to sixth point heater 1CNM-E6B to fifth point heater 1CNM-E5B to fourth point heater 1CNM-E4B.

Failure Effect

Loss of condensate/feedwater from heater train B.

b. Moisture Separator Vents and Drains (DSM, 32-7)

1) Line Nos. 1DSM-002-37-4 through 002-44-4, 012-1-4, through 012-4-4, 012-6-4, 018-5-4, 018-7-4, and 018-31-4

Function

Drains from moisture separator 1CRS-MSR1 to moisture separator drain receiver 1DSM-TK1A.

Failure Effect

Loss of condensate from moisture separator 1CRS-MSR1 to moisture separator drain receiver 1DSM-TK1A, and partial loss of condensate/feedwater heating at third point heater 1CNM-E3A. Loss of condensate inventory. Third point heater drain pump flow reduced. (The most significant event is the loss of condensate/feedwater heating.)

2) Line Nos. 1DSM-002-45-4 through 002-52-4, 012-16-4 through 012-19-4, 012-21-4, 018-20-4, 018-22-4, and 018-32-4

Function

Drains from moisture separator 1CRS-MSR2 to moisture separator drain receiver 1DSM-TK1B.

Failure Effect

Loss of condensate from moisture separator 1CRS-MSR2 to moisture separator drain receiver 1DSM-TK1B and partial loss of condensate/feedwater heating at third point heater 1CNM-E3B. Loss of condensate inventory. Third point heater drain pump flow reduced. (The most significant event is the loss of condensate/feedwater heating.)

3) Line Nos. 1DSM-006-15-4, 004-33-4, and 004-34-4

Function

Supply steam from moisture separator drain receiver 1DSM-TK1A to hot reheat for low-pressure turbine T2A.

Failure Effect

Partial loss of steam supply to low-pressure turbine T2A.

4) Line Nos. 1DSM-006-26-4, 004-35-4, and 004-36-4

Function

Supply steam from moisture separator drain receiver 1DSM-TK1B to hot reheat for low-pressure turbine T2A.

Failure Effect

Partial loss of steam supply to low-pressure turbine T2A.

5) Line Nos. 1DSM-002-8-4, 002-9-4, and 004-10-4

Function

Level instrumentation standpipe and process conrections for 1DSM-TK1A.

Failure Effect

Loss of moisture separator drain receiver tank 1DSM-TK1A condensate, and partial steam to low-pressure turbines. Partial loss of condensate/feedwater heating at third point heater 1CNM-E3A. Third point heater 1CNM-E3A drain pump flow is reduced. (The most significant event is the loss of condensate/feedwater heating.)

6) Line Nos. 1DSM-002-23-4, 002-24-4, and 004-25-4

Function

Level instrumentation standpipe and process connections for 1DSM-TK1B.

Failure Effect

Loss of moisture separator drain receiver tank 1DSM-TK1B condensate, and partial steam to low-pressure turbines. Partial loss of condensate/feedwater heating at third point heater 1CNM-E3B. Third point heater 1CNM-E3B drain pump flow is reduced. (The most significant event is the loss of condensate/feedwater heating.)

7) Line Nos. 1DSM-014-13-4, 014-29-4

Function

Provides path to main condenser from moisture separator drain receiver 1DSM-TK1A or 1DSM-TK1B.

Failure Effect

Loss of condensate from moisture separator drain receiver 1DSM-TK1A or 1DSM-TK1B, partial loss of main steam to condenser, and partial loss of condensate/feedwater heating at third point heater 1CNM-E3A or 1CNM-E3B. 1CNM-E3A or 1CNM-E3B heater drain pump flow is reduced. (The most significant event is the loss of condensate/feedwater heating.)

8) Line Nos. 1DSM-014-30-4, 014-54-4, 014-14-4, and 014-53-4

Function

Provides path to main condenser from moisture separator drain receiver 1DSM-TK1A or 1DSM-TK1B.

Failure Effect

Loss of main condenser vacuum.

9) Line No. 1DSM-012-11-4

Function

Provides condensate from moisture separator drain receiver 1DSM-TK1A to third point heater 1CNM-E3A.

Failure Effect

Partial loss of condensate/feedwater heating at third point heater 1CNM-E3A. 1CNM-E3A heater drain pump flow is reduced, which is not significant.

10) Line No. 1DSM-012-27-4

Function

Provides condensate from moisture separator drain receiver 1DSM-TK1B to third point heater 1CNM-E3B.

Failure Effect

Partial loss of condensate/feedwater heating at third point heater 1CNM-E3B from 1DSM-TK1B. 1CNM-E3B heater drain pump flow is reduced, which is not significant.

c. Moisture Separator Reheater Vents and Drains (DSR, 32-6)

1) Line Nos. 1DSR-006-6-4, 008-22-4, 008-23-4, and 008-28-4

Function

Provides steam to first point heater 1FWS-E1A and bypass to condenser.

Failure Effect

Loss of steam to first point heater 1FWS-E1A. Loss of main condenser vacuum, if 1DSR-008-23-4 breaks downstream of 1DSR-MOV108.

2) Line Nos. 1DSR-006-15-4, 006-31-4, 008-25-4, and 008-24-4

Function

Provides steam to first point heater 1FWS-E1B and bypass to condenser.

Failure Effect

Loss of steam to first point heater 1FWS-E1A. Loss of main condenser vacuum, if 1DSR-008-25-4 breaks downstream of 1DSR-MOV110.

3) Line No. 1DSR-024-1-4

Function

Condensate from reheater moisture separator 1CRS-MSR1 to reheater drain receiver 1DSR-TK1A.

Failure Effect

Loss of condensate from 1CRS-MSR1 to 1DSR-TK1A, and loss of condensate and steam to first point heater 1FWS-E1A resulting in partial loss of feedwater heating at first point heater 1FWS-E1A.

4) Line No. 1DSR-024-10-4

Function

Condensate from reheater moisture separator 1CRS-MSR2 to reheater drain receiver 1DSR-TK1B.

Failure Effect

Loss of condensate from 1CRS-MSR2 to 1DSR-TK1B, and loss of condensate and steam to first point heater 1FWS-E1B resulting in partial loss of feedwater heating at first point heater 1FWS-E1B.

5) Line No. 1DSR-012-2-4

Function

Condensate from reheater drain receiver 1DSR-TK1A to first point heater 1FWS-E1A.

Failure Effect

Loss of condensate to first point heater 1FWS-E1A and loss of steam from reheater moisture separator 1CRS-MSR1 resulting in partial loss of feedwater heating at first point heater 1FWS-E1A.

6) Line No. 1DSR-012-11-4

Function

Condensate from reheater drain receiver 1DSR-TK1B to first point heater 1FWS-E1B.

Failure Effect

Loss of condensate to first point heater 1FWS-E1B and loss of steam from reheater moisture separator 1CRS-MSR2 resulting in partial loss of feedwater heating at first point heater 1FWS-E1B.

7) Line Nos. 1DSR-014-4-4, 014-13-4

Function

Provide path to main condenser from moisture separator reheater drain receiver 1DSR-TK1A or 1DSR-TK1B.

Failure Effect

Loss of condensate from reheater drain receiver 1DSR-TK1A or 1DSR-TK1B and loss of steam from reheater moisture separator 1CRS-MSR1 or MSR2 resulting in partial loss of feedwater heating at first point heater 1FWS-E1A or 1FWS-E1B.

8) Line Nos. 1DSR-014-5-4, 014-26-4, 014-14-4, and 014-27-4

Function

Provide path to main condenser from moisture separator reheater drain receiver 1DSR-TK1A or 1DSR-TK1B.

Failure Effect

Loss of main condenser vacuum.

9) Line Nos. 1DSR-002-7-4, 002-8-4, and 004-9-4

Function

Level instrumentation standpipe and process connections for reheater drain receiver tank 1DSR-TK1A

Failure Effect

Loss of 1DSR-TK1A condensate and steam resulting in partial loss of feedwater heating at first point heater 1FWS-E1A.

10) Line Nos. 1DSR-002-16-4, 002-17-4, and 004-18-4

Function

Level instrumentation standpipe and process connections for reheater drain receiver tank 1DSR-TK1B.

Failure Effect

Loss of 1DSR-TK1B condensate and steam resulting in partial loss of feedwater heating at first point heater 1FWS-E1B.

d. Turbine Plant Miscellaneous Drains (DTM, 32-5)

1) Line Nos. 1DTM-002-324-4, 002-327-4, 150-317-4, 150-316-4, 012-318-4, 008-325-4, 008-347-4, 002-125-4, 002-126-4, 002-129-4, 002-130-4, 006-259-4, 004-266-4, 004-269-4, 008-294-4, 004-295-4, 004-278-4, 004-298-4, 002-322-4, 002-326-4, and 002-323-4

Function

Provides condensate drain path from first point, third point, and fourth point extraction steam lines and valve leakoffs to main condenser.

Failure Effect

Gradual loss of condensate inventory to main condenser, and loss of main condenser vacuum.

2) Line Nos. 1DTM-006-455-4, 006-456-4, 006-457-4, 006-458-4, 008-363-4, 008-364-4, and 012-365-4

Function

Provides condensate drain path from high-pressure turbine 1MSS-T1 to main condenser.

Failure Effect

Loss of condensate inventory to main condenser, and loss of main condenser vacuum.

3) Line No. 1DTM-002-461-4

Function

Provides condensate drain path from gland seal steam to main condenser.

Failure Effect

Gradual loss of condensate inventory to main condenser, and loss of main condenser vacuum.

4) Line No. 1DTM-150-357-4

Function

Gland steam condenser (steam packing exhauster) 1TME-CND1 drain to main condenser.

Failure Effect

Loss of main condenser vacuum.

5) Line Nos. 1DTM-025-368-4 through 025-371-4, 008-372-4, and 008-373-4

Function

Hot reheat combined intercept valves 1HRS-CIV1, CIV2, CIV3, and CIV4 leakoff drains to main condenser.

Failure Effect

Loss of main condenser vacuum.

6) Line Nos. 1DTM-002-432-4, 004-433-4, 004-443-4, 002-444-4, and 024-434-4

Function

Drain lines from radwaste reboiler 1ASR-SG1 to main condenser.

Failure Effect

Loss of main condenser vaccum.

7) Line Nos. 1DTM-006-425-4 and 025-431-4

Function

Drain lines to condenser from drain receivers 1DTM-TK1 or TK2.

Failure Effect

Loss of main condenser vacuum.

8) Line No. 1DTM-004-435-4

Function

Drains condensate from steam seal evaporator 1TME-EV1 to turbine miscellaneous drain header.

Failure Effect

Loss of main condenser vacuum.

9) Line No. 1DTM-008-421-4

Function

Drains condensate from radwaste reboiler 1ASR-SG1 to drain receiver 1DTM-TK1.

Failure Effect

Loss of condensate inventory and partial loss of condensate/feedwater heating at fourth point heater 1CNM-E4A.

10) Line Nos. 1DTM-004-422-4, 002-430-4, 002-428-4, and 004-424-4

Function

Drains condensate from drian receivers 1DTM-TK1 or TK2 to fourth point heater and bypass to condenser.

Failure Effect

Loss of condensate inventory and partial loss of condensate/feedwater heating at fourth point heater 1CNN-E4A.

11) Line Nos. 1DTM-002-437-4, 002-438-4, 002-440-4, and 002-441-4

Function

Standpipe and process connections for drain receiver tank 1DTM-TK1 or TK2 level instrumentation.

Failure Effect

Loss of condensate inventory and partial loss of condensate/feedwater heating at fourth point heater 1CNM-E4A.

12) Line No. 1DTM-004-151-4

Function

Drains reactor water cleanup blowdown to main condenser.

Failure Effect

Loss of main condenser vacuum.

13) Line Nos. 1DTM-003-188-4 and 003-204-4

Function

Drain lines to main condenser from main steam header moisture separator 1CRS-MSR1.

Failure Effect

Loss of main condenser inventory and vacuum.

14) Line Nos. 1DTM-002-231-4, 002-232-4, 002-233-4, 002-238-4, 002-239-4, 002-240-4, 010-237-4, and 010-244-4

Function

Drain lines to main condenser from cold reheat to moisture separator reheater 1CRS-MSR1 or MSR2.

Failure Effect

Loss of main condenser vacuum.

15) Line Nos. 1DTM-150-245-4, 150-246-4, 150-608-4, and 150-609-4

Function

Drain lines to main condenser from moisture separator 1CRS-MSR1 or MSR2 shell pockets.

Failure Effect

Loss of main condenser vacuum.

16) Line Nos. 1DTM-003-110-4, 006-150-4, 006-166-4, 002-656-4, 006-187-4, 006-197-4, 003-198-4, 003-199-4, 010-203-4, 008-227-4, 010-206-4, and 003-360-4

Function

Miscellaneous drains to condenser.

Failure Effect

Loss of main condenser vacuum and some condensate inventory.

17) Line Nos. 1DTM-003-1-4, 003-2-4, 003-4-4 through 003-8-4, 003-530-4, 014-25-4, and 020-631-4

Function

Main steam header drain to main condenser.

Failure Effect

Loss of main condenser vacuum and condensate inventory.

18) Line Nos. 1DTM-006-50-4, 006-35-4, 002-58-4, 003-60-4, 003-79-4, and 003-81-4

Function

Main steam stop valves, control valves, and isolation valve leakoff drains to main condenser.

Failure Effect

Loss of main condenser vacuum and some condensate inventory.

19) Line Nos. 1DTM-003-37-4 through 003-39-4, 003-47-4 through 003-49-4, 003-653-4, 014-40-4, 003-650-4, 025-46-4, 002-45-4, 150-42-4, and 150-43-4

Function

Turbine bypass steam chest drains to main condenser.

Failure Effect

Loss of main condenser vacuum and condensate inventory.

e. Extraction Steam (ESS, 3-4)

1) Line Nos. 1ESS-010-1-4, 010-2-4, and 010-3-4

Function

Extraction steam supply to first point heaters 1FWS-E1A and E1B.

Failure Effect

Loss of first point extraction steam from high-pressure turbine 1MSS-T1 causing total loss of heating at first point heaters 1FWS-E1A and E1B.

2) Line Nos. 1ESS-016-4-4, 016-5-4, 016-105-4, and 016-106-4

Function

Extraction steam supply from cold reheat to second point heater 1CNM-E2A or E2B.

Failure Effect

Loss of extraction steam from cold reheat system causing total loss of heating at second point heater 1CNM-E2A or E2B.

3) Line Nos. 1ESS-012-6-4, 012-7-4, 012-13-4, 012-14-4, 012-71-4 through 012-74-4, 018-8-4, 018-11-4, 018-12-4, 018-9-4, and 018-15-4

Function

Extraction steam supply to third point heater 1CNM-E3A or E3B.

Failure Effect

Loss of third point extraction steam from low-pressure turbines 1HRS-T2A and T2B causing total loss of heating at third point heaters 1CNM-E3A and E3B.

4) Line Nos. 1ESS-012-10-4, 010-62-4, and 008-63-4

Function

Extraction steam supply from low-pressure turbines 1HRS-T2A and T2B to steam seal evaporator turbine generator gland seal and exhaust steam system and to radwaste auxiliary steam reboiler.

Failure Effect

Loss of third point extraction steam from low-pressure turbines 1HRS-T2A and T2B, loss of steam to steam seal evaporator, turbine generator gland seal and exhaust steam system, and loss of steam to radwaste auxiliary steam reboiler.

5) Line Nos. 1ESS-020-75-4 through 020-78-4, 020-17-4, 020-21-4, 028-18-4, 028-19-4, 028-22-4, 028-38-4, and 028-39-4

Function

Extraction steam supply from low-pressure turbines 1HRS-T2A and T2B to fourth point heaters 1CNM-E4A and E4B.

Failure Effect

Loss of fourth point extraction steam from low-pressure turbines 1HRS-T2A and T2B, causing total loss of heating at fourth point heaters 1CNM-E4A and E4B.

f. Feedwater Pump Recirculation (FWR, 6-3)

Line Nos. 1FWR-010-2-4, 010-4-4, and 010-6-4

Function

Feedwater pumps 1FWS-P1A, P1B and P1C recirculation to main condenser.

Failure Effect

Loss of feedwater and main condenser vacuum.

g. Low-Pressure Feedwater Heater Drains (HDL, 4-2)

Line Nos. 1HDL-016-54-4, 016-69-4

Function

Heater drains from fifth point heaters 1CNM-E5A or E5B to drain receiver 1HDL-TK1A or TK1B.

Failure Effect

Loss of condensate drain from fifth point heater 1CNM-E5A or E5B resulting in loss of condensate/feedwater heating at fifth point drain cooler 1CNM-DCL1A or DCL1B.

h. Hot Reheat (HRS, 3-3)

Line Nos. 1HRS-024-4-4, 026-3-4, 150-13-4, 024-2-4, 026-1-4, and 150-16-4

Function

Moisture separators 1CRS-MSR1 or MSR2 relief valve vents to condenser.

Failure Effect

Loss of main condenser vacuum.

i. Main Steam System (MSS, 3-1)

1) Line Nos. 1MSS-024-13-4 through 024-16-4

Function

Main steam supply to main steam stop valves 1HVY-SV1, SV2, SV3, and SV4.

Failure Effect

Loss of main steam.

2) Line Nos. 1MSS-024-45-4 through 024-48-4 and 042-12-4

Function

Main steam header and main steam supplies from reactor main steam isolation valves 1MSS*MOV98A, B, C, D.

Failure Effect

Loss of main steam.

3) Line No. 1MSS-004-51-4

Function

Main steam pressure averaging header at inlet of main steam stop valves for pressure instruments 1C85-PTN001A and PTN001B.

Failure Effect

Loss of main steam pressure instrumentation may result in loss of main steam pressure regulation.

4) Line Nos. 1MSS-012-17-4 and 012-18-4

Function

Connects main steam header to turbine bypass steam chest.

Failure Effect

Loss of main steam.

5) Line Nos. 1MSS-010-11-4, 010-19-4, 016-56-4, and 016-57-4

Function

Main steam supply to moisture separator reheaters 1CRS-MSR1 and MSR2.

Failure Effect

Loss of main steam.

6) Line Nos. 1MSS-006-24-4, 003-21-4, and 004-22-4

Function

Main steam to turbine generator gland seal and exhaust, off-gas preheaters, steam jet air ejectors, and radwaste auxiliary steam and moisture separator reheater 1CRS-MSR2.

Failure Effect

Partial loss of main steam, loss of air ejectors 1ARC-J1A, J2A, J3A, J1B, J2B, and J3B, off-gas preheaters EB001A and 1B, and moisture separator reheater 1CRS-MSR2.

7) Line Nos. 1MSS-010-66-4 through 1MSS-010-69-4, 010-9-4, and 010-10-4

Function

Main steam turbine bypass to main condenser.

Failure Effect

Loss of main condenser vacuum and loss of main steam if bypass valve to main steam is open.

8) Line Nos. 1MSS-008-33-4, 002-39-4, and 002-40-4

Function

Steam jet air ejectors 1ARC-E2A and E2B and off-gas preheaters EB001A or 1B relief valves to condenser.

Failure Effect

Loss of main condenser vacuum.

j. Feedwater Heater Relief Vents and Drips (SVH, 32-14)

1) Line Nos. 1SVH-002-78-4, 003-76-4, 002-168-4, 002-96-4, 002-94-4, and 003-101-4

Function

Fifth point heater vents to drain receivers 1HDL-TK1A or 1B.

Failure Effect

Partial loss of fifth point extraction steam causing partial loss of condensate/feedwater heating at fifth point drain cooler 1CNM-DCL1A or 1CNM-DCL1B.

2) Line Nos. 1SVH-003-148-4, 003-149-4, 003-151-4, 003-152-4, 003-73-4, 003-74-4, 003-91-4, 003-92-4, 002-80-4, 003-81-4, 002-82-4, 002-98-4, 003-99-4, 002-100-4, 003-154-4, 003-132-4, 003-156-4, and 003-133-4

Function

Fifth point and sixth point heater vents and drips to main condenser.

Failure Effect

Loss of main condenser vacuum.

3) Line Nos. 1SVH-006-79-4, 006-150-4, 002-77-4, 006-97-4, 006-153-4, and 002-95-4.

Function

Connects fifth point heaters to main condenser.

Failure Effect

Loss of main condenser vacuum.

4) Line Nos. 1SVH-002-75-4, 002-93-4

Function

Connects fifth point heaters to main condenser.

Failure Effect

No significant effect.

k. Turbine Generator Gland Seal and Exhaust (TME, 16-1)

1) Line Nos. 1TME-010-2-4, 010-3-4, 003-1-4, 010-13-4, and 010-14-4

Function

Relief valve vents lines to main condenser.

Failure Effect

Loss of main condenser vacuum.

2) Line No. 1TME-004-4-4, 004-5-4, and 004-6-4

Function

Steam from high-pressure turbine 1MSS-T1 gland packing to fourth point heaters 1CNM-E4A and 1CNM-E4B.

Failure Effect

Loss of steam causing partial loss of condensate/feedwater heating at fourth point heaters 1CNM-E4A and 1CNM-E4B.

2. The following is the list of nonsafety-related control components that are affected by a high energy line break on any of the lines listed in Item 1. The consequences of failure of each control component is analyzed. Refer to Appendix B for the function of each component.

a. Condenser Air Removal (ARC, 5-1)

1ARC-AOV1A, AOV1B
1ARC-SOV1A, SOV1B

Failure Effect

If valve ARC-AOV1A or 1B fails closed, condenser air removal is affected, causing loss of main condenser vacuum.

b. Cold Reheat (CRS, 3-2)

LS-5TM2-M101S1, M101S2, M101S3 (1CRS-MSR1)
LS-5TM2-M201S1, M201S2, M201S3 (1CRS-MSR2)

Failure Effect

When two out of three level switches fail to trip the turbine on high condensate level in moisture separator 1CRS-MSR1 (1CRS-MSR2), it may cause water induction into low-pressure turbine T2A (T2B), resulting in high turbine vibrations, which may lead to turbine trip. Spurious operation of two out of three switches due to line break may trip the turbine.

c. Moisture Separator Vents and Drains (DSM, 32-7)

1) 1DSM-LT75A (1DSM-TK1A)
1DSM-LT75B (1DSM-TK1B)

Failure Effect

Partial loss of heating to third point heater 1CNM-E3A or 3B when respective level transmitter fails valve 1DSM-LV75A or 75B in closed position.

2) 1DSM-LT78A, LV78A, SOV78A, LIC78A, LS77A (1DSM-TK1A)
1DSM-LT78B, LV78B, SOV78B, LS77B (1DSM-TK1B)

Failure Effect

If instrumentation fails 1DSM-LV78A or LV78B in open position, condensate from 1DSM-TK1A or TK1B will drain to main condenser, causing partial loss of main steam to condenser and partial loss of condensate/feedwater heating at third point heater 1CNM-E3A or 3B.

If instrumentation fails valves in closed position, a high condensate level in 1DSM-TK1A or TK1B may result.

d. Moisture Separator Vents and Drains (DSR, 32-6)

1) 1DSR-LT65A (1DSR-TK1A)
1DSR-LT65B (1DSR-TK1B)

Failure Effect

Loss of partial heating at first point heater 1FWS-E1A or E1B when level transmitter fails valve 1DSR-LV65A or LV65B in closed position.

2) 1DSR LT68A, LV68A, SOV68A, LS67A (1DSR-TK1A)
1DSR-LT68B, LV68B, SOV68B, LS67B (1DSR-TK1B)

Failure Effect

If instrumentation fails 1DSR-LV68A or LV68B in open position, condensate from 1DSR-TK1A or TK1B will drain to main condenser, causing partial loss of main steam to condenser, and partial loss of feedwater heating at first point heater 1FWS-E1A or E1B.

If instrumentation fails 1DSR-LV68A or LV68B in closed position, condensate may back up in 1DSR-TK1A or TK1B.

e. Turbine Plant Miscellaneous Drains (DTM, 32-5)

1) 1DTM-AOV5A, SOV5A
1DTM-AOV5B, SOV5B

Failure Effect

If valves fail open, this will result in partial loss of main steam to condenser.

2) 1DTM-AOV32A, SOV32A, AOV35A, SOV35A, AOV41A, SOV41A
1DTM-AOV32B, SOV32B, AOV35B, SOV35B, AOV41B, SOV41B
1DTM-AOV118, SOV118

Failure Effect

If any valve fails open, small loss of extraction steam to condenser will result.

3) 1DTM-LT189, LVX189, SOVX189, LVY189, SOVY189, LS189

Failure Effect

If instrumentation fails 1DTM-LVX189 in open position, condensate from drain receiver tank 1DTM-TK2 will drain to main condenser, causing small loss of extraction steam or main steam to condenser resulting in partial loss of condensate/feedwater heating at fourth point heater 1CNM-E4A.

If instrumentation fails 1DTM-LVY189 in closed position, partial loss of condensate/feedwater heating at fourth point heater 1CNM-E4A will be the result.

4) 1DTM-LT187, LVX187, SOVX187, LVY187, SOV187, LS187

Failure Effect

If instrumentation fails 1DTM-LVX187 in open position, condensate from drain receiver 1DTM-TK1 will drain to main condenser, causing small loss of extraction steam or main steam to condenser resulting in partial loss of condensate heating at fourth point heater 1CNM-E4A.

f. Extraction Steam (ESS, 3-4)

1) 1ESS-NRV16A, SOVX16A, SOVY16A, NRV23A, SOVX23A, SOVY23A, NRV29A, SOVX29A, SOVY29A, NRV34A, SOVX34A, SOVY34A

1ESS-NRV16B, SOVX16B, SOVY16B, NRV23B, SOVX23B, SOVY23B, NRV34B, SOVX34B, SOVY34B

Failure Effect

If any nonreturn valve fails open, some protection is lost against turbine overspeed and water induction.

2) 1ESS-NRV115, NRV116, SOV115, SOV116

Failure Effect

If any nonreturn valve fails open, some protection is lost against turbine overspeed and water induction.

3) 1ESS-PDT112

Failure Effect

If pressure transmitter fails to close 1ESS-MOV112 and open 1MSS-MOV155 on low differential pressure between third point extraction steam and main steam, a loss of turbine generator seal steam may occur.

g. Feedwater Pump and Drive Lube Oil (FWL, 7-3)

1) 1FWL-PS2A, PS12A, PS2B, PS12B, PS2C, PS12C

Failure Effect

Instrumentation failure may cause either inadvertent feedwater pump trip or failure to trip feedwater pump on extreme low lube oil pressure.

2) 1FWL-PS3A, PS13A, PS3B, PS13B, PS3C, PS13C

Failure Effect

No significant effect.

h. Feedwater Pump Recirculation (FWR, 6-3)

1FWR-FV2A, SOV2A, FV2B, SOV2B, FV2C, SOV2C

Failure Effect

If valves fail open, feedwater flow to reactor will be reduced resulting in turbine runback.

If valves fail closed, feedwater pump minimum recirculation requirement may not be met, causing feedwater pump degradation at low feedwater flow levels.

i. Low-Pressure Feedwater Heater Drains (HDL, 4-2)

1HDL-LS7A, LS7B, LS8A, LS8B

Failure Effect

If either feedwater heater train is inadvertently isolated by failure of fifth or sixth point heater extreme high level switches, a drop in feedwater temperature, recirculation system runback and turbine runback will result.

If an extreme high level in fifth or sixth point heater exists and level switches fail to isolate the respective heater train, water will fill the respective heater covering condensate tubes, resulting in a loss of feedwater heating.

j. Main Steam System (MSS, 3-1)

1) 1MSS-PT30A and PT30B

Failure Effect

Instrumentation failure causing inadvertent closure of moisture separater main steam supply valves 1MSS-PVRSHLV1 or PVRSLLV1 (1MSS-PVRSHLV2 or PVRSLLV2) can result in reduction of hot reheat steam temperature to low-pressure turbines.

2) 1MSS-FTX13A

Failure Effect

An inadvertent extreme low flow signal from the flow transmitter can isolate the condenser air removal system by closing 1ARC-AOV1A.

k. Steam Bypass and Regulation (C85)

1C85-PDSN002A and PDSN002B

Failure Effect

If instrumentation fails to monitor loss of main condenser vacuum, turbine will not trip.

Instrumentation may also inadvertently trip the turbine.

l. Nuclear Boiler Instrumentation (B21)

1B21-AOVF069, SOVF069
1B21-AOVF033, SOVF033

Failure Effect

No significant effect.

m. Feedwater Heater Relief Vents and Drips (SVH, 32-14)

1SVH-AOV36A, SOV36A, AOV37A, SOV37A, AOV38A, SOV38A, AOV39A, SOV39A

Failure Effect

No significant effect.

3. Combined Effect

a. A break in any of the condensate high energy lines [Item 1.a.1) or 1.a.2)] will result in total loss of condensate flow in feedwater heater train associated with the pipe break. A low feedwater suction pressure will result in reactor feedwater pump trip. This is a break in feedwater line outside the containment and therefore is bounded by FSAR 15.6.6 analyses. Failure of control components in this zone does not exacerbate this event.

b. 1) A break in any of the moisture separator vent and drain high energy lines [Item 1.b.1), 1.b.2), 1.b.5), 1.b.6), 1.b.7), 1.b.9), or 1.b.10)] results in loss of condensate from moisture separator. Moisture separator drain receiver tank associated pipe break results in loss of condensate inventory, reduced heater drain pump flow, and loss of condensate/feedwater heating at associated third point heater. Loss of feedwater heating is bounded by Chapter 15.1.1 analyses.

The failure of control components [Item 2.d.1), 2.d.2), 2.e.3), or 2.e.4)] in this zone may also result in further reduction in feedwater heating, which is bounded by FSAR Chapter 15.1.1 analyses for the above line break. In addition to this, failure of control components (Item 2.b or 2.k) may result in turbine trip. If the turbine trip occurs at a reactor power level elevated from initial operating value due to the loss of feedwater heating, the reactor may experience a change in critical power ratio greater than that described in the unacceptable results of incidents of moderate frequency anticipated operational transients of FSAR Chapter 15.

2) A break in any of the moisture separator vent or drain high energy lines [Items 1.b.3) and 1.b.4)] causes loss of hot reheat steam to associated low-pressure turbine, causing unbalanced steam temperature resulting in asymmetrical operation leading to high vibration and turbine trip. For failure of control components in this zone, refer to Item 3.b.1).

3) A break in any of the moisture separator vent and drain lines [Item 1.b.8)] causes loss of main condenser vacuum bounded by FSAR Chapter 15.2.5 analyses. Loss of condenser vacuum causes a turbine trip by 1C85-PDSN002A and 1C85-PDSN002B pressure switches. However, if pressure switches fail due to break in high energy line, a further loss in condenser vacuum will isolate the main steam isolation valves as bounded by FSAR Chapter 15.2.4 analyses.

c. 1) A break in any of the moisture separator reheater vent and drain high energy lines (Items 1.c.1 and 1.c.2) results in loss of extraction steam to associated first point heater. If the break occurs on the main condenser pipe (between main condenser and isolation valve 1DSR-MOV108/110), a loss of main condenser vacuum results. Loss of steam to first point heater results in loss of feedwater heating as bounded by FSAR Chapter 15.1.1 analyses. For failure of control components in this zone, refer to Item 3.b.1).

Loss of main condenser vacuum bounded by FSAR Chapter 15.2.5 analyses. A failure of pressure switches to trip turbine is as analyzed in Item 3.b.3).

2) A break in any of the moisture separator reheater vent and drain high energy lines [Item 1.c.3) through 1.c.7), 1.c.9), or 1.c.10)] results in loss of condensate to first point heater. This results in loss of feedwater heating at first point heater. Loss of feedwater heating is bounded by FSAR Chapter 15.1.1 analyses. For loss of condensate inventory refer to Item 3.d.2). For failure of control components in this zone, refer to Item 3.b.1).

3) A break in any of the moisture separator reheater vent and drain high energy lines [Item 1.c.8)] results in loss of main condenser vacuum. The event and results are the same as those analyzed in Item 3.b.3).

d. 1) A break in any turbine plant miscellaneous drain high energy lines connecting to main condenser [Items 1.d.2) through 1.d.8), 1.d.12), 1.d.15) through 1.d.19)] causes loss of main condenser vacuum. Refer to Item 3.b.3) for further analysis.

2) A break in any turbine plant miscellaneous drain high energy lines [Item 1.d.9), 1.d.10), or 1.d.11)] causes partial loss of condensate inventory to fourth point heater 1CNM-E4A. This results in partial loss of feedwater heating, an event bounded by FSAR Chapter 15.1.1 analyses. For failure of control components in this zone, refer to Item 3.b.1). Loss of condensate inventory will result in reduced condenser level and higher main condenser back pressure. Loss of main condenser vacuum event is bounded by FSAR Chapter 15.2.5 analyses. Refer to Item 3.b.3) for further analysis.

3) If a break in any turbine plant miscellaneous drain high energy line [Item 1.d.1) or 1.d.13)] occurs between main condenser and normally closed valves, a loss of main condenser vacuum results. Refer to Item 3.b.3) for further analyses.

If the break occurs on the extraction steam header side of the high energy line [Item 1.d.1)] a loss in extraction steam will result causing partial loss of feedwater heating. Loss of feedwater heating is bounded by FSAR

Chapter 15.1.1 analyses. For failure of control components in this zone, refer to Item 3.b.1).

The break in main steam to moisture separator reheater header drain lines will result in loss of main steam to moisture separator reheater. This event is a main steam pipe break outside containment bounded by FSAR Chapter 15.6.4.

e. 1) If a break in any extraction steam high energy line [Item 1.e.1), 1.e.3), 1.e.4), or 1.e.5)] results in loss of extraction steam to first point, third point, and fourth point heater, a loss of feedwater heating results. This event is bounded by FSAR Chapter 15.1.1 analyses. For failure of control components in this zone, refer to Item 3.b.1).

Loss of extraction steam will result in loss of condensate inventory. Loss of condensate inventory will result in reduced condenser level and higher main condenser back pressure. Loss of main condenser vacuum is bounded by FSAR Chpater 15.2.5 analyses. Also, refer to Item 3.b.3) for loss of condenser vacuum analysis.

2) A break in any extraction steam high energy line [Item 1.e.2)] will result in loss of extraction steam to second point heater. Analysis for this event is the same as Item 3.e.1).

Additionally, a break in extraction steam high energy line to second point heater will result in loss of cold reheat steam to one of the moisture separators. This will result in turbine vibration and turbine trip.

f. A break in any feedwater recirculation high energy results in loss of main condenser vacuum and partial loss of feedwater. Loss of main condenser vacuum is bounded by FSAR Chapter 15.2.5 analyses and failure to trip turbine on control component failure is further analyzed in Item 3.b.3).

g. A break in any low-pressure feedwater heater drains will result in loss of condensate heating at fifth point drain cooler. This results in a slight decrease in feedwater temperature. Loss of feedwater heating event is bounded by FSAR Chapter 15.1.1 analyses. Failure of control components is further analyzed in Item 3.b.1).

h. A break in any hot reheat high energy line [Item 1.h)] results in loss of main condenser vacuum bounded by FSAR Chapter 15.2.5 analyses. Control component failure to trip turbine on loss of condenser vacuum is further analyzed in Item 3.b.3).

i. 1) A break in any main steam high energy line [Item 1.i.1), 1.i.2), 1.i.4), or 1.i.5)] causes a loss of main steam. A steam system pipe break is bounded by FSAR Chapter 15.6.4 analyses. Control component failure does not exacerbate this event.

2) A break in any main steam high energy line [Item 1.i.7) or 1.i.8)] causes a loss in main condenser vacuum. Refer to Item 3.b.3) for control component failure analyses.

3) A break in steam pressure averaging header at inlet of main steam stop valves for PTs 1C85-PTN001A and 1B [Item 1.i.3)] results in loss of turbine steam pressure control instrumentation. Two pressure transmitters provide signals to two identical pressure regulators. Each pressure regulator compares two separate setpoints. Failure of pressure regulator as a result of failure of pressure transmitter is bounded by FSAR Chapter 15.1.3 or 15.2 analyses. Failure of control components in this zone does not exacerbate this event.

4) A break in any main steam high energy line [Item 1.i.6)] in this zone will result in loss of main condenser vacuum due to loss of main steam to condenser air removal steam jet air ejectors. Loss of main condenser vacuum event is bounded by FSAR Chapter 15.2.5 analyses. Refer to Item 3.b.3) for loss of main condenser vacuum analysis due to control component failures.

j. 1) A break in any of the high energy lines in feedwater heater relief vents and drips [Item 1.j.1) or 1.j.4)] causes partial loss of extraction steam to fifth point heaters associated with the pipe break resulting in loss of feedwater heating at fifth point heater. Loss of feedwater heating is bounded by FSAR Chapter 15.1.1 analyses. Failure of control system components is further analyzed in Item 3.b.1).

2) A break in any of the high energy lines in feedwater heater relief vents and drips [Item 1.j.2) or 1.j.3)] causes loss of main condenser vacuum. Control system components failure effect and loss of main condenser vacuum is analyzed in Item 3.b.3).

k. 1) A break in any turbine generator gland seal and exhaust steam high energy line [Item 1.k.2)] results in loss of extraction steam from fourth point. This results in loss of feedwater heating at fourth point heater. Loss of feedwater heating is bounded by FSAR Chapter 15.1.1 analyses. Failure of control system components is further analyzed in Item 3.b.1).

2) A break in any turbine generator gland seal and exhaust steam high energy line [Item 1.k.1)] results in loss of main condenser vacuum. Results of loss of main condenser vacuum are analyzed in Item 3.b.3).

APPENDIX D

ZONE V

Building: Turbine Building
Locations: El 123 ft 6 in.

HIGH ENERGY LINE BREAK ANALYSIS

	HELB System			Control System
1. a)	CNA (4-4)	Auxiliary Condensate	2. a) DTM (32-5)	Turbine Plant Miscellaneous Drains
b)	DTM (32-5)	Turbine Plant Miscellaneous Drains		
c)	MSS (3-1)	Main Steam		
d)	TME (16-1)	Turbine Generator Gland Seal and Exhaust Steam		

1. The following is a list of high energy lines analyzed on a system basis:

   a. Auxiliary Condensate (CNA, 4-4)

      1) Line Nos. 1CNA-002-2-4, 002-3-4, 002-4-4, 002-5-4, 002-31-4, and 002-34-4

         Function

         Condensate supply to steam seal evaporator 1TME-EV1.

         Failure Effect

         Loss of condensate inventory, loss of 1TME-EV1 and radwaste reboiler 1ASR-SG1 steam for turbine generator gland seal and exhaust steam (TME) system.

      2) Line Nos. 1CNA-002-7-4, 002-8-4, and 004-6-4

         Function

         Instrument standpipe and process connections for condensate level control of steam seal evaporator 1TME-EV1.

         Failure Effect

         Loss of condensate inventory and loss of 1TME-EV1 and radwaste reboiler 1ASR-SG1 steam for turbine generator gland seal and exhaust steam (TME) system.

b. Turbine Plant Miscellaneous Drains (DTM, 32-5)

1) Line No. 1DTM-006-427-4

Function

Drain the condensed third-point extraction steam from the steam seal evaporator 1TME-EV1 to the drain receiver tank 1DTM-TK2.

Failure Effect

Loss of condensate inventory and loss of partial condensate/feedwater heating at fourth-point heater 1CNM-E4A.

2) Line No. 1DTM-004-435-4

Function

Drain condensate from steam seal evaporator to turbine plant miscellaneous drain header through locked closed manually operated valve 1DTM-V335.

Failure Effect

Loss of main condenser vacuum.

c. Main Steam System (MSS, 3-1)

Line No. 1MSS-006-24-4

Function

Provide main steam to steam seal evaporator 1TME-EV1 through normally closed motor-operated valve 1MSS-MOV155 during startup operation.

Failure Effect

A break on main steam side of 1MSS-MOV155 will result in loss of some main steam.

d. Turbine Generator Gland Seal and Exhaust Steam (TME, 16-1)

Line Nos. 1TME-003-1-4, 010-2-4, 010-3-4, 010-13-4, and 010-14-4

Function

Steam line relief valves to main condenser.

Failure Effect

Loss of main condenser vacuum.

2. The following is the list of nonsafety-related control components that are affected by a high energy line break on any of the lines listed in Item 1. The consequence of failure of each control component is analyzed. Refer to Appendix B for function of individual components.

   Additionally, a high energy line break in this zone will also result in failure of control components as described in Zone VIII, Item 2. The significant consequences of such a failure have been integrated into the analysis by referring to Zone VIII control component failure in the "Combined Effect" section to this zone.

   a. Turbine Plant Miscellaneous Drains (DTM, 32-5)

      1DTM-AOV223 and 1DTM-SOV-223

      Failure Effect

      No substantial effect as this valve is on a 1-in. line.

3. Combined Effects

   a. A break in the auxiliary condensate high energy line in this zone will result in loss of condensate inventory and loss of steam seal evaporator 1TME-EV1 and radwaste reboiler 1ASR-SG1 steam for turbine generator gland seal and exhaust system. Loss of condensate inventory will result in loss of main condenser level leading to loss of main condenser vacuum. The total loss of turbine gland seal steam will cause air inleakage through the low-pressure turbine glands, resulting in loss of main condenser vacuum. The loss of main condenser vacuum event is bounded by FSAR Chapter 15.2.5 analyses. Failure of any control components in this zone or Zone VIII does not exacerbate this event.

   b. A break in the turbine plant miscellaneous drains high energy line (Item 1.b.1) in this zone will result in loss of condensate inventory and partial loss of condensate heating at fourth-point heater 1CNM-E4A. This results in a slight decrease in feedwater temperature. Loss of feedwater heating event is bounded by FSAR Chapter 15.1.1 analyses. Refer to Item 3.a above for loss of condensate inventory analysis. Failure of any control components in this zone or Zone VIII does not exacerbate this event.

      A break in the turbine plant miscellaneous drains high energy line (Item 1.b.2) in this zone will result in loss of main condenser vacuum. The loss of main condenser vacuum event is bounded by FSAR Chapter 15.2.5 analyses. Failure of any control components in this zone or Zone VIII does not exacerbate this event.

   c. A break in the main steam high energy line in this zone upstream of 1MSS-MOV155 will result in loss of main steam.

This is a break in main steam line outside containment and is bounded by FSAR Chapter 15.6.4 analyses. Failure of any control components in this zone or Zone VIII does not exacerbate this event.

d. A break in the turbine generator gland seal and exhaust steam high energy line will result in loss of main condenser vacuum. The loss of main condenser vacuum event is bounded by FSAR Chapter 15.2.5 analyses. The failure of any control components in this zone or Zone VIII does not exacerbate this event.

APPENDIX D

ZONE VI

Building: Turbine Building
Locations: El 123 ft 6 in.

HIGH ENERGY LINE BREAK ANALYSIS

HELB System		Control System	
1. a) DTM (32-5)	Turbine Plant Miscellaneous Drains	2. a) DTM (32-5)	Turbine Plant Miscellaneous Drains
b) CNA (4-4)	Auxiliary Condensate		

1. The following is a list of high energy lines analyzed on a system basis:

   a. <u>Turbine Plant Miscellaneous Drains (DTM, 32-5)</u>

      1) Line No. 1DTM-008-421-4

         <u>Function</u>

         Drain line from radwaste reboiler 1ASR-SG1 to drain receiver tank 1DTM-TK1.

         <u>Failure Effect</u>

         Partial loss of condensate/feedwater heating at fourth-point heater 1CNM-E4A.

      2) Line Nos. 1DTM-002-432-4, 004-433-4, 004-443-4, and 002-444-4

         <u>Function</u>

         Drain lines from radwaste reboiler 1ASR-SG1 to main condenser.

         <u>Failure Effect</u>

         Loss of main condenser vacuum.

   b. <u>Auxiliary Condensate (CNA, 4-4)</u>

      Line Nos. 1CNA-003-1-4, 003-32-4, 025-35-4, 002-10-4, 002-30-4, 002-2-4, and 025-9-4

Function

Supply condensate to radwaste steam reboiler 1ASR-SG1 and steam seal evaporator 1TME-EV1.

Failure Effect

Loss of condensate inventory and loss of 1ASR-SG1 and 1TME-EV1 steam for turbine generator gland seal and exhaust steam (TME) system.

2. The following is the list of nonsafety-related control components that are affected by a high energy line break on any of the lines listed in Item 1. The consequence of failure of each control component is analyzed. Refer to Appendix B for function of individual components.

   Additionally, a high energy line break in this zone will also result in failure of control components as described in Zone VIII, Item 2. The significant consequences of such a failure have been integrated into this analysis by referring to Zone VIII control component failure in the "Combined Effect" section of this zone.

   a. Turbine Plant Miscellaneous Drains (DTM, 32-5)

      1DTM-AOV222 and 1DTM-SOV222

      Failure Effect

      No substantial effect as this valve is on a 1-in. line.

3. Combined Effect

   a. A break in the turbine plant miscellaneous drains' high energy line (Item 1.a.1) in this zone will result in loss of condensate inventory, and partial loss of condensate heating at fourth-point heater 1CNM-E4A. This results in a slight decrease in feedwater temperature. Loss of feedwater heating event is bounded by FSAR Chapter 15.1.1 analyses. Loss of condensate inventory will result in low level in main condenser leading to low main condenser vacuum. A break in the turbine plant miscellaneous drains high energy line (Item 1.a.2) in this zone will result in loss of main condenser vacuum. The loss of main condenser vacuum event is bounded by FSAR Chapter 15.2.5 analyses. Failure of any control components in this zone or Zone VIII does not exacerbate these events.

   b. A break in the auxiliary condensate high energy line in this zone will result in loss of condensate inventory and total loss of turbine generator gland seal steam. As a result of the loss of turbine generator gland seal, air inleakage through the low-pressure turbine glands will create low main condenser vacuum. The loss of main condenser vacuum event is bounded by FSAR Chapter 15.2.5 analyses. Loss of condensate inventory will result in low level in main condenser leading to low main condenser vacuum. Failure of any control components in this zone or Zone VIII does not exacerbate this event.

APPENDIX D

ZONE VIII

Building: Turbine Building
Locations: El 67 ft 6 in. and 95 ft

HIGH ENERGY LINE BREAK ANALYSIS

HELB System

1. a) CNM (4-1) Condensate

   b) CNS (4-3) Condensate Makeup and Drawoff

   c) DTM (32-5) Turbine Plant Miscellaneous Drains

   d) FWS (6-1) Feedwater

   e) FWR (6-3) Feedwater Pump Recirculation

   f) HDH (6-6) High-Pressure Feedwater Heater Drains

   g) HDL (4-2) Low-Pressure Feedwater Heater Drains

   h) SVH (32-14) Feedwater Heater Relief, Vents, and Drips

Control System

2. a) CCS (9-7) Turbine Plant Component Cooling Water

   b) CNM (4-1) Condensate

   c) DSM (32-7) Moisture Separator Vents and Drains

   d) DSR (32-6) Moisture Separator Reheater Vents and Drains

   e) DTM (32-5) Turbine Plant Miscellaneous Drains

   f) ESS (3-4) Extraction Steam

   g) FWR (6-3) Feedwater Pump Recirculation

   h) GMC (16-8) Stator Cooling Water

   i) HDH (6-6) High-Pressure Feedwater Heater Drains

   j) HDL (4-2) Low-Pressure Feedwater Heater Drains

   k) IAS (12-1) Instrument Air

   l) MSS (3-1) Main Steam

   m) SVH (32-14) Feedwater Heater Relief, Vents, and Drips

n) TME (16-1) Turbine Generator Gland Seal and Exhaust Steam

o) C33 Feedwater Control

p) C85 Turbine Bypass

1. The following is a list of high energy lines analyzed on a system basis for this zone. High energy lines for Zone XX (feedwater system) are similar to Item 1.d below. There are no control components in Zone XX affected by a high energy line break.

   a. Condensate (CNM, 4-1)

      1) Line Nos. 1CNM-020-14-4, 020-15-4, 020-16-4, and 024-17-4

         Function

         Condensate pump A, B, or C discharge lines, common discharge header.

         Failure Effect

         Loss of condensate/feedwater flow.

      2) Line Nos. 1CNM-003-146-4, 003-147-4, and 003-148-4

         Function

         Condensate pump A, B, or C discharge valves 1CNM-MOV3A, 3B, and 3C bypass lines.

         Failure Effect

         Condensate/feedwater flow is reduced. Turbine runback. Loss of condensate inventory.

      3) Line No. 1CNM-020-38-4

         Function

         Air ejector intercondensers 1ARC-E2A and E2B bypass line.

         Failure Effect

         Loss of condensate/feedwater flow.

      4) Line Nos. 1CNM-002-45-4 and 002-46-4

         Function

         Condensate to loop seal low-pressure feedwater heater drains.

Failure Effect

If line breaks on the side of loop seal, loss of condenser vacuum will be the result. If line breaks on the condensate side, reduced condensate flow and loss of condensate inventory will result.

5) Line Nos. 1CNM-020-47-4, 020-50-4, and 018-49-4

Function

Condensate recirculation to main condenser and bypass.

Failure Effect

Loss of feedwater/condensate flow.

6) Line Nos. 1CNM-024-54-4, 016-64-4, and 016-66-4

Function

From condensate demineralizer to heater trains A and B. Heater trains bypass.

Failure Effect

Loss of condensate/feedwater flow.

7) Line Nos. 1CNM-020-67-4, 020-76-4, 020-80-4, 030-85-4, 030-81-4, 016-88-4, 016-180-4, and 016-181-4

Function

Condensate from condensate demineralizer to 5th point drain coolers 1CNM-DCL1A and 1B, from 2nd point heaters 1CNM-E2A and E2B to reactor feed pump suction header. Feedwater pump bypass. Condensate demineralizer system bypass.

Failure Effect

Loss of condensate/feedwater flow.

8) Line Nos. 1CNM-003-159-4, 003-160-4, 003-161-4, 003-162-4, and 003-153-4

Function

Reactor feed pump A, B, or C inlet valve bypass. Reactor feed pump bypass line valve bypass. Condensate to reactor flow control valve inlet isolation valve bypass.

Failure Effect

Condensate/feedwater flow is reduced. Turbine runback. Loss of condensate inventory.

b. Condensate Makeup and Drawoff (CNS, 4-3)

Line Nos. 1CNS-006-7-4, 006-8-4, and 004-9-4

Function

Condensate recirculation to main condenser from condensate polishing demineralizers.

Failure Effect

Loss of condenser makeup water and loss of condensate inventory.

c. Turbine Plant Miscellaneous Drains (DTM, 32-5)

1) Line Nos. 1DTM-004-176-4 and 004-177-4

Function

Air ejector intercondenser 1ARC-E2A or E2B loop seal drains to main condenser.

Failure Effect

No significant effect.

2) Line No. 1DTM-004-625-4

Function

Gland steam condenser 1TME-CND1 drains to main condenser.

Failure Effect

Loss of main condenser vacuum.

3) Line Nos. 1DTM-002-541-4 through 002-544-4

Function

Off-gas from steam air ejectors to preheater EB001A or 1B line drains to main condenser.

Failure Effect

Loss of main condenser vacuum and loss of main condenser off-gas treatment.

4) Line No. 1DTM-004-151-4

Function

Reactor water cleanup blowdown drain to main condenser.

Failure Effect

Loss of main condenser vacuum.

5) Line No. 1DTM-003-110-4

Function

Main steam isolation valves drain to main condenser.

Failure Effect

Loss of main condenser vacuum.

6) Line No. 1DTM-003-79-4

Function

Main steam isolation valve drain header to main condenser.

Failure Effect

Loss of condensate inventory from main steam isolation valve body drains.

7) Line Nos. 1DTM-002-511-4 and 002-512-4

Function

Capped lines to main condenser.

Failure Effect

Loss of main condenser vacuum.

8) Line Nos. 1DTM-002-513-4 and 002-514-4

Function

Regenerant evaporator reboiler drain receiver 1DTM-TK3 and waste evaporator boiler drain receiver 1DTM-TK4 drain to auxiliary boiler deaerator.

Failure Effect

No significant impact, since the drain lines are normally closed by valves 1DTM-AOV-206 and 207 and are manually operated remotely when auxiliary boiler is used.

9) Line No. 1DTM-002-656-4

Function

Main steam isolation valve seal line is drained to the condenser through remotely operated, normally closed motor-operated valve 1E33*MOVF026.

Failure Effect

Loss of main condenser vacuum.

d. Feedwater (FWS, 6-1)

1) Line Nos. 1FWS-020-1-4, 020-2-4, 020-3-4, 030-28-4, 020-5-4, 020-6-4, 020-7-4, 020-8-4, 020-9-4, 020-10-4, 030-20-4, 020-21-4, 020-22-4, 020-25-4, 020-26-4, 030-61-4, 020-29-4, 016-81-4, 020-31-4, 020-32-4, 016-11-4, and 020-46-4

Function

Carry feedwater from reactor feedwater pumps to common headers to 1st point heaters to feedwater isolation valves.

Failure Effect

Loss of feedwater flow to reactor vessel.

2) Line Nos. 1FWS-003-70-4, 003-71-4, 003-72-4, 002-73-4, 003-74-4, 003-75-4, 003-76-4, and 003-79-4

Function

Feedwater miscellaneous valves bypass lines.

Failure Effect

Reduced feedwater flow to reactor vessel.

3) Line Nos. 1FWS-012-12-4 and 012-13-4

Function

Feedwater level control bypass line.

Failure Effect

Loss of feedwater flow.

4) Line Nos. 1FWS-020-80-4, 020-30-4, and 016-82-4

Function

Feedwater recirculation to main condenser.

Failure Effect

Loss of main condenser vacuum.

e. Feedwater Pump Recirculation (FWR, 6-3)

Line Nos. 1FWR-008-1-4, 008-3-4, and 008-5-4

Function

Feedwater pump 1FWS-P1A, 1B, or 1C recirculation line.

Failure Effect

Reduced feedwater flow and loss of main condenser vacuum.

f. High-Pressure Feedwater Heater Drains (HDH, 6-6)

Line Nos. 1HDH-016-6-4 and 016-13-4

Function

First point heater 1FWS-E1A or 1B bypass line to main condenser.

Failure Effect

Loss of feedwater heating and loss of condensate inventory.

g. Low-Pressure Feedwater Heater Drains (HDL, 4-2)

1) Line No. 1HDL-018-6-4

Function

Second point heater 1CNM-E2A bypass line to main condenser.

Failure Effect

Loss of feedwater heating and loss of condensate inventory.

2) Line Nos. 1HDL-010-24-4 and 010-46-4

Function

Same as Item g.1) for 1CNM-E4A or E4B.

Failure Effect

Same as Item f.1) for 1CNM-E4A or E4B.

3) Line Nos. 1HDL-002-52-4, 002-53-4, 004-96-4, 002-67-4, 002-68-4, and 004-66-4

Function

Fifth point heater drain receiver tanks 1HDL-TK1A or 1B level instrumentation.

Failure Effect

Loss of condensate inventory and loss of condensate heating at fifth point heater drain coolers 1CNM-DCL1A or 1B.

4) Line Nos. 1HDL-010-55-4 and 010-70-4

Function

Fifth point heater drain receiver tanks 1HDL-TK1A or 1B to fifth point heater drain coolers 1CNM-DCL1A or 1B.

Failure Effect

Same as Item 3) above.

5) Line Nos. 1HDL-012-58-4 and 012-73-4

Function

Fifth point heater drain receiver tanks 1HDL-TK1A or 1B bypass to main condenser.

Failure Effect

Same as Item 3) above.

6) Line Nos. 1HDL-016-54-4 and 016-69-4

Function

Fifth point heater 1CNM-E5A or E5B drains to drain receiver tank 1HDL-TK1A or 1B.

Failure Effect

Loss of condensate inventory and partial loss of condensate heating at fifth point heater 1CNM-E5A or E5B and fifth point heater drain cooler 1CNM-DCL1A or 1B.

7) Line Nos. 1HDL-014-110-4 and 014-115-4

Function

Heater drain pumps discharge line relief to main condenser.

Failure Effect

Loss of main condenser vacuum.

8) Line Nos. 1HDL-020-16-4 and 020-41-4

Function

Third point heater 1CNM-E3A or E3B drain bypass to main condenser.

Failure Effect

Loss of condensate inventory. Heater drain pump flow to condensate system is reduced.

h. Feedwater Heater Relief, Vents, and Drips, (SVH, 32-14)

1) Line Nos. 1SVH-003-76-4 and 003-101-4

Function

Fifth point heater 1CNM-E5A or E5B vent lines to 1HDL-TK1A or 1B.

Failure Effect

No significant effect.

2) Line Nos. 1SVH-025-46-4 and 025-64-4

Function

Fourth point heater 1CNM-E4A or E4B vent lines to main condenser.

Failure Effect

Loss of main condenser vacuum.

2. The following is the list of nonsafety-related control components that are affected by a high energy line break on any of the lines listed in Item 1. Refer to Appendix B for the function of each component.

These control components are also subject to failure due to a high energy line break in Zones V, VI, XV, XVI, and XX, and the consequences of failure have been combined with those in Zones V, VI, XV, and XVI, as Zone XX has no control component of interest.

a. Turbine Plant Component Cooling Water (CCS, 9-7)

1CCS-PIC111 and PV111

Failure Effect

If 1CCS-PV111 fails open, turbine plant component cooling water header pressure will be reduced, resulting in reduced component cooling water heat removal capability.

b. Condensate (CNM, 4-1)

1) 1CNM-FT68A, 68B, and 68C

Failure Effect

If flow transmitter 1CNM-FT68A, 68B, or 68C fails 1FWR-FV2A, 2B, or 2C in open position, reactor feedwater flow to reactor vessel is reduced and the turbine will go into a runback mode.

If flow transmitter 1CNM-FT68A, 68B, or 68C fails 1FWR-FV2A, FV2B, or FV2C in closed position, reactor feedwater pump 1FWS-P1A, 1B, or 1C minimum recirculation requirements will not be met, causing feedwater pump degradation at low feedwater flow levels.

2) 1CNM-PT70A, 70B, and 70C

Failure Effect

If pressure transmitter 1CNM-PT70A, PT70B, or PT70C inadvertently provides a low suction pressure signal, reactor feedwater pump 1FWS-P1A, P1B, or P1C will trip.

If pressure transmitter 1CNM-PT70A, PT70B, or PT70C inadvertently does not provide a low suction pressure signal, a degraded feedwater pump operation will result.

3) 1CNM-I/P114

Failure Effect

If 1CNM-I/P114 fails 1CNM-FV114 in open position, condensate/feedwater flow is reduced as well as feedwater pump suction pressure is reduced.

c. Moisture Separator Vents and Drains (DSM, 32-7)

1) 1DSM-LIC75A, LV75A, SOV75A,
LIC75B

Failure Effect

Partial loss of condensate/feedwater heating by third point heater 1CNM-E3A or 3B when instrumentation fails valve 1DSM-LV75A or 75B in closed position.

2) 1DSM-LIC78B

Failure Effect

If 1DSM-LIC78B fails 1DSM-LV78B in open position, condensate from 1DSM-TK1B will drain from 1DSM-TK1B to main condenser, causing partial loss of condensate/feedwater heating by third point heater 1CNM-E3A or E3B.

d. Moisture Separator Vents and Drains (DSR, 32-6)

1) 1DSR-LIC65A
1DSR-LIC65B, LV65B, and SOV65B

Failure Effect

If instrumentation fails valve 1DSR-LV65A or 65B in closed position, partial loss of heating at first point heater 1FWS-E1A or E1B results.

2) 1DSR-LIC68B and LY68B

Failure Effect

If instrumentation fails 1DSR-LV68B in open position, condensate from 1DSR-TK1B will drain to main condenser, resulting in partial loss of heating at first point heater 1FWS-E1B.

e. Turbine Plant Miscellaneous Drains (DTM, 32-5)

1) 1DTM-LIC187

Failure Effect

If instrumentation fails 1DTM-LVX187 in open position, condensate from radwaste reboiler drain receiver 1DTM-TK1 will drain into condenser, resulting in partial loss of condensate/feedwater heating at fourth point heater 1CNM-E4A.

2) 1DTM-LIC189

Failure Effect

If instrumentation fails 1DTM-LVX189 in open position, condensate from steam seal evaporator drain receiver tank 1DTM-TK2 will drain into main condenser. Partial loss of condensate/feedwater heating at fourth point heater 1CNM-E4A will result.

If instrumentation fails 1DTM-LVY189 in close position, partial loss of condensate/feedwater heating at fourth point heater 1CNM-E4A will result.

3) 1DTM-AOV12A, SOV12A
1DTM-SOV12B, SOV12B

Failure Effect

Failure of these valves will have no adverse impact, since they are not used during normal plant operation.

f. Extraction Steam (ESS, 3-4)

1ESS-NRV29B, SOVX29B, and SOVY29B

Failure Effect

If nonreturn valve 1ESS-NRV29B fails open, then some protection is lost against turbine water induction and overspeed leading to turbine trip.

g. Feedwater Pump Recirculation (FWR, 6-3)

1FWR-I/P2A, 2B, and 2C

Failure Effect

If 1FWR-I/P2A, 2B, or 2C fails, reactor feedwater pump recirculation valves 1FWR-FV2A, 2B, or 2C in open position, feedwater flow to reactor will be reduced.

If valve 1FWR-FV2A, 2B, or 2C fails in closed position, feedwater pump minimum recirculation requirements will not be met, causing feedwater pump degradation at low feedwater flow levels.

h. Stator Cooling Water (GMC, 16-8)

1GMC-PS63-P96, and TS63-T86

Failure Effect

If instrumentation fails such that it energizes generator stator winding cooling water heater inadvertently, stator temperature rise may result.

i. High-Pressure Feedwater Heater Drains (HDH, 6-6)

1) 1HDH-LIC6A and 6B

Failure Effect

If controller 1HDH-LIC6A or 6B fails 1HDH-LV6A or 6B in close position, condensate/feedwater heating at second point heater 1CNM-E2A or E2B will be reduced.

2) 1HDH-LIC26A and 26B

Failure Effect

If controller 1HDH-LIC26A or 26B fails 1HDH-LV26A or 26B in open position, first point heater 1FWS-E1A or E1B drains to second point heater 1CNM-E2A or E2B will be bypassed to main condenser, resulting in partial loss of condensate heating at second point heater 1CNM-E2A or E2B.

j. Low-Pressure Feedwater Heater Drains (HDL, 4-2)

1) 1HDL-LT2A and 2B, 1HDL-LIC2A and 2B, and 1HDL-LV2A and 2B

Failure Effect

If controller 1HDL-LIC2A or 2B or level transmitter 1HDL-LT2A or 2B fails 1HDL-LV2A or 2B in closed position, the result will be loss of condensate/feedwater heating at fifth point drain cooler 1CNM-DCL1A or 1B.

2) 1HDL-LT22A and 22B
1HDL-LIC22A and 22B

Failure Effect

If controller 1HDL-LIC22A or 22B or level transmitter 1HDL-LT22A or 22B fails drain valve 1HDL-LV22A or 22B in open position, the result will be loss of condensate/feedwater heating at fifth point drain cooler 1CNM-DCL1A or 1B.

3) 1HDL-LS22A and 22B

Failure Effect

If 1HDL-LS22A or 22B fails drain valve 1HDL-LV22A or 22B in closed position with high water level in drain receiver 1HDL-TK1A or 1B, fifth point heater 1CNM-E5A or 5B water level will rise. This will necessitiate isolation of heater string A or B and will result in reduction in condensate/feedwater heating.

4) 1HDL-LIC3A and 3B

Failure Effect

If controller 1HDL-LIC3A or 3B fails 1HDL-LV3A or 3B in closed position, condensate/feedwater heating at fourth point heater drain cooler 1CNM-DCL2A or 2B will be lost.

5) 1HDL-LIC4A and 4B

Failure Effect

If controller 1HDL-LIC4A or 4B fails 1HDL-LV4A or 4B in closed position, the respective heater drain pump flow to condensate system will be lost.

6) 1HDL-LIC5A and 5B

Failure Effect

If controller 1HDL-LIC5A or 5B fails 1HDL-LV5A or 5B in closed position, the result will be partial loss of condensate/feedwater heating at third point heater 1CNM-E3A or 3B, and heater drain pump discharge flow will be reduced.

7) 1HDL-I/P20A and 20B

Failure Effect

If 1HDL-I/P20A or 20B fails 1HDL-FV20A or 20B in full open position, heater drain pump discharge flow will be reduced. If 1HDL-I/P20A or 20B fails 1HDL-FV20A or 20B in closed position, it may result in heater drain pump overheating when flow is low.

8) 1HDL-LIC23A and 23B

Failure Effect

If controller 1HDL-LIC23A or 23B fails 1HDL-LV23A or 23B in open position, fourth point heater 1CNM-E4A or 4B drains to fourth point heater drain cooler 1CNM-DCL2A or 2B will be bypassed to main condenser. This will result in loss of condensate/feedwater heating at fourth point drain cooler 1CNM-DCL2A or 2B.

9) 1HDL-LIC24A and 24B

Failure Effect

If controller 1HDL-LIC24A or 24B fails 1HDL-LV24A or 24B in open position, drain will be bypassed to main condenser, reducing heater drain pump discharge flow.

10) 1HDL-LIC25A and 25B

Failure Effect

If controller 1HDL-LIC25A or 25B fails 1HDL-LV25A or 25B in closed position, second point heater 1CNM-E2A or 2B drains to third point heater 1CNM-E3A or 3B will be bypassed to main condenser. This will result in loss of partial condensate/feedwater heating at third point heater 1CNM-E3A or 3B.

k. Instrument Air (IAS, 12-1)

1) 1IAS-TS2A, 2B, 2C, 3A, 3B, 3C, 1IAS-PS4A, 4B, 4C, 1IAS-TS6A, 6B, 6C, 10A, 10B, and 10C

Failure Effect

Failure of instrumentation will result in trip of instrument air compressor 1IAS-C1A, 1B, or 1C.

2) 1IAS-TS20A, 20B, and 20C

Failure Effect

Failure of instrumentation will result in loss of instrument air dryer 1A or 1B heating.

l. Main Steam (MSS, 3-1)

1MSS-FTX13B

Failure Effect

An inadvertent extreme low flow signal from the flow transmitter can isolate the main condenser air removal system by closing 1ARC-AOV1B.

m. Feedwater Heater Relief, Drips, and Vents (SVH, 32-14)

1SVH-AOV25A, 25B, 1SVH-SOV25A, and 25B

Failure Effect

No significant effect.

n. Turbine Generator Gland Seal and Exhaust Steam (TME, 16-1)

1TME-PVSSAFV
1TME-PCW2

Failure Effect

If instrumentation failure closes 1TME-PVSSAFV, steam supply for turbine gland sealing from radwaste auxiliary steam will be lost. This will not result in any significant event, since steam for turbine gland sealing will be available from steam seal evaporator 1TME-EV1.

o. Feedwater Control System (C33)

1) 1C33-LVF002, 1C33-SOVF002, and 1C33-I/PF002

Failure Effect

No significant effect

2) 1C33-N002A and 002B

Failure Effect

If 1C33-N002A and 2B fail providing a high flow signal to three element master controllers, an error signal between reactor level, steam flow, and feedwater flow will be detected by master controller. If reactor level reaches high, feedwater pump and turbine trip signal with reactor scram is initiated.

If 1C33-N002A and 2B signal fails low, feedwater flow control valves 1C33-LVF001A, 001B, and 001C are fail locked in their last position. Alarm is initiated.

p. Steam Bypass and Regulation (C85)

1C85-PTN001A and 001B

Failure Effect

Each pressure transducer provides steam pressure signal to individual pressure regulator, a sudden change in a single transducer signal will not affect the system as control is assumed by the second pressure regulator. If both pressure regulators fail low/high that will scram the reactor.

3. Combined Effect

a. 1) A break in any of the condensate high energy lines [Item 1.a.1), 1.a.3), 1.a.5), 1.a.6), or 1.a.7)] will result in total loss of feedwater/condensate flow to reactor. This is a break in the feedwater line outside containment and is bounded by FSAR Chapter 15.6.6 analyses. Reactor feedwater pumps 1FWS-P1A, P1B, and P1C will trip on low suction pressure measured by 1CNM-PT70A, 70B, and 70C. However, if the above pressure transducers fail to trip the feedwater pumps, a low reactor water level scram is initiated as a result of loss of feedwater flow bounded by FSAR Chapter 15.2.7 analyses.

2) A break in any condensate high energy line [Item 1.a.2), 1.a.4), or 1.a.8)] will result in reduced condensate flow and loss of condensate inventory. If control components fail 1CNM-PT70A, 70B, or 70C, it causes a feedwater pump trip, partial loss of feedwater flow, and turbine runback result. However, if no feedwater pump trip results and turbine runback signal is not initiated, a proportional loss in feedwater flow will result in a low reactor water level scram bounded by FSAR Chapter 15.2.7 analyses.

b. A break in any condensate makeup and drawoff high energy line will result in loss of condensate makeup water and loss of condensate inventory. Control component failure in this zone is analyzed in Item 3.a.2) above.

c. A break in any turbine plant miscellaneous drain high energy line [Item 1.c.2), 1.c.3), 1.c.4), 1.c.5), 1.c.7), or 1.c.9)] will result in loss of main condenser vacuum. Loss of main condenser vacuum is bounded by FSAR Chapter 15.2.5 analyses. Control system component failure does not exacerbate this event.

d. 1) A break in any feedwater high energy line will result in total loss of feedwater flow to reactor [Item 1.d.1) or 1.d.3)]. This is a break in the feedwater line outside containment and is bounded by FSAR Chapter 15.6.6 analyses.

A break in any feedwater high energy line [Item 1.d.2)] in this zone will result in reduced feedwater flow to the reactor. A proportional loss in feedwater flow to reactor results in a low level reactor scram bounded by FSAR Chapter 15.2.7 analyses, if failure of control components in this zone will result in loss of turbine runback signal.

2) A break in any feedwater high energy line [Item 1.d.4)] in this zone will result in loss of main condenser vacuum. Loss of main condenser vacuum event is bounded by FSAR Chapter 15.2.5 analyses. Control component failure does not exacerbate this event.

e. A break in any feedwater recirculation high energy line in this zone results in reduction of feedwater flow to reactor. As a result of a high energy line break in this zone, if reactor recirculation valves 1FWR-FV2A, FV2B, or FV2C fail open, a further reduction in feedwater flow to reactor results. Loss of feedwater flow will result in a low reactor water level scram bounded by FSAR Chapter 15.2.7 analyses, if failure of control components in this zone results in loss of turbine runback signal. However, if reactor recirculation valve opens in the line associated with the pipe break, a loss of main condenser vacuum will result. Loss of main condenser vacuum event is bounded by FSAR Chapter 15.2.5 analyses.

f. A break in the high-pressure feedwater heater drain in this zone will result in loss of condensate inventory and loss of feedwater heating at second and third point heaters. Loss of feedwater heating event is bounded by FSAR Chapter 15.1.1 analyses.

If the high energy line break in this zone results in failure of moisture separator drain tank receiver valve 1DSM-LV75A or 1DSM-LV75B in closed position, condensate discharge to third point heater is reduced as well as third point heating. Instrumentation on drain tank will open valve 1DSM-LV78A, bypassing condensate to condenser. However, if 1DSM-LV78 also fails to open on tank high level, moisture separator tank level will backup in moisture separator reheater and turbine trip will result.

If 1DSM-LV78A or 78B control valve associated with pipe break opens due to control component failure, loss of main condenser vacuum results. This event is bounded by FSAR Chapter 15.2.5 analyses.

g. 1) A break in the low-pressure feedwater high energy line [Items 1.g.1) through 1.g.6)] will result in loss of condensate inventory and loss of feedwater heating at second point, fourth point, or fifth point heater. Loss of feedwater heating is bounded by FSAR Chapter 15.1.1 analyses. If the high energy line break in this zone results in failure of 1DSM-LV75A in closed position at third point heater, a moisture separator drain tank high level will result. Refer to Item 3.f for further analysis.

2) A break in the low-pressure heater drain high energy line [Item 1.g.7)] will result in loss of main condenser vacuum. Loss of main condenser vacuum event is bounded by FSAR Chapter 15.2.5 analyses. Control components failure does not exacerbate this event.

3) A break in the low-pressure high energy line [Item 1.g.8)] will result in loss of feedwater heating and loss of condensate inventory at third point heater associated with the break. Loss of feedwater heating event is bounded by FSAR Chapter 15.1.1 analyses. If the high energy line break in this zone results in failure of 1HDL-LV24A or LV24B valve (associated with pipe break) in open position, a loss of main condenser vacuum results. Loss of main condenser vacuum event is bounded by FSAR Chapter 15.2.5 analyses.

h. A break in feedwater heater relief, vents, and drips in this zone results in a loss of main condenser vacuum. Loss of main condenser vacuum event is bounded by FSAR Chapter 15.1.1 analyses. Control system component failure does not exacerbate this event.

APPENDIX D

ZONE XI

Building: Turbine Building
Locations: El 95 ft 0 in.

HIGH ENERGY LINE BREAK ANALYSIS

HELB System			Control System		
1.	a) ARC (5-1)	Condenser Air Removal	2.	a) DTM (32-5)	Turbine Plant Miscellaneous Drains
	b) CNM (4-1)	Condensate			
	c) DTM (32-5)	Turbine Plant Miscellaneous Drains			
	d) MSS (3-1)	Main Steam			
	e) OFG (31-4)	Off-Gas			

1. The following is a list of high energy lines analyzed on a system basis:

   a. Condensate Air Removal (ARC, 5-1)

   Line No. 1ARC-006-60-4

   Function

   Off-gas from condenser air removal system steam jet air ejector 1ARC-J3A to off-gas system for treatment.

   Failure Effect

   Loss of off-gas treatment.

   b. Condensate (CNM, 4-1)

   Line Nos. 1CNM-020-35-4, 003-149-4, and 020-36-4

   Function

   Condensate to air ejector intercondenser 1ARC-E2A.

   Failure Effect

   Loss of condensate/feedwater.

c. Turbine Plant Miscellaneous Drains (DTM, 32-5)

1) Line Nos. 1DTM-004-176-4 and 150-174-4

Function

Intercooler 1ARC-E3A or air ejector intercondenser 1ARC-E2A drains to main condenser.

Failure Effect

Loss of condensate inventory from air ejector intercondenser 1ARC-E2A or intercooler 1ARC-E3A to condenser, and loss of main condenser vacuum.

2) Line Nos. 1DTM-002-540-4, 002-543-4, and 002-544-4

Function

Bypass of off-gas line between air ejector 1ARC-J3A and preheater EB001A to the main condenser.

Failure Effect

Loss of main condenser vacuum.

d. Main Steam System (MSS, 3-1)

Line Nos. 1MSS-006-35-4, 002-36-4, 002-37-4, and 003-38-4

Function

Main steam supply to air ejectors 1ARC-J1A, J2A, and J3A.

Failure Effect

Loss of main steam to air ejectors 1ARC-J1A, J2A, and J3A for condenser air removal and loss of main condenser vacuum.

e. Off-Gas (OFG, 31-4)

Line No. 1OFG-016-3-4

Function

Off-gas from condenser air removal system air ejectors to off-gas preheater EB001A.

Failure Effect

Loss of main condenser off-gas treatment.

2. The following is the list of nonsafety-related control components that are affected by a high energy line break on any of the lines listed in Item 1. The consequence of failure of each control com-

ponent is analyzed. Refer to Appendix B for function of individual components.

Additionally, a high energy line break in this zone will also result in failure of control components as described in Zone I, Item 2. The significant consequences of such a failure have been integrated into the analysis by referring to Zone I control components failure in the "Combined Effect" section of this zone.

a. Turbine Plant Miscellaneous Drains (DTM, 32-5)

1) 1DTM-AOV55A and 1DTM-SOV-55A

Failure Effect

No significant effect.

3. Combined Effects

a. A break in the condenser air removal high energy line in this zone will result in a loss of condenser air ejector 1ARC-J3A causing loss of main condenser off-gas treatment. This event is bounded by FSAR Chapter 15.7 analyses. The failure of any control components in this zone or Zone I does not exacerbate this event.

b. A break in any of the condensate high energy lines in this zone will result in loss of condensate/feedwater. This event is bounded by FSAR Chapter 15.2.7 analyses. The failure of any control components in this zone or Zone I does not exacerbate this event.

c. A break in any of the turbine plant miscellaneous drains' high energy lines in this zone can result in loss of main condenser vacuum. This event is bounded by FSAR Chapter 15.2.5 analyses. The failure of any control components in this zone or Zone I does not exacerbate this event.

d. A break in any of the main steam high energy lines in this zone can cause some loss of main steam and loss of air ejectors 1ARC-J1A, J2A, and J3A and loss of main condenser vacuum bounded by Chapter 15.2.5 analyses. The failure of any control components in this zone or Zone I does not exacerbate this event.

e. A break in the off-gas high energy line in this zone will result in loss of main condenser off-gas treatment and gaseous release in the turbine building. This event is bounded by FSAR Chapter 15.7 analyses. Increased radioactivity levels detected by area radiation monitoring provides alarm in the control room. Manual isolation of off-gas system will result in high condenser pressure and reactor scram. Failure of control components in this zone or Zone I does not exacerbate this event.

APPENDIX D

ZONE XII

Location: Turbine Building
Elevation: El 95 ft

HIGH ENERGY LINE BREAK ANALYSIS

HELB System			Control System		
1.a)	ARC (5-1)	Condenser Air Removal	2.a)	DTM (32-5)	Turbine Plant Miscellaneous Drains
b)	CNM (4-1)	Condensate			
c)	DTM (32-5)	Turbine Plant Miscellaneous Drains			
d)	MSS (3-1)	Main Steam			
e)	OFG (31-4)	Off-Gas System			

1. The following is a list of high energy lines analyzed on a system basis:

   a. Condenser Air Removal (ARC, 5-1)

   Line No. 1ARC-006-61-4

   Function

   Off-gas from condenser air removal system steam jet air ejector 1ARC-J3B to off-gas system for treatment.

   Failure Effect

   Loss of main condenser off-gas treatment.

   b. Condensate (CNM, 4-1)

   Line Nos. 1CNM-020-35-4, 020-40-4, 024-17-4, 020-37-4, and 003-150-4

   Function

   Air ejector intercondenser 1ARC-E2B condensate.

   Failure Effect

   Loss of condensate/feedwater.

c. Turbine Plant Miscellaneous Drains (DTM, 32-5)

1) Line Nos. 1DTM-150-173-4 and 1DTM-004-177-4

Function

Air ejector intercondenser 1ARC-E2B and intercooler 1ARC-E3B drains to main condenser

Failure Effect

Loss of condensate inventory from air ejector intercondenser 1ARC-E2B and intercooler 1ARC-E3B to condenser, and loss of main condenser vacuum.

2) Line Nos. 1DTM-002-381-4, 1DTM-002-541-4, and 1DTM-002-542-4

Function

Bypass of off-gas lines between air ejector 1ARC-J3B and preheater EB001A to the main condenser.

Failure Effect

Loss of main condenser vacuum.

d. Main Steam (MSS, 3-1)

Line Nos. 1MSS-006-34-4, 1MSS-002-42-4, 1MSS-002-43-4, and 1MSS-003-44-4

Function

Main steam supply to air ejectors 1ARC-J1B, J2B, and J3B.

Failure Effect

Loss of main steam to air ejectors 1ARC-J1B, J2B, and J3B for condenser air removal resulting in loss of main condenser vacuum.

e. Off-Gas (OFG, 31-4)

Line No. 1OFG-016-4-4

Function

Off-gas from condenser air removal system air ejectors to off-gas preheater EB001A.

Failure Effect

Loss of main condenser off-gas treatment.

2. The following is a list of nonsafety-related control components that are affected by a high energy line break on any of the lines listed in Item 1. The consequences of failure of each control component are analyzed. Refer to Appendix B for function of individual components.

Additionally, a high energy line break in this zone will also result in failure of control components as described in Zone I, Item 2. The significant consequences of such a failure have been integrated into this analysis by referring to control components failure in Zone I in the "Combined Effect" section of this zone.

a. <u>Turbine Plant Miscellaneous Drains (DTM, 32-5)</u>

1DTM-AOV55B
1DTM-SOV55B

<u>Failure Effect</u>

No significant effect.

3. <u>Combined Effect</u>

a. A break in the condenser air removal high energy line in this zone will result in loss of condenser air ejectors 1ARC-J3A and J3B causing loss of main condenser air off-gas treatment. This event is bounded by FSAR Chapter 15.7 analyses. Failure of any control components in this zone or Zone I does not exacerbate this event.

b. A break in any of the condensate high energy lines in this zone will result in loss of condensate/feedwater. This event is bounded by FSAR Chapter 15.2.7 analyses. The failure of any control components in this zone or Zone I does not exacerbate this event.

c. A break in any of the turbine plant miscellaneous drains' high energy lines in this zone will result in loss of main condenser vacuum. This event is bounded by FSAR Chapter 15.2.5 analyses. The failure of any control components in this zone or Zone I does not exacerbate this event.

d. A break in any of the main steam high energy lines in this zone will cause some loss of main steam and loss of air ejectors 1ARC-J1B, J2B, and J3B resulting in loss of main condenser vacuum. This event is bounded by FSAR Chapter 15.2.5 analyses. The failure of any control components in this zone or Zone I does not exacerbate this event.

e. A break in off-gas high energy line in this zone will result in loss of main condenser off-gas treatment and a gaseous release in the turbine building. This event is bounded by FSAR Chapter 15.7 analyses.

This event is bounded by FSAR Chpater 15.7 analyses. Increased radioactivity levels detected by area radiation monitoring alarm in the control room. Manual isolation of off-gas system will result in high condenser pressure and reactor scram. Failure of control components in this zone or Zone I does not exacerbate this event.

APPENDIX D

ZONE XIII

Building. Turbine Building
Location: El 95 ft 0 in.

HIGH ENERGY LINE BREAK ANALYSIS

HELB System		Control System	
1.a) DTM (32-5)	Turbine Plant Miscellaneous Drains	2.a) TML (16-2)	Turbine Generator Lube Oil

1. The following is a list of high energy lines analyzed on a system basis.

   a. Turbine Plant Miscellaneous Drains (DTM, 32-5)

      1) Line No. 1-DTM-004-151-4

      Function

      Reactor water cleanup system drain line to condenser.

      Failure Effect

      A break in this line will reduce some condensate inventory, and a loss of condenser vacuum through the break may result.

      2) Line No. 1-DTM-002-656-4

      Function

      Main steam isolation valve seal line is drained to the condenser through remotely operated, normally closed motor-operated valve 1E33*MOVF026.

      Failure Effect

      A break in this line will have the same effect as Item 1.a.1) above. However, since the valve is normally closed, no loss of condensate is expected.

2. The following is a list of nonsafety-related control components that are affected by a high energy line break on any of the lines listed in Item 1. The consequence of failure of each control component is analyzed. Refer to Appendix B for function of individual components.

a. Turbine Generator Lube Oil (TML, 16-2)

1) 1TML-PSPS1

Failure Effect

The maloperation of the pressure switch may not permit the automatic start of the motor driven suction oil pump 1MSP for the turbine. Since the pump is used only during startup, failure will not cause any adverse effect.

2) 1TML-PSPS2A and 2B

Failure Effect

The failure of the switches will not permit the automatic start of dc emergency bearing oil pump 1EBOP. This pump is used as a backup of 1MSP and ac driven turbine gear oil pump, both of which are used during startup. Therefore, failure of the pressure switches will not impact normal operation of the plant.

3) 1TML-PSPS3 and 4

Failure Effect

Failure of these pressure switches will not allow automatic start of dc emergency break oil pump 1EGOP. Since this pump is used for startup operations only, it will have similar effect as Item 2 above.

3. Combined Effect

A break in the turbine plant miscellaneous drains high energy line will reduce some condensate inventory and cause a loss of main condenser vacuum. Loss of condenser vacuum event is bounded by FSAR Chapter 15.25 analyses. Failure of control components in this zone does not exacerbate this event.

APPENDIX D

ZONE XV

BUILDING: Turbine Building
LOCATION: El 67 ft 6 in. and 95 ft

HIGH ENERGY LINE BREAK ANALYSIS

HELB SYSTEM

1. a) CNA (4-4) Auxiliary Condensate

   b) CNM (4-1) Condensate

   c) DSM (32-7) Moisture Separator Vents and Drains

   d) DSR (32-6) Moisture Separator Reheater Vents and Drains

   e) DTM (32-5) Turbine Plant Miscellaneous Drains

   f) ESS (3-4) Extraction Steam

   g) FWS (6-1) Feedwater

   h) HDH (6-6) High-Pressure Feedwater Heater Drains

   i) HDL (4-2) Low-Pressure Feedwater Heater Drains

   j) SVH (32-14) Feedwater Heater Relief, Vents, and Drips

CONTROL SYSTEM

2. a) DSR (32-6) Moisture Separator Reheater Vents and Drains

   b) DTM (32-5) Turbine Plant Miscellaneous Drains

   c) HDH (6-6) High-Pressure Feedwater Heater Drains

   d) HDL (4-2) Low-Pressure Feedwater Heater Drains

   e) SVH (32-14) Feedwater Heater Relief, Vents, and Drips

1. The following is a list of high energy lines analyzed on a system basis:

   a. Auxiliary Condensate (CNA, 4-4)

      Line Nos. 1CNA-003-1-4 and 004-26-4

      Function

      Supply condensate to radwaste steam reboiler 1ASR-SG1 and steam seal evaporator 1TME-EV1.

Failure Effect

Loss of condensate inventory, and loss of steam from 1TME-EV1 and 1ASR-SG1 for turbine generator gland seal and exhaust steam (TME) system.

b. Condensate (CNM, 4-1)

1) Line Nos. 1CNM-020-67-4, 020-68-4, 020-69-4, 020-77-4, 020-78-4, 020-80-4, 016-65-4, 016-66-4, 020-72-4, 020-70-4, and 020-71-4

Function

Condensate from condensate demineralizer outlet to fifth point heater drain cooler 1CNM-DCL1A, to fourth point heater drain cooler 1CNM-DCL2A and to sixth point heater 1CNM-E6A; from fifth point heater 1CNM-E5A to fourth point heater 1CNM-E4A to third point heater 1CNM-E3A, to second point heater 1CNM-E2A leading to feedwater pump suction header. Heater string bypass line. Second point heater 1CNM-E2A bypass line.

Failure Effect

Loss of condensate flow.

2) Line Nos. 1CNM-003-155-4, 003-158-4, and 150-91-4

Function

Low-pressure heater string A inlet isolation valve 1CNM-MOV33A bypass line, second point heater 1CNM-E2A inlet isolation valve 1CNM-MOV77A bypass line, and relief valve line after fifth point heater drain cooler 1CNM-DCL1A.

Failure Effect

Loss of condensate inventory with the result that the condensate/feedwater flow is reduced.

c. Moisture Separator Vents and Drains (DSM, 32-7)

Line Nos. 1DSM-012-11-4 and 012-12-4

Function

Drain from moisture separator drain receiver 1DSM-TK1A to third point heater 1CNM-E3A.

Failure Effect

Partial loss of condensate heating at third point heater 1CNM-E3A. 1CNM-E3A heater drain pump flow reduced. Loss of condensate inventory.

d. Moisture Separator Reheater Vents and Drains (DSR, 32-6)

Line Nos. 1DSR-012-2-4 and 012-3-4

Function

Moisture separator reheater drain receiver 1DSR-TK1A to first point heater 1FWS-E1A.

Failure Effect

Loss of condensate inventory and partial loss of feedwater heating at first point heater 1FWS-E1A.

e. Turbine Plant Miscellaneous Drains (DTM, 32-5)

1) Line Nos. 1DTM-002-432-4, 004-433-4, 004-443-4, and 002-444-4

Function

Drain lines from radwaste reboiler 1ASR-SG1 to main condenser.

Failure Effect

Loss of main condenser vacuum leading to eventual turbine trip.

2) Line No. 1DTM-004-435-4

Function

Drain from steam seal evaporator 1TME-EV1 to main condenser.

Failure Effect

Loss of main condenser vacuum.

3) Line No. 1DTM-008-421-4

Function

Drain from radwaste reboiler 1ASR-SG1 to drain receiver 1DTM-TK1.

Failure Effect

Loss of condensate inventory and partial loss of condensate heating at fourth point heater 1CNM-E4A.

4) Line No. 1DTM-006-427-4

Function

Drain from steam seal evaporator 1TME-EV1 to drain receiver 1DTM-TK2.

Failure

Loss of condensate inventory and partial loss of condensate heating at fourth point heater 1CNM-E4A.

5) Line Nos. 1DTM-002-428-4, 025-429-4, 004-422-4, 006-426-4, and 008-445-4

Function

From drain receiver 1DSR-TK2 or 1DSR-TK1 to fourth point heater 1CNM-E4A.

Failure Effect

Loss of condensate inventory and partial loss of condensate heating at fourth point heater 1CNM-E4A.

f. Extraction Steam (ESS, 3-4)

Line Nos. 1ESS-010-3-4, 010-107-4, 010-016-5-4, 016-4-4, 018-9-4, and 028-18-4

Function

Extraction steam from high-pressure turbine to first point heater 1FWS-E1A, from cold reheat system to second point heater 1CNM-E2A or 1CNM-E2B, from low-pressure turbine to third point heater 1CNM-E3A or fourth point heater 1CNM-E4A.

Failure Effect

Loss of feedwater/condensate heating at heater 1CNM-E2A, 1CNM-E2B, 1CNM-E3A, 1CNM-E4A, or 1FWS-E1A. Loss of condensate inventory.

g. Feedwater (FWS, 6-1)

1) Line Nos. 1FWS-020-22-4, 026-83-4, 026-84-4, 020-26-4, and 020-24-4

Function

Feedwater pump discharge to first point heater 1FWS-E1A to reactor, and first point heater 1FWS-E1A bypass.

Failure Effect

Feedwater flow to reactor is reduced significantly.

2) Line No. 1FWS-003-78-4

Function

First point heater 1FWS-E1A inlet isolation valve 1FWS-MOV17A bypass line.

Failure Effect

Feedwater flow to reactor is reduced. Condensate inventory is reduced.

h. High-Pressure Feedwater Heater Drains (HDH, 6-6)

1) Line Nos. 1HDH-010-4-4, 010-5-4, and 016-6-4

Function

First point heater 1FWS-E1A drain to second point heater 1CNM-E2A or main condenser.

Failure Effect

Partial loss of condensate heating at second point heater 1CNM-E2A. Loss of condensate inventory.

2) Line Nos. 1HDH-002-1-4, 002-2-4, and 004-3-4

Function

Standpipe and process connections for first point heater 1FWS-E1A level instrumentation.

Failure Effect

Partial loss of condensate heating at second point heater 1CNM-E2A and loss of condensate inventory.

i. Low-Pressure Feedwater Heater Drains (HDL, 4-2)

1) Line Nos. 1HDL-002-8-4, 002-9-4, and 004-10-4

Function

Standpipe and process connections for third point heater 1CNM-E3A level instrumentation.

Failure Effect

Heater drain pumps 1HDL-P1A/1HDL-P1B trip on low level in heater. Loss of condensate inventory.

2) Line No. 1HDL-018-6-4

Function

Second point heater 1CNM-E2A drain to main condenser.

Failure Effect

Loss of condensate inventory. Partial loss of condensate heating at third point heater 1CNM-E3A. 1CNM-E3A heater drain pump 1HDL-P1A/P1B discharge flow reduced.

3) Line Nos. 1HDL-016-126-4 and 018-98-4

Function

Heater drain pump 1HDL-P1B suction and discharge.

Failure Effect

If pump 1HDL-P1B is running, loss of condensate inventory and reduced flow to condensate system.

4) Line No. 1HDL-014-110-4

Function

Heater drain pumps 1HDL-P1A and 1HDL-P1B discharge to condensate system line relief to main condenser.

Failure Effect

Loss of main condenser vacuum.

5) Line No. 1HDL-018-12-4

Function

Heater drain pump 1HDL-P1A discharge line.

Failure Effect

Loss of condensate inventory. Reduced flow to condensate system.

6) Line No. 1HDL-006-13-4

Function

Heater drain pumps 1HDL-P1A and 1HDL-P1B recirculation line to 1HDL-FV20A.

Failure Effect

Loss of condensate inventory. Reduced flow to condensate system.

7) Line No. 1HDL-006-15-4

Function

Heater drain pumps 1HDL-P1A and 1HDL-P1B recirculation line from 1HDL-FV20A to third point heater 1CNM-E3A.

Failure Effect

If recirculation valve 1HDL-FV20A is open, loss of condensate inventory and reduced flow to condensate system will result.

8) Line Nos. 1HDL-012-4-4, 010-108-4, 012-5-4, and 010-99-4

Function

Second point heater 1CNM-E2A drains to third point heater 1CNM-E3A.

Failure Effect

Loss of condensate inventory. Partial loss of condensate heating at third point heater 1CNM-E3A. 1CNM-E3A heater drain pump discharge flow is reduced.

9) Line Nos. 1HDL-002-1-4 and 004-3-4

Function

Standpipe and process connections for second point heater 1CNM-E2A level instrumentation.

Failure Effect

Loss of condensate inventory. Partial loss of condensate heating at third point heater 1CNM-E3A. 1CNM-E3A drain pump discharge flow is reduced.

10) Line No. 1HDL-020-16-4

Function

Third point heater 1CNM-E3A drain to main condenser.

Failure Effect

Loss of condensate inventory. Heater drain pump 1HDL-P1A/1HDL-P1B trip on low level in heater. Reduced flow to condensate system.

11) Line Nos. 1HDL-008-21-4 and 008-43-4

Function

Fourth point heater 1CNM-E4A or 1CNM-E4B drain to fourth point heater drain cooler 1CNM-DCL2A or 2B.

Failure Effect

Loss of condensate heating at fourth point drain cooler 1CNM-DCL2A or 2B. Loss of condensate inventory.

12) Line No. 1HDL-010-55-4

Function

Fifth point heater drain receiver 1HDL-TK1A to fifth point heater drain cooler 1CNM-DCL1A.

Failure Effect

Loss of condensate inventory. Loss of condensate heating at fifth point heater drain cooler 1CNM-DCL1A.

13) Line Nos. 1HDL-016-125-4 and 020-102-4

Function

Heater drain pump 1HDL-P1A suction from third point heater 1CNM-E3A.

Failure Effect

If 1HDL-P1A is running, loss of condensate inventory and reduced flow to condensate system.

14) Line Nos. 1HDL-020-100-4 and 020-11-4

Function

Heater drain pumps 1HDL-P1A and 1HDL-P1B discharge or suction.

Failure Effect

Loss of condensate inventory. Reduced flow to condensate system.

15) Line Nos. 1HDL-003-135-4 and 003-136-4

Function

Heater drain pump 1HDL-P1B or 1HDL-P1A discharge valve 1HDL-MOV55B or 1HDL-MOV55A bypass.

Failure Effect

Loss of condensate inventory. Reduced flow to condensate system.

16) Line Nos. 1HDL-004-19-4, 002-18-4, and 002-20-4

Function

Standpipe and process connections for fourth point heater 1CNM-E4A level instrumentation.

Failure Effect

Loss of condensate inventory. Loss of condensate heating at fourth point heater drain cooler 1CNM-DCL2A.

j. Feedwater Heater Relief, Vents, and Drips (SVH, 32-14)

1) Line Nos. 1SVH-002-3-4, 002-12-4, 002-38-4, and 002-48-4

Function

First point heater 1FWS-E1A, second point heater 1CNM-E2A, third point heater 1CNM-E3A, fourth point heater 1CNM-E4A vent lines.

Failure Effect

No significant effect.

2) Line Nos. 1SVH-002-110-4, 002-109-4, 002-117-4, and 002-115-4

Function

Fourth point heater drain cooler 1CNM-DCL2A and fifth point heater drain cooler 1CNM-DCL1A vent lines.

Failure Effect

No significant effect.

3) Line Nos. 1SVH-002-5-4, 002-14-4, 002-41-4, and 002-50-4

Function

First point heater 1FWS-E1A, second point heater 1CNM-E2A, third point heater 1CNM-E3A, fourth point heater 1CNM-E4A vent lines.

Failure Effect

Loss of main condenser vacuum.

4) Line Nos. 1SVH-150-1-4, 003-10-4, 150-37-4, and 025-46-4

Function

First point heater 1FWS-E1A, second point heater 1CNM-E2A, third point heater 1CNM-E3A, fourth point heater 1CNM-E4A drip lines.

Failure Effect

Loss of main condenser vacuum.

2. The following is a list of nonsafety-related control components that are affected by a high energy line break on any of the lines listed in Item 1. The consequences of failure of each control component is analyzed. Refer to Appendix B for the function of individual components.

   Additionally, a high energy line break in this zone will also result in failure of control components considered in Zone VIII. The significant consequences of such a failure have been integrated into the analysis by referring to the appropriate "Failure Effect" from Zone VIII in the "Combined Effect" section of this zone.

   a. Moisture Separator Reheater Vents and Drains (DSR, 32-6)

      1DSR-LV65A
      1DSR-SOV65A

      Failure Effect

      If 1DSR-LV65A fails closed, partial loss of feedwater heating at first point heater 1FWS-E1A will be the result.

   b. Turbine Plant Miscellaneous Drains (DTM, 32-5)

      1DTM-LVY187
      1DTM-SOVY187

Failure Effect

If 1DTM-LVY187 fails closed, partial loss of condensate heating at fourth point heater 1CNM-E4A will be the result.

c. High-Pressure Feedwater Heater Drains (HDH, 6-6)

1) 1HDH-LT6A
1HDH-LV6A
1HDH-SOV6A

Failure Effect

If 1HDH-LV6A fails closed, partial heating of condensate at second point heater 1CNM-E2A will be lost.

2) 1HDH-LT26A
1HDH-LS26A

Failure Effect

If 1HDH-LT26A or 1HDH-LS26A fails thereby signaling high level in first point heater 1FWS-E1A, 1HDH-LV26A will open to drain heater directly to main condenser. This will bypass the heater drain to second point heater 1CNM-E2A, resulting in loss of partial condensate heating at second point heater 1CNM-E2A. 1HDH-LS26A failure will also close 1DSR-LV65A resulting in loss of feedwater heating at first point heater 1FWS-E1A.

3) 1HDH-LS7A

Failure Effect

If 1HDH-LS7A fails thereby signaling extreme high level in first point heater 1FWS-E1A, first point heater extraction steam isolation valve 1ESS-MOV3A and nonreturn valve 1ESS-NRV34A will close. This will result in loss of feedwater heating at first point heater 1FWS-E1A.

d. Low-Pressure Feedwater Heater Drains (HDL, 4-2)

1) 1HDL-LT3A

Failure Effect

If 1HDH-LT3A fails low, 1HDL-LV3A will close resulting in loss of heating of condensate at fourth point heater drain cooler 1CNM-DCL2A.

2) 1HDL-LT4A
1HDL-LV4A

Failure Effect

If 1HDL-LV4A fails closed, third point heater 1CNM-E3A drain pump 1HDL-P1A/1HDL-P1B discharge flow to condensate system will be lost.

3) 1HDL-LT5A
1HDL-LV5A
1HDL-SOV5A

Failure Effect

If 1HDL-LV5A fails closed, partial heating of condensate at third point heater 1CNM-E3A will be lost and heater drain pump 1HDL-P1A/1HDL-P1B discharge flow to condensate system will be reduced.

4) 1HDL-LS6A

Failure Effect

If 1HDL-LS6A fails thereby signaling low water level in third point heater 1CNM-E3A, heater drain pump 1HDL-P1A/1HDL-P1B will trip, resulting in loss of pump discharge flow to condensate system.

5) 1HDL-LS9A
1HDL-LS10A
1HDL-LS11A

Failure Effect

If 1HDL-LS9A/1HDL-LS10A/1HDL-LS11A fails and provides spurious signal of extreme high water level in fourth point heater 1CNM-E4A, third point heater 1CNM-E3A, or second point heater 1CNM-E2A, extraction steam isolation valve 1ESS-MOV15A/1ESS-MOV22A/1ESS-MOV28A and nonreturn valve 1ESS-NRV16A/1ESS-NRV23A/1ESS-NRV29A will close. Result will be loss of condensate/feedwater heating at fourth point, third point, or second point heater.

6) 1HDL-FT20A
1HDL-FV20A
1HDL-SOV20A

Failure Effect

If 1HDL-FV20A fails open, third point heater 1CNM-E3A drain pump discharge to condensate system will be reduced.

7) 1HDL-LS23A
1HDL-LT23A

Failure Effect

If 1HDL-LT23A or 1HDL-LS23A fails with spurious high level signal in fourth point heater 1CNM-E4A, 1HDL-LV23A will open to drain heater to main condenser. This will bypass the heater drain to fourth point heater drain cooler 1CNM-DCL2A, resulting in loss of condensate heating at 1CNM-DCL2A.

8) 1HDL-LS24A
1HDL-LT24A

Failure Effect

If 1HDL-LS24A or 1HDL-LT24A fails thereby signaling high level in third point heater 1CNM-E3A, 1HDL-LV24A will open to drain third point heater to main condenser. This will result in loss of heater drain pump 1HDL-P1A/1HDL-P1B discharge flow to condensate system.

9) 1HDL-LS25A
1HDL-LT25A

Failure Effect

If 1HDL-LS25A or 1HDL-LT25A fails thereby signaling high level in second point heater 1CNM-E2A, 1HDL-LV25A will open to drain second point heater to main condenser. Results will be partial loss of condensate heating at third point heater 1CNM-E3A and reduced flow from heater drain pump 1HDL-P1A/1HDL-P1B to condensate system.

e. Feedwater Heater Relief, Vents, and Drips (SVH, 32-14)

1) 1SVH-AOV26A, -SOV26A
1SVH-AOV31A, -SOV31A
1SVH-AOV32A, -SOV32A
1SVH-AOV40A, -SOV40A
1SVH-AOV41A, -SOV41A
1SVH-AOV42A, -SOV42A
1SVH-AOV43A, -SOV43A
1SVH-AOV45A, -SOV45A
1SVH-AOV46A, -SOV46A
1SVH-AOV51A, -SOV51A
1SVH-AOV52A, -SOV52A

Failure Effect

No significant effect.

3. Combined Effect

a. A break in auxiliary condensate high energy line in this zone will result in loss of condensate inventory and total loss of steam to turbine generator gland seal and exhaust steam system. Loss of turbine generator gland seal steam will cause air inleakage through the low-pressure turbine glands resulting in loss of main condenser vacuum. Loss of main condenser vacuum event is bounded by FSAR Chapter 15.2.5 analyses. Failure of any control components in this zone or Zone VIII does not exacerbate this event.

b. A break in the condensate high energy line, Item 1.b.1), in this zone will result in total loss of condensate flow. Reactor feedwater pumps will trip on low suction pressure. This is a break in feedwater line outside containment and is bounded by FSAR Chapter 15.6.6 analyses. A break in the condensate high energy line, Item 1.b.2), in this zone will result in loss of condensate inventory and reduced condensate flow. Failure of any control components in this zone or Zone VIII does not exacerbate these events.

c. A break in the moisture separator vents and drains high energy line in this zone will result in reduced condensate heating at third point heater 1CNM-E3A, loss of condensate inventory, and reduced flow from third point heater drain pump 1HDL-P1A/1HDL-P1B to condensate system. Reduced condensate heating at 1CNM-E3A and reduced flow from pump 1HDL-P1A/1HDL-P1B will result in decrease of temperature of feedwater to reactor. Loss of feedwater heating event is bounded by FSAR Chapter 15.1.1 analyses. Failure of any control components in this zone or Zone VIII does not exacerbate this event.

   As a result of this high energy line break in this zone, control components in Zone VIII may fail resulting in any of the following events:

   1) Loss of main condenser vacuum due to failure of 1TME-PVSSAFV (see Item 2.n., Zone VIII analyses).

   2) Reactor scram due to failure of 1C85-PTN001A and 1C85-PTN001B (see Item 2.p., Zone VIII analyses).

   3) Turbine trip due to moisture separator drain tank high level (Item 3.f., Zone VIII analyses).

d. A break in moisture separator reheater vents and drains high energy line will result in reduced feedwater heating at first point heater 1FWS-E1A and loss of condensate inventory. Reduced feedwater heating at 1FWS-E1A will result in decrease of temperature of feedwater to reactor. Loss of feedwater heating event is bounded by FSAR Chapter 15.1.1 analyses. Failure of any components in this zone or Zone VIII does not exacerbate this event.

e. A break in turbine plant miscellaneous drains, Item 1.e.1) or 1.e.2), high energy line in this zone will result in loss of main condenser vacuum. Loss of main condenser vacuum event is bounded by FSAR Chapter 15.2.5 analyses. A break in turbine plant miscellaneous drains, Item 1.e.3), 1.e.4 or 1.e.5), high energy line in this zone will result in reduced condensate heating at fourth point heater 1CNM-E4A leading to decreased feedwater temperature. Loss of feedwater heating event is bounded by FSAR Chapter 15.1.1 analyses. Failure of any control components in this zone or Zone VIII does not exacerbate any of these events.

f. A break in extraction steam high energy line in this zone will result in loss of condensate/feedwater heating at first point heater 1FWS-E1A, second point heaters 1CNM-E2A and 1CNM-E2B, third point heater 1CNM-E3A, or fourth point heater 1CNM-E4A. This will reduce temperature of feedwater to reactor. Loss of feedwater heating event is bounded by FSAR Chapter 15.1.1 analyses. Failure of any control components in this zone or Zone VIII does not exacerbate this event.

g. A break in any of the feedwater high energy lines in this zone will result in reduced/total loss of feedwater flow to reactor and loss of condensate inventory. This event is a break in feedwater line outside containment, and as such, is bounded by FSAR Chapter 15.6.6 analyses. Failure of any control components in this zone or Zone VIII does not exacerbate this event.

h. A break in the high-pressure feedwater heater drains high energy line in this zone will result in loss of condensate heating at second point heater 1CNM-E2A and loss of condensate inventory. Loss of condensate heating at second point heater will lead to decrease in temperature of feedwater to reactor. Loss of feedwater heating event is bounded by FSAR Chapter 15.1.1 analyses. Failure of any control components in this zone or Zone VIII does not exacerbate these events.

i. A break in the low-pressure feedwater heater drains high energy line [Item 1.i.1), 1.i.3), 1.i.5), 1.i.6), 1.i.7), 1.i.10), 1.i.13), 1.i.14), or 1.i.15)] in this zone will result in a loss of condensate inventory and reduced flow to condensate system. A break in the low-pressure feedwater heater drains high energy line, Item 1.i.4), in this zone will result in a loss of main condenser vacuum. A break in the low-pressure feedwater heater drains high energy line [Item 1.i.2), 1.i.8), 1.i.9), 1.i.11), 1.i.12), or 1.i.16)] will result in a loss of condensate inventory and a partial loss of feedwater/condensate heating.

Loss of main condenser vacuum event is bounded by FSAR Chapter 15.2.5 analyses. Loss of feedwater heating event is bounded by FSAR Chapter 15.1.1 analyses. Failure of any control components in this zone or Zone VIII does not exacerbate these events.

j. A break in the feedwater heater relief vents and drips high energy line, Item 1.j.3) or 1.j.4), will result in a loss of main condenser vacuum. Loss of main condenser vacuum event is bounded by FSAR Chapter 15.2.5 analyses. Failure of control system components in this zone or in Zone VIII does not exacerbate this event.

APPENDIX D

ZONE XVI

Building: Turbine Building
Locations: El 67 ft 6 in., 95 ft 0 in.

HIGH ENERGY LINE BREAK ANALYSIS

HELB System		Control System	
1. a) CNM (4-1)	Condensate	2. a) DSM (32-7)	Moisture Separator Vents and Drains
b) ESS (3-4)	Extraction Steam	b) HDH (6-6)	High-Pressure Feedwater Heater Drains
c) FWS (6-1)	Feedwater	c) HDL (4-2)	Low-Pressure Feedwater Heater Drains
d) HDH (6-6)	High-Pressure Feedwater Drains	d) SVH (32-14)	Feedwater Heater Relief Vents and Drips
e) HDL (4-2)	Low-Pressure Feedwater Heater Drains		
f) OFG (31-4)	Off-Gas		
g) SVH (32-14)	Feedwater Heater Relief Vents and Drips		

1. The following is a list of high energy lines analyzed on a system basis:

   a. Condensate (CNM, 4-1)

      1) Line Nos. 1CNM-020-59-4, 020-60-4, 020-61-4, 020-63-4, 020-73-4, 020-74-4, 020-76-4, 020-64-4, 024-24-4, 024-54-4, and 020-62-4

         Function

         Condensate from condensate demineralizer outlet to fifth point heater drain cooler 1CNM-DCL1B, to fourth point heater drain cooler 1CNM-DCL2B, to sixth point heater 1CNM-E6B, to fifth point heater 1CNM-E5B to fourth point heater 1CNM-E4B, to third point heater 1CNM-E3B, to second point heater 1CNM-E2B, to feedwater pump suction header. Second point heater 1CNM-E2B bypass line. Condensate from off-gas condenser (CNDB002) to condensate demineralizer.

Failure Effect

Loss of condensate flow.

2) Line Nos. 1CNM-003-157-4, 003-154-4, and 150-92-4

Function

Second point heater 1CNM-E2B inlet isolation valve 1CNM-MOV77B bypass line, fifth point heater drain cooler inlet isolation valve 1CNM-MOV33B bypass line or relief valve line after fifth point heater drain cooler 1CNM-DCL1B.

Failure Effect

Loss of condensate inventory and condensate/feedwater flow is reduced.

b. Extraction Steam (ESS, 3-4)

1) Line Nos. 1ESS-010-2-4, 010-108-4, 016-4-4, 018-15-4, and 028-22-4

Function

Extraction steam from high-pressure turbine to first point heater 1FWS-E1B, from cold reheat system to second point heater 1CNM-E2B, from low-pressure turbine to third point heater 1CNM-E3B or fourth point heater 1CNM-E4B.

Failure Effect

Loss of feedwater/condensate heating at heater 1CNM-E2B, 1CNM-E3B, 1CNM-E4B, or 1FWS-E1B. Loss of condensate inventory.

c. Feedwater (FWS, 6-1)

1) Line Nos. 1FWS-020-21-4, -026-85-4, -026-86-4, -020-25-4, and -020-23-4

Function

Feedwater pump discharge to first point heater 1FWS-E1B to reactor or first point heater 1FWS-E1B bypass.

Failure Effect

Feedwater flow is reduced significantly.

2) Line No. 1FWS-003-77-4

Function

First point heater 1FWS-E1B inlet isolation valve 1FWS-MOV17B bypass line.

Failure Effect

Feedwater flow to reactor is reduced. Condensate inventory is reduced.

d. High-Pressure Feedwater Heater Drains (HDH, 6-6)

1) Line Nos. 1HDH-010-11-4, 010-12-4, and 016-13-4

Function

First point heater 1FWS-E1B drain to second point heater 1CNM-E2B.

Failure Effect

Partial loss of heating at second point heater 1CNM-E2B. Loss of condensate inventory.

2) Line Nos. 1HDH-002-8-4, 002-9-4, and 004-10-4

Function

Standpipe and process connections for first point heater 1FWS-E1B level instrumentation.

Failure Effect

Partial loss of heating at second point heater 1CNM-E2B. Loss of condensate inventory.

e. Low-Pressure Feedwater Heater Drains (HDL, 4-2)

1) Line Nos. 1HDL-002-33-4, 002-34-4, and 004-35-4

Function

Standpipe and process connections for third point heater 1CNM-E3B level instrumentation.

Failure Effect

Heater drain pumps 1HDL-P1C/1HDL-P1D trip on low level in heater. Loss of condensate inventory.

2) Line No. 1HDL-018-31-4

Function

Second point heater 1CNM-E2B drain to main condenser.

Failure Effect

Loss of condensate inventory. Partial loss of condensate heating at third point heater 1CNM-E3B. 1CNM-E3B heater drain pump 1HDL-P1A/1HDL-P1B discharge flow reduced.

3) Line Nos. 1HDL-016-124-4 and 1HDL-018-91-4

Function

Heater drain pump 1HDL-P1D suction or discharge.

Failure Effect

If pump 1HDL-P1D is running, loss of condensate inventory and reduced flow to condensate system.

4) Line No. 1HDL-014-115-4

Function

Heater drain pumps 1HDL-P1C and 1HDL-P1D discharge to condensate system line relief to main condenser.

Failure Effect

Loss of main condenser vacuum.

5) Line No. 1HDL-018-37-4

Function

Heater drain pump 1HDL-P1C discharge line.

Failure Effect

Loss of condensate inventory. Reduced flow to condensate system.

6) Line No. 1HDL-006-38-4

Function

Heater drain pumps 1HDL-P1C and 1HDL-P1D recirculation line to 1HDL-FV20B.

Failure Effect

Loss of condensate inventory. Reduced flow to condensate system.

7) Line No. 1HDL-006-39-4

Function

Heater drain pumps 1HDL-P1C and 1HDL-P1D recirculation line from 1HDL-FV20B to third point heater 1CNM-E3B.

Failure Effect

If recirculation valve 1HDL-FV20B is open, loss of condensate inventory and reduced flow to condensate system.

8) Line Nos. 1HDL-012-29-4, 012-30-4, and 010-92-4

Function

Second point heater 1CNM-E2B drains to third point heater 1CNM-E3B.

Failure Effect

Loss of condensate inventory. Partial loss of heating at third point heater 1CNM-E3B. 1CNM-E3B heater drain pump discharge flow is reduced.

9) Line Nos. 1HDL-002-26-4, 004-28-4, and 002-27-4

Function

Standpipe and process connections for second point heater 1CNM-E2A level instrumentation.

Failure Effect

Loss of condensate inventory. Partial loss of heating at third point heater 1CNM-E3B. 1CNM-E3B drain pump discharge flow is reduced.

10) Line No. 1HDL-020-41-4

Function

Third point heater 1CNM-E3A drain to main condenser.

Failure Effect

Loss of condensate inventory. Heater drain pump 1HDL-P1C/1HDL-P1D trip on low level in heater. Reduced flow to condensate system.

11) Line No. 1HDL-010-70-4

Function

Fifth point heater drain receiver 1CNM-TK1A to fifth point heater drain cooler 1CNM-DCL1A.

Failure Effect

Loss of condensate inventory. Loss of condensate heating at fifth point heater drain cooler 1CNM-DCL1B.

12) Line Nos. 1HDL-016-123-4 and 020-93-4

Function

Heater drain pump 1HDL-P1C suction from third point heater 1CNM-E3B.

Failure Effect

If 1HDL-P1C is running, loss of condensate inventory and reduced flow to condensate system.

13) Line Nos. 1HDL-020-89-4 and 020-36-4

Function

Heater drain pumps 1HDL-P1C and 1HDL-P1D discharge or suction.

Failure Effect

Loss of condensate inventory. Reduced flow to condensate system.

14) Line Nos. 1HDL-003-137-4 and 003-138-4

Function

Heater drain pump 1HDL-P1D or 1HDL-P1C discharge valves 1HDL-MOV55D or 1HDL-MOV55C bypass.

Failure Effect

Loss of condensate inventory. Reduced flow to condensate system.

15) Line Nos. 1HDL-004-48-4, 002-49-4, and 002-50-4

Function

Standpipe and process connections for fourth point heater 1CNM-E4B level instrumentation.

Failure Effect

Loss of condensate inventory. Loss of condensate heating at fourth point heater drain cooler 1CNM-DCL2B.

16) Line No. 1HDL-010-46-4

Function

Fourth point heater 1CNM-E4B drain to main condenser.

Failure Effect

Loss of condensate inventory. Loss of condensate heating at fourth point heater drain cooler 1CNM-DCL2B.

f. Off-Gas System (OFG, 31-4)

1) Line Nos. 1OFG-016-3-4 and 016-4-4

Function

Steam-diluted off-gas from condenser air removal system air ejector 1ARC-J3A or 1ARC-J3B to off-gas system preheater EB001A or EB001B, respectively.

Failure Effect

Loss of condenser air removal system off-gas treatment.

g. Feedwater Heater Relief Vents and Drips (SVH, 32-14)

1) Line Nos. 1SVH-002-21-4, 002-30-4, 002-59-4, 002-68-4, and 002-38-4

Function

First point heater 1FWS-E1B, second point heater 1CNM-E2B, third point heater 1CNM-E3B, fourth point heater 1CNM-E4B or third point heater 1CNM-E3A vent lines.

Failure Effect

No significant effect.

2) Line Nos. 1SVH-002-114-4, 002-112-4, 002-118-4, and 002-120-4

Function

Fourth point heater drain cooler 1CNM-DCL2B or fifth point heater drain cooler 1CNM-DCL1B vent lines.

Failure Effect

No significant effect.

3) Line Nos. 1SVH-002-5-4, 002-14-4, 002-41-4, and 002-50-4

Function

First point heater 1FWS-E1A, second point heater 1CNM-E2A, third point heater 1CNM-E3A, or fourth point heater 1CNM-E4A vent lines.

Failure Effect

Loss of main condenser vacuum.

4) Line Nos. 1SVH-150-1-4, 003-10-4, 150-37-4, and 025-46-4

Function

First point heater 1FWS-E1A, second point heater 1CNM-E2A, third point heater 1CNM-E3A, or fourth point heater 1CNM-E4A drip lines.

Failure Effect

Loss of main condenser vacuum.

5) Line Nos. 1SVH-002-23-4, 002-32-4, and [illegible]-57-4

Function

First point heater 1FWS-E1B, second point heater 1CNM-E2B, or third point heater 1CNM-E3B vent lines.

Failure Effect

Loss of main condenser vacuum.

6) Line Nos. 1SVH-150-19-4, 003-28-4, and 150-55-4

Function

First point heater 1FWS-E1B, second point heater 1CNM-E2B, or third point heater 1CNM-E3B drip lines.

Failure Effect

Loss of main condenser vacuum.

2. The following is the list of nonsafety-related control components that are affected by a high energy line break on any of the lines listed in Item 1. The consequences of failure of each control com-

ponent is analyzed. Refer to Appendix B for function of individual components.

Additionally, a high energy line break in this zone may also result in failure of control components considered in Zone VIII. The significant consequences of such a failure have been integrated into the analysis by referring to Zone VIII control component failures in the "Combined Effect" section of this zone.

a. Moisture Separator Reheater Vents and Drains (DSM, 32-7)

1DSM-LV75B, 1DSM-SOV75B

Failure Effect

If 1DSM-LV75B fails closed, partial loss of condensate heating at third point 1CNM-E3B.

b. High-Pressure Feedwater Heater Drains (HDH, 6-6)

1) 1HDH-LT26B, 1HDH-LS26B, 1HDH-LV26B, and 1HDH-SOV26B

Failure Effect

If 1HDH-LV26B fails open, heater drain to second point heater 1CNM-E2B will be bypassed to main condenser, resulting in partial loss of condensate/feedwater heating at second point heater 1CNM-E2B.

2) 1HDH-LS7B

Failure Effect

If 1HDH-LS7B fails thereby signaling extreme high level in first point heater 1FWS-E1B, first point heater extraction steam isolation valve 1ESS-MOV3A and nonreturn valve 1ESS-NRV34B will close. This will result in loss of first point heater 1FWS-E1B feedwater heating.

3) 1HDH-LT6B, 1HDH-LV6B, and 1HDH-SOV6B

Failure Effect

If 1HDH-LV6B fails closed, heater drain to second point heater will be lost, resulting in partial loss of condensate heating at second point heater 1CNM-E2B.

c. Low-Pressure Feedwater Heater Drains (HDL, 4-2)

1) 1HDL-LT3B

Failure Effect

If 1HDH-LT3B fails low, 1HDL-LV3A will close, resulting in loss of heating of condensate at fourth point heater drain cooler 1CNM-DCL2B.

2) 1HDL-LT4B and 1HDL-LV4B

Failure Effect

If 1HDL-LV4B fails closed, third point heater 1CNM-E3B drain pump 1HDL-P1C/1HDL-P1D discharge flow to condensate system will be lost.

3) 1HDL-LT5B, -LV5B, and -SOV5B

Failure Effect

If 1HDL-LV5B fails closed, partial heating at third point heater 1CNM-E3B will be lost and heater drain pump 1HDL-P1C/1HDL-P1D discharge flow to condensate system will be reduced.

4) 1HDL-LS6B

Failure Effect

If 1HDL-LS6B fails thereby signaling low water level in third point heater 1CNM-E3B, heater drain pump 1HDL-P1C/1HDL-P1D will trip, resulting in loss of discharge flow to condensate system.

5) 1HDL-LS9B, 1HDL-LS10B and 1HDL-LS11B

Failure Effect

IF 1HDL-LS9B/1HDL-LS10B/1HDL-LS11B fails giving spurious signal of extreme high water level in fourth point heater 1CNM-E4B, third point heater 1CNM-E3B, and second point heater 1CNM-E2B, and extraction steam isolation valves 1ESS-MOV15B/1ESS-MOV22B/1ESS-MOV28B and nonreturn valves 1ESS-NRV16B/1ESS-NRV23B/1ESS-NRV29B will close. Result will be loss of condensate/feedwater heating at fourth point heater, third point heater, or second point heater.

6) 1HDL-FT20B, 1HDL-FV20B, and 1HDL-SOV20B

Failure Effect

If 1HDL-FV20B fails open, third point heater 1CNM-E3B drain pump discharge to condensate system will be reduced.

7) 1HDL-LS23B and 1HDL-LT23B

Failure Effect

IF 1HDL-LT23B or 1HDL-LS23B fails thereby signaling high level in fourth point heater 1CNM-E4B, 1HDL-LV23B will open to drain heater directly to main condenser. This will bypass the heater drain to fourth point heater drain cooler 1CNM-DCL2D, resulting in loss of condensate/feedwater heating.

8) 1HDL-LS24B and 1HDL-LT24B

Failure Effect

If 1HDL-LS24B or 1HDL-LT24B fails giving spurious signal of high level in third point heater 1CNM-E3B, 1HDL-LV24B will open to drain third point heater to main condenser. This will result in loss of heater drain pump 1HDL-P1C/1HDL-P1D discharge flow to condensate system.

9) 1HDL-LS25B and 1HDL-LT25B

Failure Effect

If 1HDL-LS25B or 1HDL-LT25B fails and signals high level in second point heater 1CNM-E2B, 1HDL-LV25B will open to drain second point heater to main condenser. Results will be partial loss of condensate heating at third point heater 1CNM-E3B and reduced flow from heater drain pump 1HDL-P1C/1HDL-P1D to condensate system.

d. Feedwater Heater Relief Vents and Drips (SVH, 32-14)

1SVH-AOV26B -SOV26B -AOV31B -SOV31B
AOV32B -SOV32B -AOV40B -SOV40B
AOV41B -SOV41B -AOV42B -SOV42B
AOV43B -SOV43B -AOV45B -SOV45B
AOV46B -SOV46B -AOV51B -SOV51B
AOV52B -SOV52B

Failure Effect

No significant effect.

3. Combined Effect

a. A break in the condensate high energy line (Item 1.a.1) in this zone will result in the total loss of condensate flow. Reactor feedwater pumps will trip on low suction pressure. This is a break in the feedwater line outside containment and is bounded by FSAR Chapter 15.6.6 analyses. A break in the condensate high energy line (Item 1.a.2) in this zone will result in reduced condensate flow and loss of condensate inventory.

Failure of any control components in this zone or Zone VIII does not exacerbate any of these events.

b. A break in the extraction steam high energy line in this zone will result in a loss of condensate/feedwater heating at first point heater 1FWS-E1B, second point heater 1CNM-E2B, third point heater 1CNM-E3B, or fourth point heater 1CNM-E4B. This will reduce temperature of feedwater to reactor. The loss of feedwater heating event is bounded by FSAR Chapter 15.1.1 analyses. Failure of any control components in this zone or Zone VIII does not exacerbate these events.

c. A break in any of the feedwater high energy lines in this zone will result in reduced/total loss of feedwater flow to reactor and loss of condensate inventory. This event is a break in feedwater line outside containment, and as such bounded by FSAR Chapter 15.6.6 analyses. Failure of any control components in this zone or Zone VIII does not exacerbate this event.

d. A break in the high-pressure feedwater heater drain high energy line in this zone will result in the loss of condensate heating at second point heater 1CNM-E2B and loss of condensate inventory. Loss of condensate heating at second point heater will result in reduction of feedwater temperature to reactor. Loss of feedwater heating event is bounded by FSAR Chapter 15.1.1 analyses. Failure of any control components in this zone or Zone VIII does not exacerbate these events.

e. A break in the low-pressure feedwater heater drain high energy line (Item 1.e.1, 1.e.3, 1.e.5, 1.e.6, 1.e.7, 1.e.10, 1.e.12, 1.e.13, or 1.e.14) in this zone will result in a loss of condensate inventory and reduced flow to condensate system. A break in the low-pressure feedwater heater drain high energy line (Item 1.e.4) in this zone will result in loss of main condenser vacuum. A break in the low-pressure feedwater heater drain high energy line (Item 1.e.2, 1.e.8, 1.e.9, 1.e.11, 1.e.15, or 1.e.16) in this zone will result in a loss of condensate inventory and partial loss of feedwater/condensate heating. The loss of main condenser vacuum event is bounded by FSAR Chapter 15.2.5 analyses. The loss of feedwater heating event is bounded by FSAR Chapter 15.1.1 analyses. Failure of any control components in this zone or Zone VIII does not exacerbate these events.

f. A break in the off-gas high energy line will result in loss of main condenser off-gas treatment. Failure of control components in this zone will result in loss of condensate/feedwater heating at first point heater 1FWS-E1B, second point heater 1CNM-E2B, third point heater 1CNM-E3B, fourth point heater 1CNM-E4B, or fourth point drain cooler 1CNM-DCL2B. This will result in reduction of feedwater temperature to reactor. The loss of feedwater heating event is bounded by FSAR Chapter 15.1.1 analyses. Failure of control components in this zone or Zone VIII does not exacerbate these events.

g. A break in feedwater heater relief, vents, and drips high energy line (Item 1.g.3, 1.g.4, 1.g.5, or 1.g.6) in this zone will result in loss of main condenser vacuum. The loss of main condenser vacuum event is bounded by FSAR Chapter 15.2.5 analyses. Failure of any control components in this zone or Zone VIII does not exacerbate this event.

APPENDIX D

ZONE XIX

Building: Turbine Building
Location: El 67 ft 6 in.

HIGH ENERGY LINE BREAK ANALYSIS

HELB System			Control System		
1 a)	DTM (32-5)	Turbine Plant Miscellaneous Drains	2 a)	CNM (4-1)	Condensate
b)	HDL (4-2)	Low-Pressure Feedwater Heater Drains	b)	DTM (32-5)	Turbine Plant Miscellaneous Drains
c)	SVH (32-14)	Feedwater Heater Relief, Vents and Drips	c)	HDH (6-6)	High-Pressure Feedwater Heater Drains
d)	CNM (4-1)	Condensate	d)	HDL (4-2)	Low-Pressure Feedwater Heater Drains
			e)	TMB (16-5.2)	Turbine Generator EH Fluid System

1. The following is a list of high energy lines analyzed on a system basis.

   a. Turbine Plant Miscellaneous Drains (DTM, 32-5)

      1) Line Nos. 1DTM-002-541-4, 002-542-4, 002-543-4, 002-544-4, 002-56-4, 002-511-4, and 002-512-4

         Function

         Condenser off-gas to preheater drains to main condenser, main steam line downstream of control valves drains to main condenser, capped lines to main condenser.

         Failure Effect

         Loss of main condenser vacuum.

      2) Line Nos. 1DTM-004-625-4, 008-175-4, 006-454-4, 004-176-4, and 004-177-4

         Function

         Gland steam condenser 1TME-CND1 drain and vent lines drain to main condenser, moisture separator line to steam jet air ejectors drain line to main condenser, steam jet air ejector 1ARC-E2A or 1ARC-E2B drain lines to loop seal.

Failure Effect

Loss of main condenser vacuum.

b. Low-Pressure Feedwater Heater Drains (HDL, 4-2)

1) Line Nos. 1HDL-014-110-4 and 014-115-4

Function

Heater drain pump discharge line relief to main condenser.

Failure Effects

Loss of main condenser vacuum.

2) Line Nos. 1HDL-018-6-4 and 018-31-4

Function

Second point heater 1CNM-E2A or E2B drain to main condenser.

Failure Effect

Partial loss of condensate heating at third point heater 1CNM-E3A or E3B. Heater drain pump discharge flow reduced, resulting in reduced condensate/feedwater heating. Loss of condensate inventory.

3) Line Nos. 1HDL-020-16-4 and 020-41-4

Function

Third point heater 1CNM-E3A or E3B drains to main condenser.

Failure Effect

Heater drain pump discharge to condensate system is lost. Condensate/feedwater temperature reduced. Loss of condensate inventory.

4) Line Nos. 1HDL-020-17-4, 020-148-4, 020-42-4, and 020-150-4

Function

Third point heater 1CNM-E3A or E3B drains to main condenser.

Failure Effect

Loss of main condenser vacuum.

5) Line Nos. 1HDL-010-24-4 and 010-46-4

Function

Fourth point heater 1CNM-E4A or E4B drains to main condenser.

Failure Effect

Loss of heating for condensate at fourth point heater drain cooler 1CNM-DCL2A or DCL2B.

6) Line Nos. 1HDL-010-25-4, 010-152-4, 010-47-4, and 008-154-4

Function

Fourth point heater 1CNM-E4A or 1CNM-E4B drains to main condenser.

Failure Effect

Loss of main condenser vacuum.

7) Line Nos. 1HDL-010-55-4, 012-58-4, and 012-73-4

Function

Fifth point heater 1CNM-E5A drain receiver TK1A drains to main condenser, fifth point heater drain cooler 1CNM-DCL2A, or fifth point heater 1CNM-E5B drain receiver TK1B drains to main condenser.

Failure Effect

Loss of condensate heating at fifth point heater drain cooler 1CNM-DCL2A or 1CNM-DCL2B.

8) Line Nos. 1HDL-012-59-4, 014-156-4, 012-74-4, and 014-158-4

Function

Fifth point heaters 1CNM-E5A/1CNM-E5B drain receiver TK1A/TK1B drain to main condenser.

Failure Effect

Loss of main condenser vacuum.

9) Line No. 1HDL-018-32-4

Function

Second point heater 1CNM-E2B drains to main condenser.

Failure Effect

Loss of main condenser vacuum.

c. Feedwater Heater Relief Vents and Drips (SVH, 32-14)

1) Line Nos. 1SVH-025-144-4, 025-145-4, 025-46-4, and 025-64-4

Function

Fourth point heater 1CNM-E4A or 1CNM-E4B vent and drip lines.

Failure Effect

Loss of main condenser vacuum.

2) Line Nos. 1SVH-003-76-4 and 003-101-4

Function

Fifth point heater 1CNM-E5A or 1CNM-E5B drains to drain receiver 1DHL-TK1A or 1HDL-TK1B.

Failure Effect

No significant effect.

d. Condensate (CNM, 4-1)

Line No. 1CNM-020-50-4

Function

Condensate recirculation to main condenser.

Failure Effect

Loss of feedwater/condensate flow. Feedwater pumps trip on low suction.

2. The following is the list of nonsafety-related control components that are affected by a high energy line break on any of the lines listed in Item 1. The consequences of failure of each control component is analyzed. Refer to Appendix B for function of each component.

a. Condensate (CNM, 4-1)

1CNM-FV114
1CNM-SOVX114
1CNM-SOVY114

Failure Effect

If 1CNM-FV114 fails open, feedwater pumps will trip on low suction.

b. Turbine Plant Miscellaneous Drains (DTM, 32-5)

1DTM-AOVSPDV3
1DTM-SOV20DV3

Failure Effect

No significant effect.

c. High-Pressure Feedwater Heater Drains (HDH, 6-6)

1HDH-LV26A and 1HDH-SOV26A

Failure Effect

If 1HDH-LV26A fails open, partial heating of condensate at second point heater 1CNM-E2A will be lost.

d. Low-Pressure Feedwater Heater Drains (HDL, 4-2)

1) 1HDL-LV2A and 1HDL-LV3A

Failure Effect

If 1HDL-LV2A or 1HDL-LV3A fails closed, condensate heating at fifth point or fourth point drain cooler 1CNM-DCL1A or 1CNM-DCL2A will be lost.

2) 1HDL-LV22A, 1HDL-SOV22A, 1HDL-LV22B, 1HDL-SOV22B, 1HDL-LV23A, 1HDL-SOV23A, 1HDL-LV23B, and 1HDL-SOV23B

Failure Effect

If any of the valves fails open, condensate heating at fifth point or fourth point heater drain cooler 1CNM-DCL1A, 1CNM-DCL1B, 1CNM-DCL2A, or 1CNM-DCL2B will be lost.

3) 1HDL-LV24A, 1HDL-SOVX24A, 1HDL-SOVY24A, 1HDL-LV24B, 1HDL-SOVX24B, and 1HDL-SOVY24B

Failure Effect

If 1HDL-LV24A or 1HDL-LV24B fails open, heater drain pump discharge flow will be lost, resulting in reduced condensate/feedwater heating.

4) 1HDL-LV25A, 1HDL-SOVX25A, 1HDL-SOVY25A, 1HDL-LV25B, 1HDL-SOVX25B, and 1HDL-SOVY25B

Failure Effect

If 1HDL-LV25A or 1HDL-LV25B fails open, partial condensate heating at third point heater 1CNM-E3A or 1CNM-E3B will be lost.

e. Turbine Generator EH Fluid System (TMB, 16-5.2)

1) 1TMB-PSPS102
1TMB-PSPS103

Failure Effect

Failure of the switch will not permit automatic start of selected standby pump 1HFPM-A (or B) on low EH fluid pressure. Loss of EH fluid pumps may utlimately cause the turbine to trip.

2) 1TMB-TS23HF 1TMB-TSTC01
1TMB-TS23HFX 1TMB-TSTC02

Failure Effect

Failure of the EH fluid temperature control instruments may inadvertently energize the heater and cause overheating of the fluid. No significant impact.

3. Combined Effect

a. A break in any of the turbine plant miscellaneous drain high energy line will result in loss of main condenser vacuum bounded by FSAR Chapter 15.2.5 analyses. Failure of control components in this zone does not exacerbate this event.

b. 1) A break in low-pressure feedwater heater drains high energy line [Item 1.b.1), 1.b.4), 1.b.6), 1.b.8), or 1.b.9)] in this zone will result in loss of main condenser vacuum. Loss of main condenser vacuum event is bound by FSAR Chapter 15.2.5 analyses. Failure of control components in this zone does not exacerbate this event.

2) A break in low-pressure feedwater heater drains high energy line [Item 1.b.2), 1.b.3), 1.b.5), or 1.b.7)] will result in loss of condensate inventory and reduced

feedwater heating. Loss of feedwater heating event is bound by FSAR Chapter 15.1.1 analyses. Failure of control components in this zone does not exacerbate this event.

c. A break in feedwater heater relief vent and drip high energy line [Item 1.c.1)] will result in loss of main condenser vacuum, bounded by FSAR Chapter 15.2.5 analyses.

   Failure of control components in this zone does not exacerbate this event.

d. A break in condensate high energy line in this zone will result in loss of feedwater/condensate flow leading to feedwater pump trip on low suction. This is a break in feedwater line outside containment and is bounded by FSAR Chapter 15.2.7 analyses. Failure of control components in the zone does not exacerbate this event.

APPENDIX D

ZONE 13

Building: Turbine Building
Location: el 67 ft 6 in.

HIGH-ENERGY LINE BREAK ANALYSIS

	HELB System			Control System
1.a)	CNM (4-1)	Condensate	2.a) N64	Off-Gas System
b)	DTM (32-5)	Turbine Plant Miscellaneous Drains		
c)	MSS (3-1)	Main Steam System		
d)	OFG (31-4)	Off-Gas System		

1. The following is a list of high-energy lines analyzed on a system basis.

   a. Condensate (CNM, 4-1)

      Line Nos. 1CNM-024-24-4 and 024-115-4

      Function

      Carry condensate to off-gas condenser and condensate polishing demineralizer.

      Failure Effect

      Total loss of condensate/feedwater. Feedwater pumps trip on low suction.

   b. Turbine Plant Miscellaneous Drains (DTM, 32-5)

      Line Nos. 1DTM-002-384-4, 002-385-4, 002-389-4, 002-390-4, 002-392-4, 002-394-4, 002-636-4, and 002-637-4

      Function

      Condensate drain connections to main condenser from off-gas preheater EB001A, EB001B, or CNDB002.

Failure Effect

Depending on location of pipe break, loss of condensate inventory or loss of condenser vacuum.

c. Main Steam System (MSS, 3-1)

Line Nos. 1MSS-002-39-4 and 002-40-4

Function

Off-gas condenser EB001A or EB001B relief valve to main condenser.

Failure Effect

Loss of main condenser vacuum.

d. Off-Gas (OFG, 31-4)

1) Line Nos. 1OFG-016-3-4, 016-4-4, 016-12-4, and 016-13-4

Function

Carry steam-diluted off-gas from condenser air removal system air ejectors to off-gas preheater EB001A or EB001B to off-gas catalytic recombiners.

Failure Effect

Loss of off-gas treatment.

2) Line Nos. 1OFG-016-14-4, 016-15-4, and 016-16-4

Function

Off-gas from catalytic recombiners to off-gas condenser.

Failure Effect

Loss of off-gas treatment.

2. The following is the list of nonsafety-related control components that are affected by a high-energy line break on any of the lines listed in Item 1. The consequence of failure of each control component is analyzed. Refer to Appendix B for function of each component.

Additionally, a high energy line break in this zone will also result in failure of control components considered in Zone 15. The instruments in Zone 15 are included below for the off-gas system with Zone 13 control components.

a. Off-Gas System (OFG, N64)

1) 1N64-PVF009A, PIC48A, and 1N64-PVF009B, PIC48B

Failure Effect

If instrumentation fails 1N64-PVF009A or 9B in closed position, main steam supply to off-gas preheater is lost, affecting off-gas removal capability.

2) 1N64-I/P K001A, 1N64-LT-N007A, 1N64-I/P K001B, 1N64-LT-N007B, 1N64-LCR005A, 1N64-LCR005B, 1N64-LISN008A, 1N64-LIS-N008B.

Failure Effect

Loss of the above instrumentation may fail 1N64-LVF016A or LVF016B in closed position. Condensate level in off-gas condenser CNDB002 may rise, affecting the gas removal capability.

3) 1N64-TEN020A and 1N64-TEN020B

Failure Effect

Loss of these moisture separators 1N64-D010A or D010B resistor temperature detector (worst-case failure) causes inlet valve 1N64-AOF032A or B on cooler condenser 1N64-B010A or B to fail closed. This will cause failure of air ejectors and loss of main condenser vacuum.

4) 1N64-LCR005A, LIS-N008A, LCR-005B, LIS-N008B

If either of the valves fails open, off-gas along with process condensate will drain to main condenser. This will reduce the cooling and moisture separation capability of the off-gas condenser. If the valves fail closed, condensate level in off-gas condenser CNDB002 may rise, affecting the moisture removal capability and the efficiency of the system.

3. Combined Effects

a. A break in the condensate high-energy line will cause loss of condensate/feedwater flow leading to feedwater pump trip on low suction. This is a break in feedwater line outside containment and bounded by FSAR Chapter 15.6.6 analyses. Failure of control components in this zone does not exacerbate this event.

b. A break in the turbine plant miscellaneous drains high energy line will cause some loss of condensate inventory or loss of main condenser vacuum. Loss of main condenser vacuum is bounded by FSAR Chapter 15.2.5 analyses. Failure of control components in this zone does not exacerbate this event.

c. A break in any of the main steam off-gas condenser relief valve high energy lines will cause a loss in main condenser vacuum bounded by FSAR Chapter 15.2.5 analyses. Failure of control component in this zone does not exacerbate this event.

d. A break in off-gas system high energy line will cause loss of off-gas treatment and inadvertent gaseous release of significant radiation level in the turbine building. Increased radioactivity levels detected by area radiation monitoring alarm in the control room. Manual isolation of off-gas system will result in high condenser pressure and reactor scram. This event is bounded by FSAR Chapter 15.7 analyses.

Failure of control system components can stop main steam to preheaters, thus affecting the off-gas treatment and can also cause failure of air ejectors and loss of condenser vacuum bound by FSAR Chapter 15.2.5 analyses.

APPENDIX D

ZONE C1

Building: Containment
Location: El 114 ft

HIGH ENERGY LINE BREAK ANALYSIS

HELB System			Control System		
1. a)	RDS (36-1)	Control Rod Drive Hydraulic System	2. a)	B21	Nuclear Boiler
			b)	B33 RCS (25-1)	Reactor Recirculation
			c)	RDS (36-1)	Control Rod Drive Hydraulic System
			d)	C33	Feedwater Control System

1. The following is a list of high energy lines analyzed on a system basis:

   a. Control Rod Drive Hydraulic System (RDS, 36-1)

   All Lines

   Function

   Supplies hydraulic drive water and cooling water to the control rod drive system.

   Failure Effect

   Loss of control rod drive system cooling and loss of hydraulic control unit supply to accumulators.

2. The following is a list of nonsafety-related control components that are affected by a high energy line break in any of the control rod drive lines in Item 1. The consequence of failure of each control component is analyzed. Refer to Appendix B for function of individual components.

   a. Nuclear Boiler (B21)

      1B21*PTN058B, *PTN058F, *LTN099B, and *LTN099F

      Failure Effect

      If the above reactor vessel pressure and level instrumentation to the anticipated transient without scram (ATWS) trip circuit fails in the worst mode, reactor recirculation pumps 1A and 1B stop.

b. Nuclear Recirculation (B33, RCS, 25-1)

1) 1B33*PTN040

Failure Effect

If this reactor vessel dome pressure instrument fails in either maximum or minimum output directions, it will effect the thermal shock interlocks for reactor recirculation pumps 1A and 1B start circuit logic.

2) 1B33*FTN011A and *FTN011B

Failure Effect

Failure of these reactor recirculation flow instruments can cause the reactor recirculation valves to fail either closed or open.

c. Control Rod Drive Hydraulic System (RDS, 36-1)

1C11-FTN004, HSSD009A, HSSD009B, I/PK001, and FCR600

Failure Effect

If this reactor control rod drive flow control instrumentation fails, worst case failure would be the total loss of control rod drive system cooling and loss of hydraulic control unit supply to accumulators.

d. Feedwater Control System (C33)

1) 1C33*FTN003B and FTN003D

Failure Effect

If this reactor steam flow control instrumentation fails, feedwater flow control valves may receive false signals from the three-element feedwater control system for two of the four steam flow input signals. The other two steam flow control input transmitters are located in zone C2. This failure can directly cause an increase in coolant inventory by increasing the feedwater flow. With excess feedwater flow, the water level rises to the high level reference point at which time the feedwater pumps and the main turbine are tripped and a scram is initiated.

2) 1C33*PTN008B

Failure Effect

If the steam dome pressure instrument for the reactor fails to either maximum or minimum output of the pressure transmitter, the recirculation pump cavita-tion interlock will be affected. Since this pressure signal is indicative of temperature differential between the steam dome and recirculation pump suction, an indication of a high differential will trip one recircu-lation pump and cause the reactor core flow and power level to stabilize at a new equilibrium condition.

3. Combined Effect

A break in any control rod drive hydraulic high energy line will cause loss of control rod drive system cooling and loss of hydraulic control unit supply to accumulators. This failure of the control rod system is bound in the FSAR by Chapter 15.4.

The failure of the control system components in the zone cause reactor recirculation failure, bound by FSAR Chapter 15.3.2.

APPENDIX D

ZONE C2

Building: Containment
Location: El 114 ft

HIGH ENERGY LINE BREAK ANALYSIS

HELB System		Control System	
1. a) RDS (36-1)	Control Rod Drive Hydraulic System	2. a) B21	Nuclear Boiler
		b) C33	Feedwater Control System

1. The following is a list of high energy lines analyzed on a system basis:

   a. Control Rod Drive Hydraulic System (C11, RHS, 36-1)

   All Lines

   Function

   Supplies hydraulic irive water and cooling water to the control rod drive system.

   Failure Effect

   Loss of control rod drive system cooling and loss of hydraulic control unit supply to accumulators.

2. The following is a list of nonsafety-related control components that are affected by a high energy line break in any of the control rod drive lines in Item 1. The consequence of failure of each control component is analyzed. Refer to Appendix B for function of individual components.

   a. Nuclear Boiler (B21)

      1B21*PTN058A, *PTN058E, *LTN099A, and *LTN099E

      Failure Effect

      If the above reactor vessel pressure and level instrumentation to the anticipated transient without scram (ATWS) trip circuit fails in the worst mode, reactor recirculation pumps 1A and 1B stop.

b. Feedwater Control System (C33)

1) 1C33*FTN003A and FTN003C

Failure Effect

If this reactor steam flow control instrumentation fails, feedwater flow control valves may receive false signals from the three-element feedwater control system for two of the four steam flow input signals. The other two steam flow control input transmitters are located in Zone C1. This failure can directly cause an increase in coolant inventory by increasing the feedwater flow. With excess feedwater flow, the water level rises to the high level reference point at which time the feedwater pumps and the main turbine are tripped, and a scram is initiated.

2) 1C33*LTN004A, LTN004B, and LTN004C

Failure Effect

If this reactor level instrumentation fails such that two out of three fail in the high or low output direction, they will cause either an inadvertent trip of the reactor feedwater pumps and main turbine or a loss of this trip when required.

3) 1C33*PTN008A

Failure Effect

If the steam dome pressure instrument for the reactor fails to either maximum or minimum output of the pressure transmitter, the recirculation pump cavitation interlock will be affected. Since this pressure signal is indicative of temperature differential between the steam dome and recirculation pump suction, an indication of a high differential will trip one recirculation pump and cause the reactor core flow and power level to stabilize at a new equilibrum condition.

4) 1C33*PTN005

Failure Effect

If this reactor vessel dome pressure instrument fails in either maximum or minimum output directions, it will affect the thermal shock interlocks for the reactor recirculation pumps 1A and 1B start circuit logic.

3. Combined Effect

A break in any control rod drive hydraulic high energy line will cause loss of control rod drive system cooling and loss of hydraulic control unit supply to accumulators. This fai'ure of the control rod system is bound in the FSAR by Chapters 15 +.

The failure of the control system components in the zone cause reactor recirculation failure, bound by FSAR Chapter 15.3.2.

APPENDIX D

ZONES AB-070-8
AB-095-8
AB-114-3
AB-114-5
AB-114-6
AB-114-8

BUILDING: Auxiliary Building
LOCATION: Various

HIGH ENERGY LINE BREAK ANALYSIS

HELB SYSTEM			CONTROL SYSTEM		
1. a)	ICS (27-6)	Reactor Core Isolation Cooling	2.a)	CCP (9-1)	Reactor Plant Component Cooling Water
b)	WCS (26-3)	Reactor Water Cleanup	b)	MWS (9-15)	Makeup Water
c)	RHS (27-7)	Residual Heat Removal			

1. The following is a list of high energy lines analyzed on a system basis:

   a. Reactor Core Isolation Cooling (ICS, 27-6)

   All lines in auxiliary building

   Function

   The high energy line is limited to the piping which provides decay heat steam from the reactor vessel to the reactor core isolation cooling pump turbine.

   Failure Effect

   A pipe break in any section of the auxiliary building will cause loss of reactor coolant and temperature transient in some areas in the auxiliary building identified in the EDC report. However, the steam supply to the turbine is automatically isolated on detection of a pipe break, and the loss of reactor coolant is minimized.

   b. Reactor Water Cleanup (WCS, 26-3)

   All lines in auxiliary building

Function

The high energy piping in the auxiliary building is limited to those associated with reactor water cleanup pumps PC-001A and 001B suction and discharge. These lines circulate reactor coolant through the cleanup system and return the clean liquid back to the reactor.

Failure Effect

A break in either the suction or discharge side of the pump will cause loss of reactor coolant. However, consequent temperature rise in the vicinity of the break will isolate the suction and discharge isolation valves minimizing the loss. In addition, a break on the suction side of the pump will trigger the low flow sensor to shut down the pumps.

c. Residual Heat Removal System (RHS, 27-7) Steam Supply Lines

Function

The high energy lines are limited to the piping which diverts steam to RHR heat exchanger during RHR steam condensive mode.

Failure Effect

A break in either the suction or discharge side of the pump will cause loss of reactor coolant. However, consequent temperature rise in the vicinity of the break will isolate the suction and discharge isolation valves minimizing the loss. In addition, a break on the suction side of the pump will trigger the low flow sensor to shut down the pumps.

2. The following is a list of nonsafety-related control components that are affected by a high energy line break on any of the lines listed in Item 1. The consequences of failure of each control component is analyzed. Refer to Appendix B for the function of individual components.

a. Reactor Plant Component Cooling Water (CCP, 9-1)

1) 1CCP-I/P-128
1CCP-TVX-128
1CCP-TVY-128

Failure Effect

Failure of a single or the group of instruments listed above may cause bypass valve 1CCP-TVX-128 to open and control valve 1CCP-TVY-128 to close. This will allow the component cooling water to bypass the heat exchangers, thereby raising the CCP water temperature and may have a long-term effect on the life of the reactor plant components.

2). 1CCP-PT127

Failure Effect

Failure of this instrument will not allow the automatic startup of the selected standby component cooling water pump. However, one pump is always running and a complete loss of component cooling will not occur.

3) 1CCP-LT120

The surge tank may go solid but will not significantly affect the operation of the system. Makeup water system itself is eleminated by using system elimination criteria.

3. Combined Effect

a. A break in the ICS or RHS steam piping will cause some loss of reactor coolant and temperature transient in the auxiliary building but there will be no effect in normal reactor operation. Failure of control components will not exacerbate the condition.

b. A break in WCS system piping will degrade the reactor water quality. However, there will be minimal impact on the reactor coolant inventory because the system is used mainly in a recirculatory mode. Concurrent failure of control components will have no worse effect on the system.

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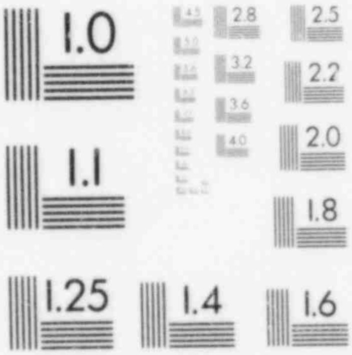
IMAGE EVALUATION
TEST TARGET (MT-3)

150mm

6"

IMAGE EVALUATION
TEST TARGET (MT-3)



150mm

6″

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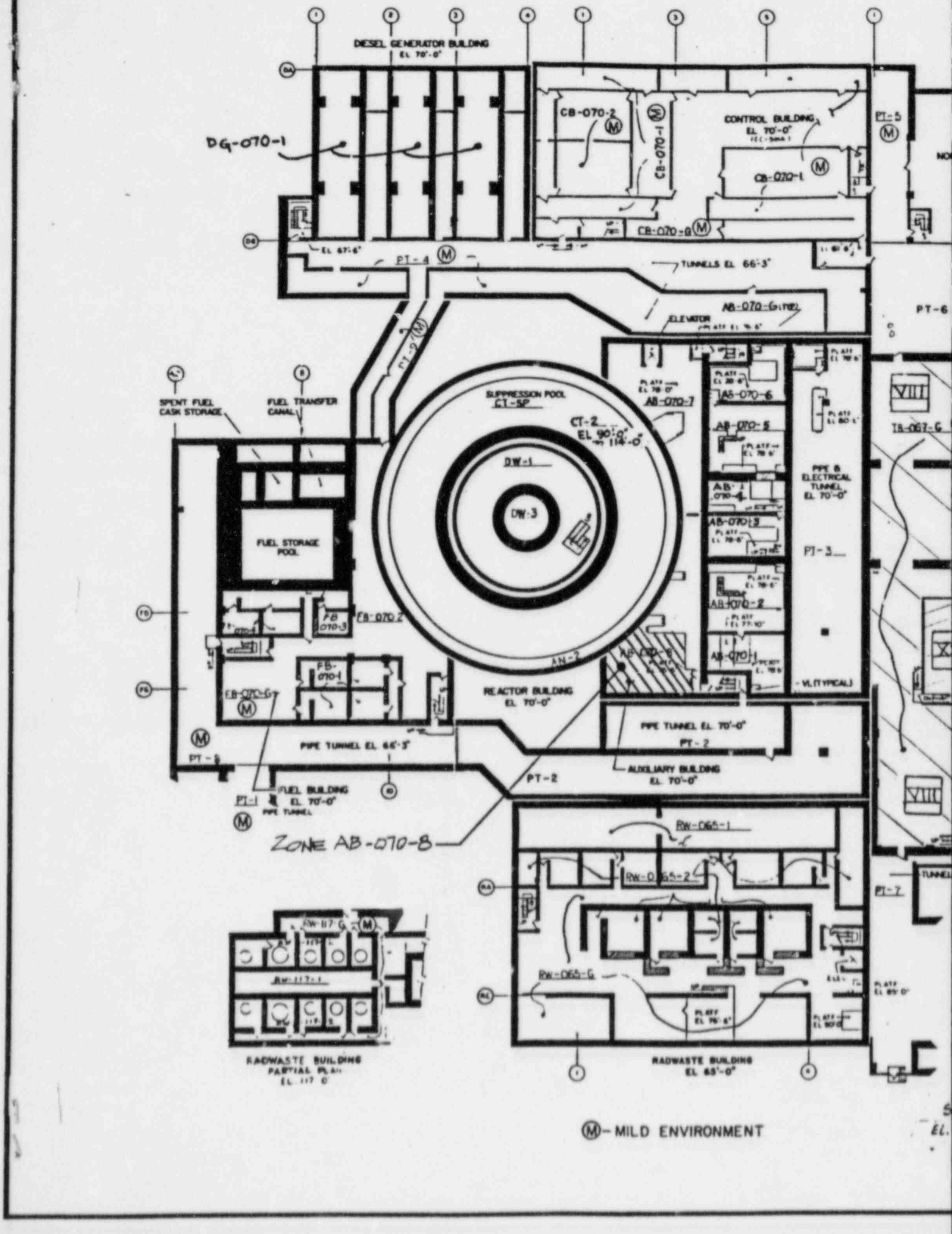
LSK-4-2.1	LP Feedwater Heater Drains 2nd Point	5
LSK-4-2.2	LP Feedwater Heater Drains 3rd Point	4
LSK-4-2.3A	LP Feedwater Heater Drains 3rd Point Heater Drain Pump	5
LSK-4-2.3B	LP Feedwater Heater Drains 3rd Point Heater Drain Pump	5
LSK-4-2.4	LP Feedwater Heater Drains 4th Point	4
LSK-4-2.5	LP Feedwater Heater Drains 5th and 6th Point	4
LSK-5-1B	Condenser Air Removal	5
LSK-5-1C	Condenser Air Removal	5
LSK-6-1.1A	Reactor Feedwater Pumps	8
LSK-6-3	Feedwater Pumps Recirculation	4
LSK-6-6	HP Feedwater Heater Drains 1st Point	4
LSK-7-3.1C	Feedwater Pumps and Drive Lube Oil	6
LSK-9-1A	Reactor Plant Component Cooling Water	9
LSK-9-1B	Reactor Plant Component Cooling Water	9
LSK-9-7B	Turbine Plant Component Cooling Water	6
LSK-12-1A	Instrument Air System	6
LSK-12-1C	Instrument Air System	6
LSK-32-5.1A	Extraction Line Drain Control	4
LSK-32-5.1C	Extraction Line Drain Control	4

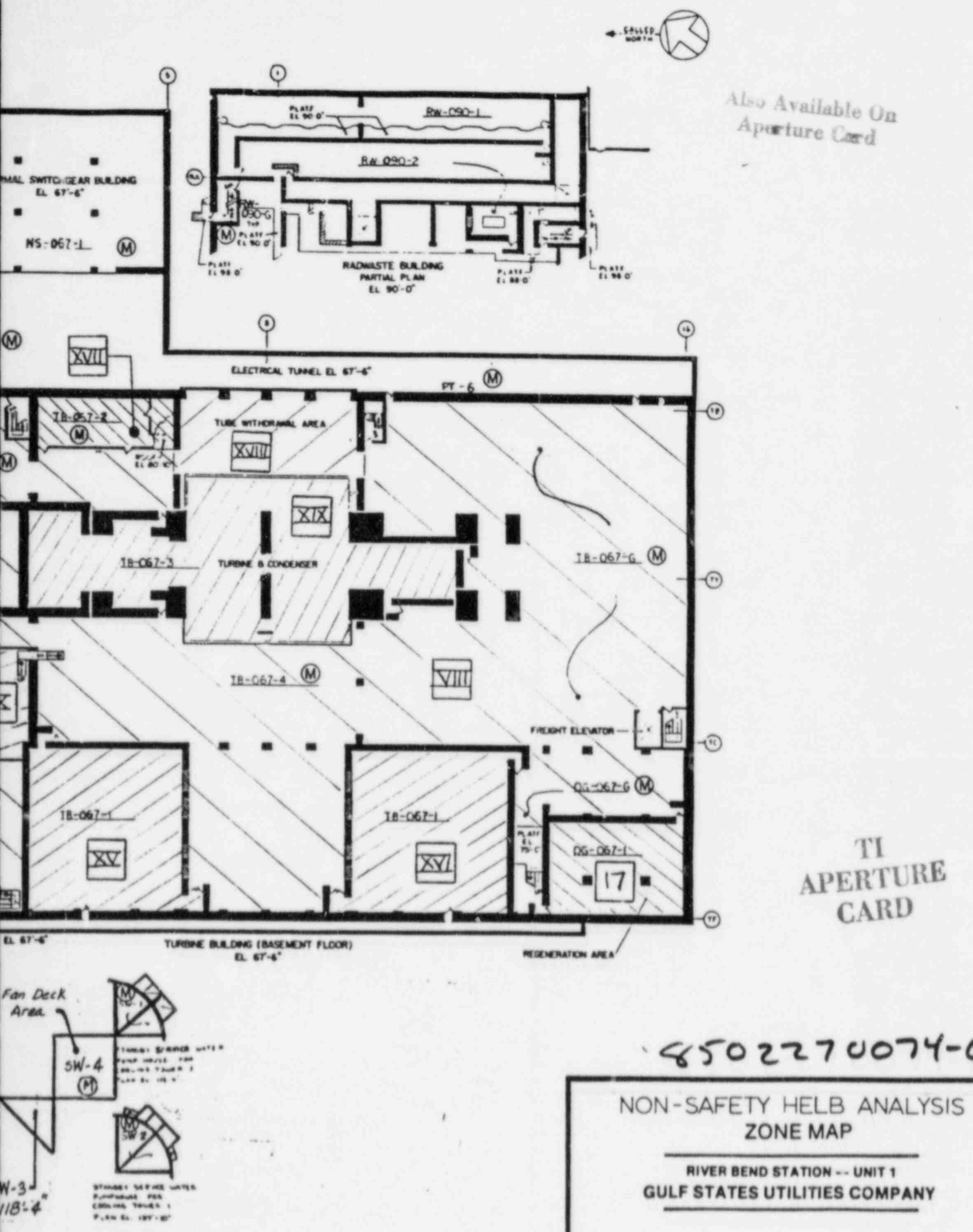
Logic Diagram No.	Title	Rev.
LSK-32-5.2A	Turbine Plant Drains - Miscellaneous, Steam, L&V Body	5
LSK-32-5.4A	Radwaste Reboiler Drain and Steam Seal Evaporator Drains	5
LSK-32-6A	Moisture Separator Reheater Vents and Drains	5
LSK-32-7	Moisture Separator Vents and Drains	4
LSK-32-14	Feedwater Heater Relief Vents and Drips	4
GE828E231AA (Sh. 3)	Elem Diagram CRD Hyd System	11
GE828E257AA (Sh. 12)	Elem Diag Off-Gas Control System	9
GE851E506 (Sh. 1)	IED Feedwater Control System	3
GE865E352AA (Sh. 6)	Reactor Recirc System IED	0
GE865E995 (Sh. 5)	FCD Nuclear Boiler System	6

Elementary Diagram No.	Title	Rev.
ESK-6CNM02	Low-Pressure Heaters Outlet Isolation Valves	9
ESK-6CNM03	Low-Pressure Heaters Inlet Isolation Valves	9
ESK-6ESS01	1st Point Heater Extraction Isolation Valves	9
ESK-6ESS02	2nd Point Heater Extraction Isolation Valves	10
ESK-6ESS03	3rd Point Heater Extraction Isolation Valves	10
ESK-6ESS04	4th Point Heater Extraction Isolation Valves	9
ESK-6ESS06	Extraction Steam System MOVs	9
ESK-6GMC03	Stator Winding Liquid Cooling Unit Heater	5
ESK-6HDL01	3rd Point Heater PP Suction Valves	10
ESK-6HDL02	3rd Point Heater PP Suction Valves	9
ESK-6IAS01	Instrument Air Compressor C1A	9
ESK-6IAS02	Instrument Air Compressor C1B	9
ESK-6IAS03	Instrument Air Compressor C1C	9
ESK-6TMB01	Turbine Generator Exhaust Flow Pump 1HFPM-A	10
ESK-6TMB03	Exhaust Fluid Auxiliary CKTS	7
ESK-6TML01	Turbine Generator Lube Oil Pumps	6
ESK-7ARC01	Condenser Air Removal System AOVs	11
ESK-7ARC02	Condenser Air Removal System AOVs	13
ESK-7CCP04	PPCCW Surge Tank Makeup Valve	6
ESK-7CNM01	Condensate System SOVs	9
ESK-7DSM01	Master Separator Drain Control Valves	8
ESK-7DSR01	Master Separator Reheater Drain Control Valves	7
ESK-7DTM01	Extraction Line Drain Control	8
ESK-7DTM02	Extraction Line Drain Control	7
ESK-7DTM03	Turbine Plant Miscellaneous Drain Valves	8
ESK-7DTM04	Mnst L Drain Bypass Valves Control CKT	8
ESK-7DTM06	Turbine Plant Miscellaneous Drain Valves	8
ESK-7DTM08	Turbine Plant Miscellaneous Drain Valves	7

Elementary Diagram No.	Title	Rev.
ESK-7ESS01	Extraction Steam System NRVs	8
ESK-7ESS02	Extraction Steam System NRVs	8
ESK-7ESS03	Extraction Steam System NRVs	8
ESK-7ESS04	Extraction Steam System SOV NRVs	7
ESK-7FWR01	Feedwater Pump Recirculation SOVs	8
ESK-7FWS01	Reactor Feedwater Pump Auxiliary Control	6
ESK-7FWS02	Reactor Feedwater Pump Auxiliary Control	6
ESK-7HDH01	High-Pressure Heater Drains	7
ESK-7HDH02	High-Pressure Heater Drains	7
ESK-7HDL01	Low-Pressure Heater Drains	9
ESK-7HDL02	Low-Pressure Heater Drains	8
ESK-7HDL03	Low-Pressure Heater Drains	9
ESK-7HDL04	Low-Pressure Heater Drains	8
ESK-7HDL05	3rd Point Heater Drain Pump Recirculation Valves	6
ESK-7SVH01	Feedwater Heater Main Vent Valves	7
ESK-7SVH02	Feedwater Heater Main Vent Valves	7
ESK-7SVH03	Feedwater Heater Main Vent Valves	7
ESK-7SVH04	Drain Cooler Main Vent Valves	7
ESK-10ANN10	Annunciators	8
ESK-10ANN11	Annunciators	7
ESK-11TML01	125-V dc Containment CKT Emergency Bearing Oil PP	6
GE795E861 (Sh. 1)	Off-Gas	3
GE828E231AA (Sh. 3)	Elementary Diagram CRD Hydraulic System	11
GE828E232AA (Sh. 3)	Elementary Diagram Feedwater Control System	12
GE828E232AA (Sh. 4)	Elementary Diagram Feedwater Control System	9

Elementary Diagram No.	Title	Rev.
GE828E243AA (Sh. 6)	Elementary Diagram Process Rad Mon System	8
GE828E243AA (Sh. 16)	Elementary Diagram Process Rad Mon System	8
GE828E257AA	Elementary Diagram Off-Gas Control System	11
GE828E443AA (Sh. 5)	Elementary Diagram NUC Boiler Process Instm System	10
GE828E446AA (Sh. 11)	Elementary Diagram Reactor Recirculation System	11
GE828E446AA (Sh. 12)	Elementary Diagram Reactor Recirculation System	14
GE828E446AA (Sh. 14)	Elementary Diagram Reactor Recirculation System	11
GE828E446AA (Sh. 16)	Elementary Diagram Reactor Recirculation System	11
GE828E446AA (Sh. 24)	Elementary Diagram Reactor Recirculation System	11
GE828E446AA (Sh. 25)	Elementary Diagram Reactor Recirculation System	11
GE851E506 (Sh. 1)	IED Feedwater Control System	3
GE851E705 (Sh. 4)	Elementary Diagram Steam Bypass and Pressure Regulation System	8
GE851E705 (Sh. 6)	Elementary Diagram Steam Bypass and Pressure Regulation System	10


DIESEL GENERATOR BUILDING
EL 70'-0"
DG-070-1
CB-070-2
CB-070-1
CONTROL BUILDING
EL 70'-0"
CB-070-1
CB-070-G
PT-5
PT-4
TUNNELS EL 66'-3"
AB-070-G
ELEVATOR
PT-6
PT-7
SPENT FUEL CASK STORAGE
FUEL TRANSFER CANAL
SUPPRESSION POOL
CT-SP
CT-2
DW-1
DW-3
AB-070-7
AB-070-6
AB-070-5
AB-070-4
AB-070-3
AB-070-2
PIPE & ELECTRICAL TUNNEL EL 70'-0"
PT-3
FUEL STORAGE POOL
FB-070-2
FB 070-3
FB-070-1
FB-070-G
REACTOR BUILDING
EL 70'-0"
PIPE TUNNEL EL 70'-0"
PT-2
PIPE TUNNEL EL 66'-3"
PT-2
AUXILIARY BUILDING
EL 70'-0"
FUEL BUILDING
EL 70'-0"
PIPE TUNNEL
PT-1
ZONE AB-070-8
RW-065-1
RW-065-2
RW-065-G
RW-117-G
RW-117-1
RADWASTE BUILDING
PARTIAL PLAN
EL 117'-0"
RADWASTE BUILDING
EL 65'-0"
Ⓜ- MILD ENVIRONMENT



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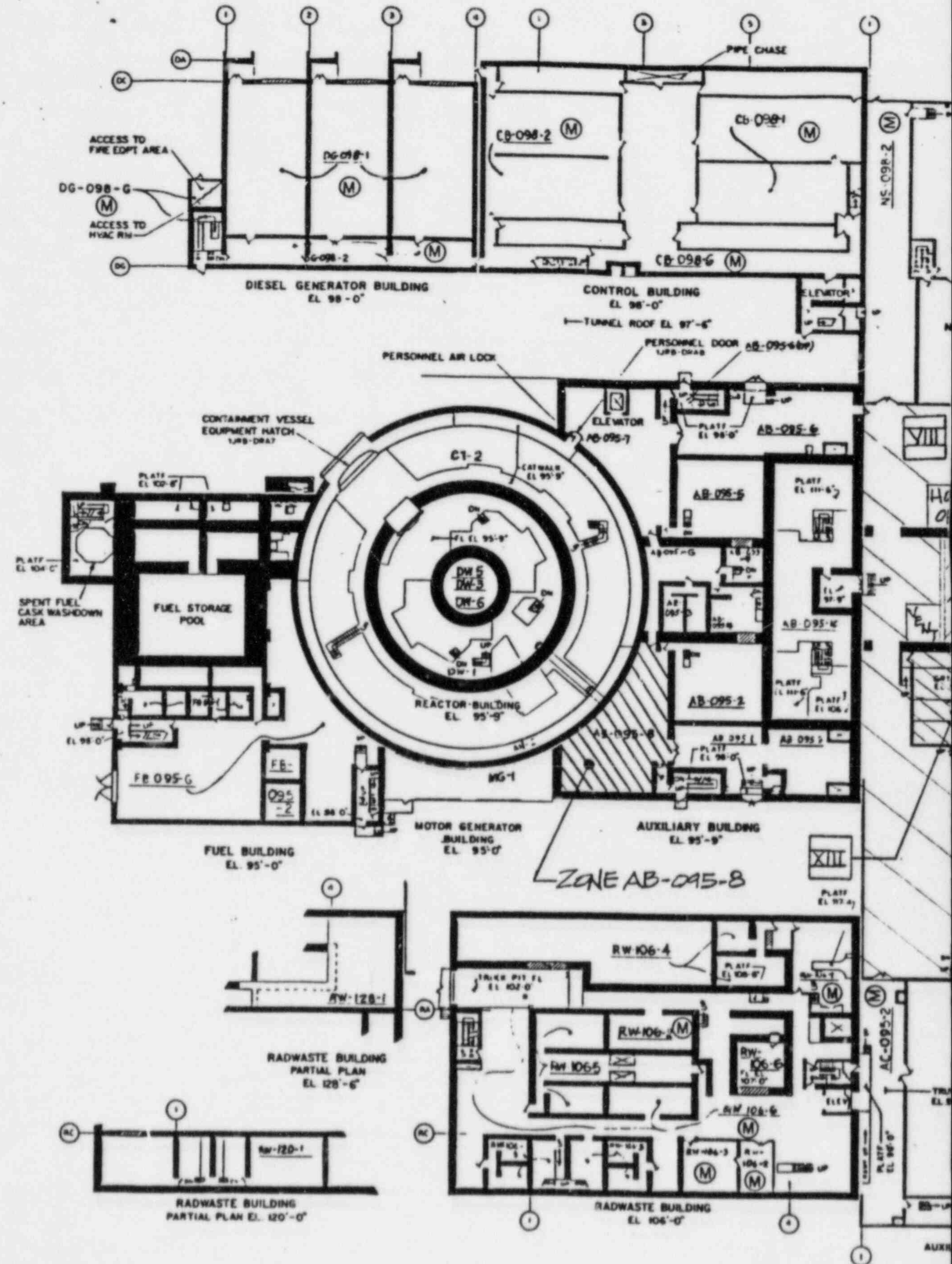
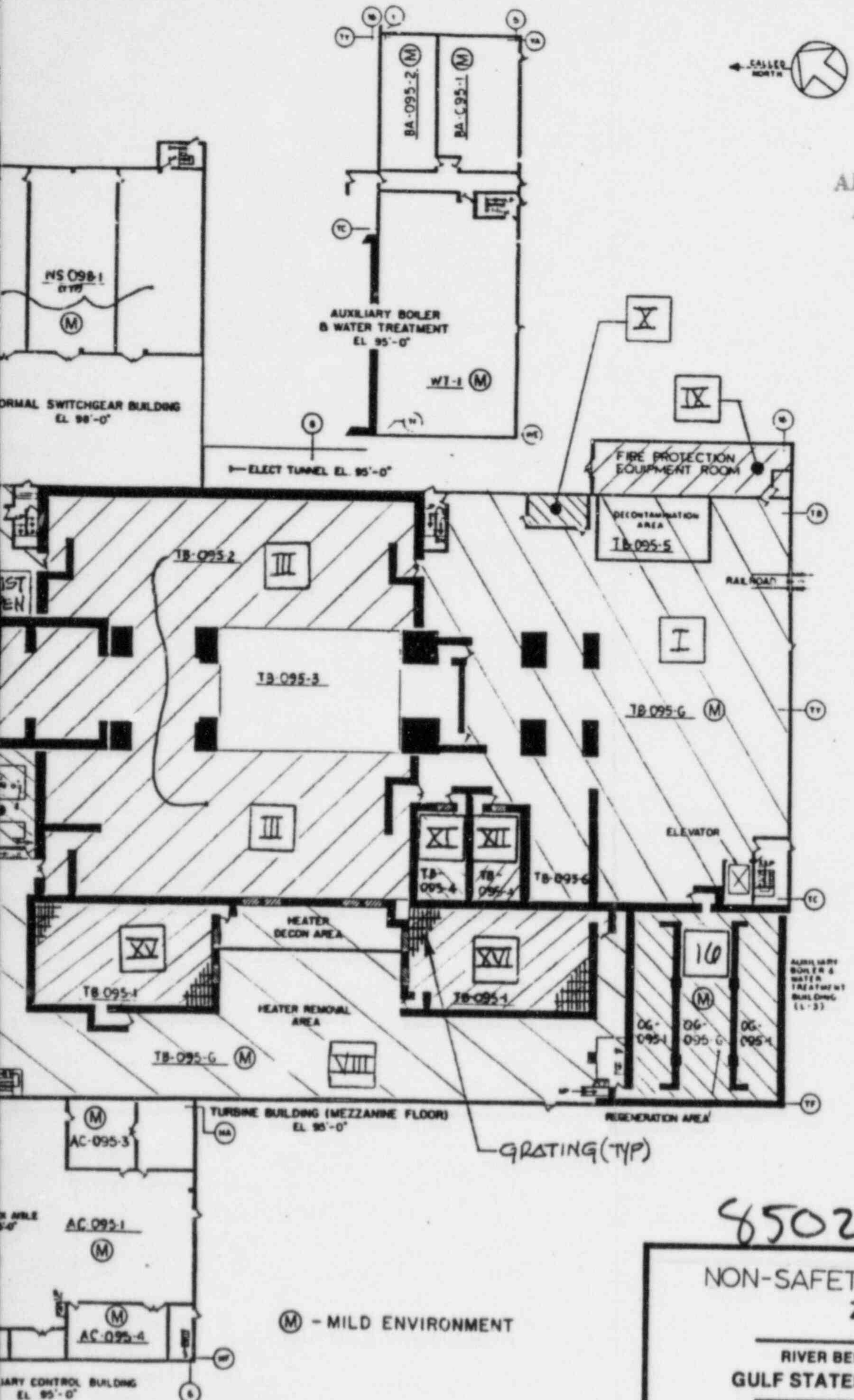
NON-SAFETY HELB ANALYSIS
ZONE MAP

RIVER BEND STATION -- UNIT 1
GULF STATES UTILITIES COMPANY

FIGURE 1


PIPE CHASE
ACCESS TO FIRE EQPT AREA
DG-098-G
ACCESS TO HVAC RM
DG-098-1
DG-098-2
CB-098-2
CB-098-1
CB-098-6
NS-098-2
DIESEL GENERATOR BUILDING
EL 98'-0"
CONTROL BUILDING
EL 98'-0"
TUNNEL ROOF EL 97'-6"
ELEVATOR
PERSONNEL DOOR
PERSONNEL AIR LOCK
CONTAINMENT VESSEL
EQUIPMENT HATCH
ELEVATOR
AB-095-7
AB-095-6
AB-095-5
C1-2
DW-5
DW-3
DW-6
PLATF
SPENT FUEL CASK WASHDOWN AREA
FUEL STORAGE POOL
AB-095-10
AB-095-2
REACTOR BUILDING
EL 95'-9"
AB-095-8
FB 095-G
MG-1
FUEL BUILDING
EL 95'-0"
MOTOR GENERATOR BUILDING
EL 95'-0"
AUXILIARY BUILDING
EL 95'-9"
ZONE AB-095-8
RW-106-4
RW-128-1
RADWASTE BUILDING
PARTIAL PLAN
EL 128'-6"
RW 106-5
RW-106-6
AC-095-2
RW-120-1
RADWASTE BUILDING
PARTIAL PLAN EL 120'-0"
RADWASTE BUILDING
EL 106'-0"



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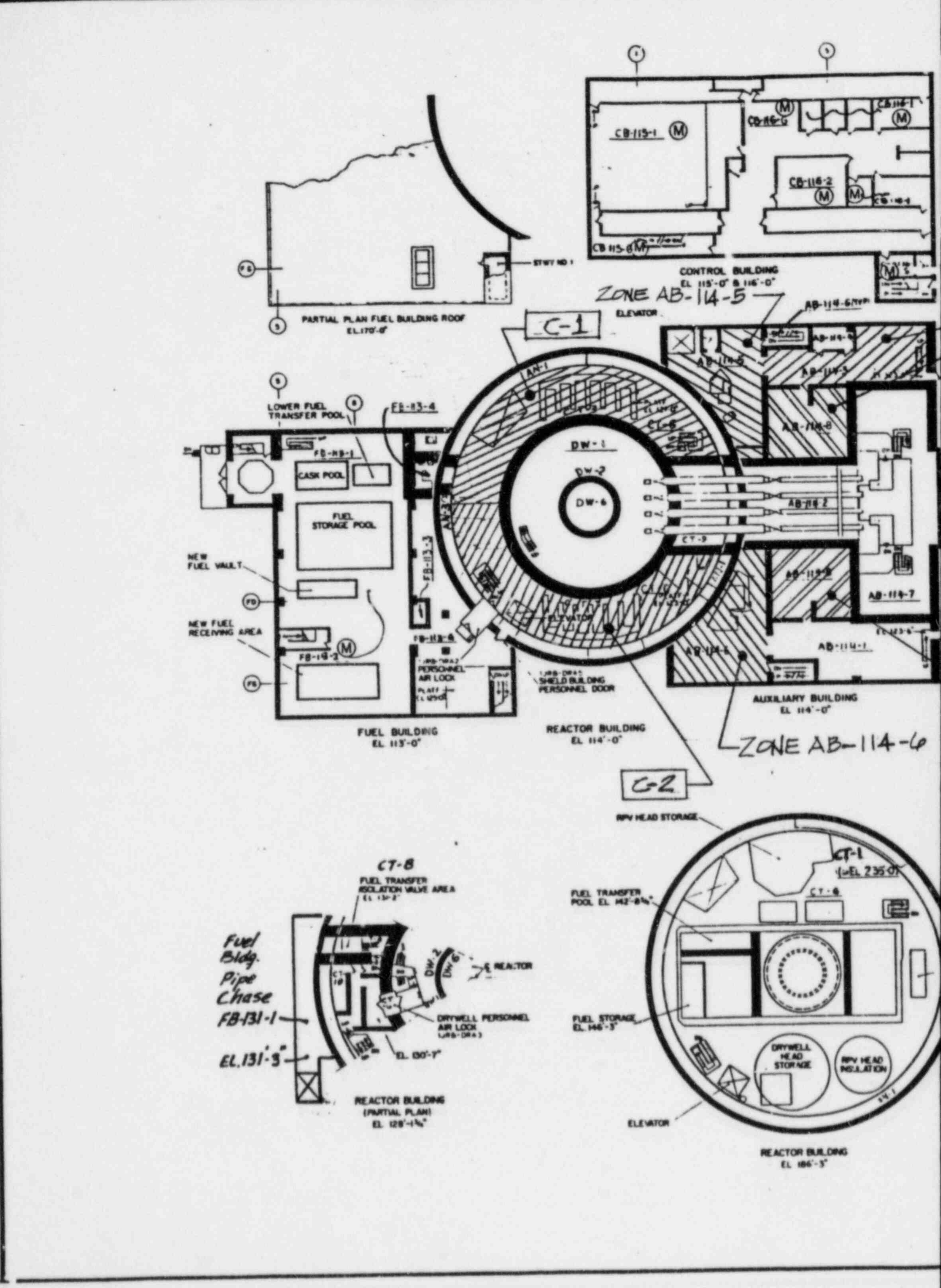
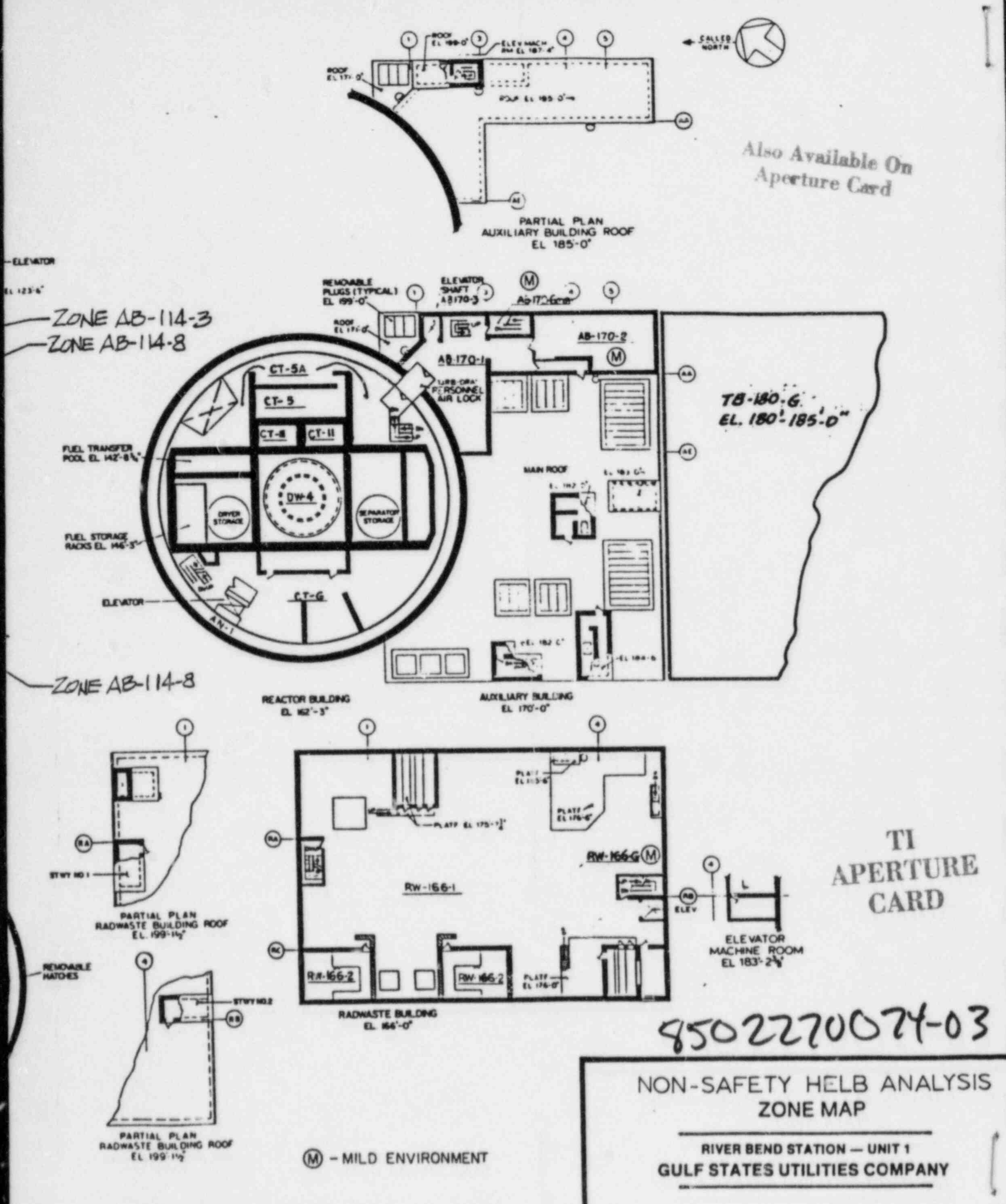
NON-SAFETY HELB ANALYSIS
ZONE MAP

RIVER BEND STATION — UNIT 1
GULF STATES UTILITIES COMPANY

FIGURE 2



PARTIAL PLAN FUEL BUILDING ROOF
EL 170'-0"
STWY NO 1
CB-115-1
CB-116-2
CB-115-8
CONTROL BUILDING
EL 115'-0" & 116'-0"
ZONE AB-114-5
ELEVATOR
AB-114-6
C-1
AN-1
LOWER FUEL TRANSFER POOL
FB-113-4
FB-113-1
CASK POOL
FUEL STORAGE POOL
NEW FUEL VAULT
NEW FUEL RECEIVING AREA
FB-113-3
FB-113-2
PERSONNEL AIR LOCK
SHIELD BUILDING PERSONNEL DOOR
DW-1
DW-2
DW-6
CT-9
AB-114-2
AB-114-3
AB-114-8
AB-114-9
AB-114-7
AB-114-1
AB-114-6
FUEL BUILDING
EL 113'-0"
REACTOR BUILDING
EL 114'-0"
AUXILIARY BUILDING
EL 114'-0"
ZONE AB-114-6
C-2
RPV HEAD STORAGE
CT-8
FUEL TRANSFER ISOLATION VALVE AREA
Fuel Bldg. Pipe Chase
FB-131-1
EL.131'-3"
DRYWELL PERSONNEL AIR LOCK
EL 130'-7"
REACTOR BUILDING
(PARTIAL PLAN)
EL 128'-1¾"
CT-1
(>EL 235'0")
CT-6
FUEL TRANSFER POOL EL 142'-8¾"
FUEL STORAGE EL 146'-3"
DRYWELL HEAD STORAGE
RPV HEAD INSULATION
ELEVATOR
REACTOR BUILDING
EL 186'-3"



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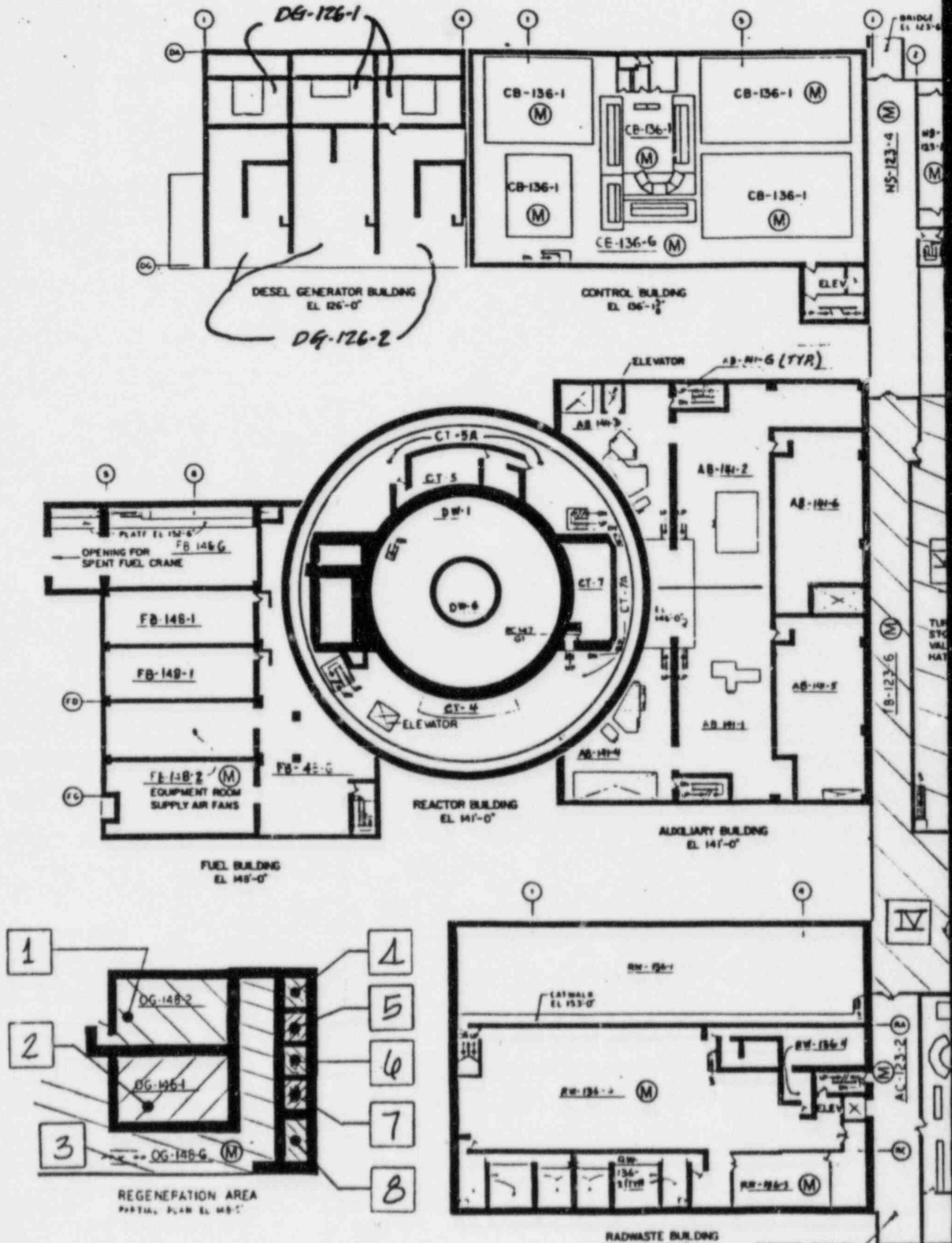
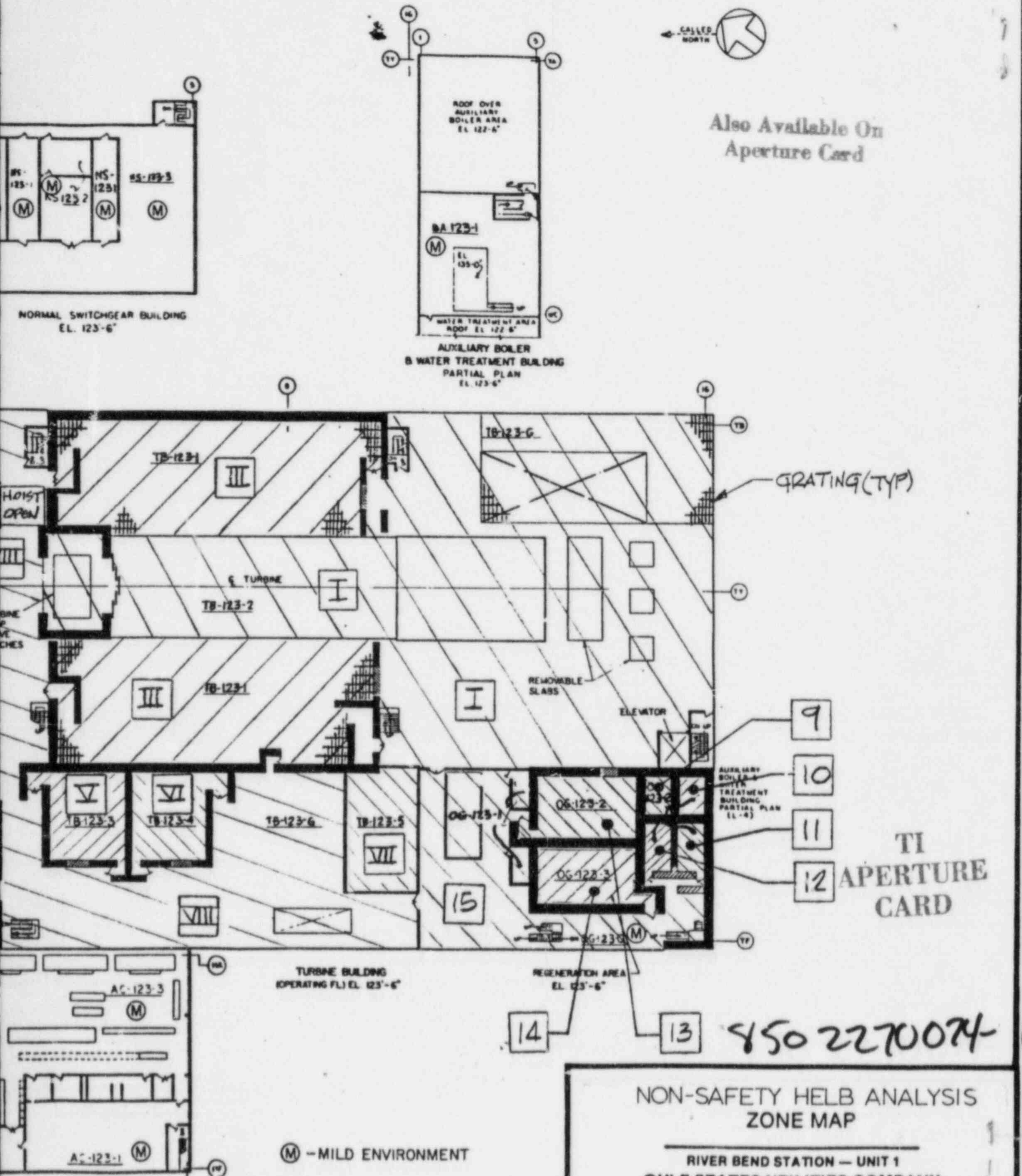
NON-SAFETY HELB ANALYSIS
ZONE MAP

RIVER BEND STATION — UNIT 1
GULF STATES UTILITIES COMPANY

FIGURE 3



DG-126-1
DG-126-2
DIESEL GENERATOR BUILDING
EL 126'-0"
CB-136-1
CE-136-6
CONTROL BUILDING
ELEV
NS-123-4
ELEVATOR
AB-141-6 (TYP.)
AB-141-2
AB-141-6
AB-141-5
AB-141-1
AB-141-4
CT-5A
CT-5
DW-1
CT-7
CT-7A
DW-6
CT-4
ELEVATOR
OPENING FOR SPENT FUEL CRANE
FB 146 G
FB-148-1
FB-149-1
FB-148-2
EQUIPMENT ROOM SUPPLY AIR FANS
REACTOR BUILDING
EL 141'-0"
AUXILIARY BUILDING
EL 141'-0"
FUEL BUILDING
EL 148'-0"
TB-123-6
IV
1
2
3
4
5
6
7
8
OG-148-2
OG-148-1
OG-148-G
REGENERATION AREA
RW-136-1
RW-136-4
RW-136-2
RW-136-3
ELEV
AC-123-2
RADWASTE BUILDING
EL 136'-0"
PERSONNEL PASSAGE



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NON-SAFETY HELB ANALYSIS
ZONE MAP

RIVER BEND STATION — UNIT 1
GULF STATES UTILITIES COMPANY

FIGURE 4