FIRE HAZARDS ANALYSIS REPORT

FOR

IOWA ELECTRIC LIGHT AND POWER COMPANY

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

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SECTION I

INTRODUCTION

I. INTRODUCTION

1.0 The purpose of this report is to evaluate the effects of a fire in specific zones of the plant and the measures, both existing and proposed, that will mitigate the effects of the fire on the safe operation of the plant. This report supplements the previously submitted evaluation of the overall fire protection program prepared in accordance with the guidelines set forth in Standard Review Plan 9.5.1 and its attached Branch Technical Position (BTP) APCSB 9.5-1. Prior to the submittal, the evaluation report was modified and reformatted to conform with the guidelines set forth in Appendix A to BTP APCSB 9.5-1, dated August 23, 1976. The evaluation responded to Appendix A on a point-by-point basis.

2.0 A fire protection review team from the NRC Division of Operating Reactors made a site visit during the week of November 28, 1977 to evaluate the overall fire protection program. The team requested additional analysis of many areas not specifically addressed in the previously submitted evaluation. By letter dated March 15, 1978, Iowa Electric Light and Power Company (IE) requested Bechtel Associates Professional Corporation to provide an in depth fire hazard analysis of the entire plant.

3.0 Enclosure 2 to the NRC letter dated September 27, 1976 to IE, entitled "Supplementary Guidance on Information Needed for Fire Protection Evaluation" has been utilized as the basic guideline for this report. The report was prepared by a team of fire protection engineers, qualified in accordance with this enclosure.

4.0 The following documents outline the basic criteria used in the preparation of this report:

a. "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," NUREG-75/087, Section 9.5.1, "Fire Protection," May 1976, which includes "Guidelines for Fire Protection for Nuclear Power Plants," (BTP APCSB 9.5-1), May 1, 1976.

b. "Guidelines for Fire Protection for Nuclear Power Plants," (Appendix A to BTP APCSB 9.5-1), August 23, 1976.

c. "Supplementary Guidance on Information Needed for Fire Protection Program Evaluation," September 30, 1976.

d. "Sample Technical Specifications," May 12, 1977.

e. "Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance," June 14, 1977.

f. "Fire Protection Evaluation," Attachment 2 to IE-77-138 submitted to the NRC by IE letter dated January 18, 1977.

g. "RFQ for Fire Hazard Analysis" IE-78-246 from IE to Bechtel February 15, 1978.

h. "Fire Protection Safety Evaluation Report," dated June 1, 1978.

SECTION II

METHODOLOGY

II. METHODOLOGY

1.0 The main portion of the plant is a complex of contiguous buildings comprising six major fire areas. These six areas are separated from each other by vertical fire walls, basically qualified for a 3 hour rating. Because of the complexity of the plant, the major fire areas are not addressed as such but are subdivided into several fire zones for the detailed analysis. Remote structures, specifically the pump house and the intake structure, are likewise divided into fire zones.

1.1 Each fire zone is identified by an alphanumeric designation, keyed to the included drawings, with the building, elevation, floor area in square feet, and the name or function of the zone. The determination of the extent of the zone is based on considerations of the architectural features, the combustible material, the size and configuration of the area, and the potential for the design basis fire (DBF) to remain within the defined boundaries. In general, the numeric designation is assigned to a single level of a large building or an entire smaller building with the letter designating a further subdivision.

1.2 The description of the zone briefly outlines the construction of the floor, walls, and ceiling. Doors are described both by the fire resistance rating and the space with which they communicate. The hourly rating of UL labeled fire doors is indicated. The nonrated doors bear no label and cannot be identified as fire doors. However, the construction of the nonrated doors, frames, and hardware is similar to the labeled (rated) doors and is assumed to be capable of qualifying for a 1 hour rating for use in Class C openings. Other openings in the zone boundaries are described. Conduit and cable penetrations are not addressed on a zone-by-zone basis. Conduit and cable penetrations through major fire barriers are sealed with a 6 inch minimum thickness cellular concrete plug. Other tray penetrations through interior walls are sealed using marinite, kaowool, and fire retardant coatings. No specific fire resistance rating is assigned to the penetrations. In individual cases where the penetrations are judged to be inadequately sealed, modifications are identified in the concluding remarks for the concerned zone. Where adjacent zones are not separated by a wall, the physical features that define the division are described. The ventilation is described in terms of the air supply and exhaust under normal plant operating conditions. The floor drainage within the zones is described.

1.3 The list provided below identifies those systems which could provide core-cooling capability from normal operation in the event of a design basis fire. The list includes both safety-related and nonsafety-related systems which could provide the cooling function. The thrust of the analysis is to evaluate the ability of the plant to achieve and maintain cold shutdown should a design basis fire occur.

DAEC Systems Which Could Provide Core-Cooling Capability

Core Cooling Systems

Condensate and feedwater
RHR
Core spray
RCIC
HPCI
LPCI
CRD supply
RWCU

Support Systems

RHR service water
Emergency service water (secondary)
Well water (secondary)
Circulating water (secondary)
ADS
S/RVs
Main condenser
Suppression pool
Emergency diesel generators
Instrument air system
DC power supply
HVAC room coolers

The list of equipment associated with the above systems is identified in the detailed fire hazards analysis for each zone discussed in Section III. The list of equipment includes if present; divisional cable trays, motor control centers, panels and instrument racks, pumps, major system components, and other equipment. Generally, not all components are included in the list, such as unit heaters, air cooler units, position switches, solenoid valves, and other instruments and devices associated with the major system components. The fire hazards analysis was performed to the system or component level as deemed appropriate to evaluate the consequences of a design basis fire in a given fire zone and to reach the conclusion provided for each zone. However, to be responsive to the guidance provided in Enclosure 2, "Supplementary Guidance on Information Needed for Fire Protection Program Evaluation," a detailed list of all divisional components located within an identified fire zone is included in Appendix A.

1.4 The inventory of combustibles identifies the material, including transients, the quantity present, either by weight, volume, or other identifiable measurement, and the calculated heat release considering total combustion in the normal atmosphere. The combustible loading is the total heat release of all combustibles per unit floor area of the zone. The equivalent severity, expressed in hours, is determined by interpolating the time values indicated in the NFPA Fire Protection Handbook, 14th Edition, Table 6-8A, and is the approximate Standard Fire Test duration of exposure at which the materials and assemblies comprising a fire barrier must withstand without failure.

1.5 The fire protection equipment listed includes the permanently installed fire suppression systems, fire alarm systems, and wet standpipe hose stations, as well as portable fire extinguishers that are permanently sited within the zone. Additional manual equipment is described if it is readily available in an accessible adjacent zone.

1.6 The design basis fire (DBF), described in general terms, is assumed to originate at any location within the zone where combustible materials are present or can reasonably be expected to be present. With ignition assumed, the most likely combustible material to be initially involved is described. Other combustibles exposed to the DBF that may possibly become involved or that probably will be involved are also identified. Any mitigating circumstances that affect the propagation of the DBF are addressed in considering the consequences of the DBF or in the concluding remarks for each zone.

1.7 The consequences of the design basis fire are discussed relative to its effect on performance of the safe shutdown function and consider the zone boundaries, systems, components and equipment both within and exterior to the zone, and the potential for radioactive release to the environs. In zones provided with automatic fire suppression systems, the analysis considers the consequences both with the system operating as designed and with failure of the system to operate properly.

The equivalent severity of the DBF is compared with the expected fire resistance of the zone boundaries to determine if the DBF is capable of propagating beyond the zone.

Where cable trays are present, it is postulated that the DBF will ignite cable insulation in the lowest tray in any one tier and will propagate to all cables in all trays above and horizontally along all involved trays. Horizontal propagation from tray to tray is assumed where trays are routed less than 3 feet apart or if some combustible path can be assumed to be present. Tray-to-tray propagation is not postulated where the horizontal separation is in excess of 3 feet and it can be reasonably postulated that no combustible path will be present. The effect of a cable tray fire on safeguard systems is discussed in detail but no attempt is made to identify all circuits that may be affected.

The normal ventilation system is designed to monitor and control radioactive release to the environs. The use of the normal system for smoke removal provides means for monitoring and controlling any fire generated releases. The adequacy of the normal system to remove such smoke is evaluated considering the air flow patterns and the amount of smoke expected to be generated by the DBF in the involved zone. Considering the above, the releases to the environs will be a small fraction of 10 CFR 100. The smoke removal capability of the ventilation system is assessed based on normal fan and damper alignment. No credit is taken for additional exhaust capability either from redundant exhaust fans or damper realignment. Where the venting capability is judged to be less than adequate, the use of portable smoke ejectors is proposed to remove smoke from the

vicinity of the fire for eventual exhaust by the normal ventilation system.

The floor drainage is considered adequate if the drainage provided will dispose of the expected automatic system or hose stream discharge without ponding in excess of approximately 2 inches deep. Radioactive materials entrained in fire protection water drainage will be normally collected and processed by the liquid radwaste system prior to release to the environment.

1.8 The adequacy of the presently provided fire protection program is assessed in the concluding remarks for each zone. Any mitigating circumstances that reduce the apparent potential for the occurrence of the DBF or its severity are discussed as are certain modifications presently proposed to upgrade the fire protection.

Where the analysis indicates that less than adequate protection exists or is currently proposed, additional modifications are suggested.

2.0 The combustible material inventory within a given zone is developed by examination of drawings and equipment specifications, as well as a physical survey of the plant. The inventory is limited to materials available as fuel for the DBF. Combustibles subject only to pyrolysis, such as cable insulation in metallic conduit or Class A materials contained in capped metal drums, contribute little if any fuel to the DBF and are excluded from the inventory. Lubricating oil contained in the reservoirs of large electric motors and other equipment as well as fuel oil is included in the inventory, as the oil is subject to spillage during maintenance operations or from a rupture in the equipment. The quantity of transient combustibles in a fire zone is variable with the greatest amount expected during a refueling outage. The inventory of transients is based on a survey made during such an outage.

2.1 The quantity of cable insulation in the inventory and the heat release are computed from information obtained from the electrical raceway drawings, raceway schedule, calculated unit weights, and calorific values.

The electrical raceway drawings are used to identify all the cable trays in the fire zone and a tabulation is made of each tray section. The electrical raceway schedule provides the actual installed tray section length in feet and the sum of the cross-sectional area in square inches of all cables routed either partially or entirely through each tray section. These two values are tabulated and the cable volume is computed for each section. The summation is the total cable volume in the zone and, for convenience, is expressed in units of inches squared feet.

The majority of the circuits routed in cable trays throughout the plant utilize single- and multiconductor cable manufactured by The Okonite Company with "Okonite" EPR insulation and "Okoprene" neoprene jacketing. The weight of the insulating, jacketing, and filler materials per unit cable volume was computed by deducting

the total weight of the copper conductor from the total cable weight per foot length and dividing by the cross-sectional area of the cable. A unit weight thus obtained was expressed in pounds per inch squared foot. The unit weight value for 15 multiconductor cables ranged between 0.3904 and 0.5995 and for eleven single conductor cables ranged between 0.2607 and 0.4598. Since the majority of the cables are multiconductor, the single conductor values were disregarded and a conservative average unit weight of 0.5141 pound per inch squared foot was determined from the arithmetic mean of the 15 multiconductor values and used for all cables.

An average calorific value for the composite cable insulating materials was calculated using a nine conductor, No. 14 AWG cable as a model since its insulation unit weight of 0.5063 pound per inch squared foot most nearly approached the average value of 0.5141. A total insulation weight per foot of cable was calculated using a density of 74.9 pounds per cubic foot for the EPR. The total jacketing weight for the conductors and complete cable was calculated using a density of 99.8 pounds per cubic foot for the neoprene. The calculated weights of the copper, insulation, and jacketing were deducted from the total cable weight to determine the weight of the filler materials. Based on calorific values of 10,000 Btu per pound for EPR, 9,850 Btu per pound for neoprene, and a conservative 12,250 Btu per pound for fillers, tape, etc, an average heat release of 10,387 Btu per pound was computed for the composite cable insulation.

The total weight of cable insulating materials in each zone is determined by multiplying the total tabulated cable volume by the average insulation unit weight (rounded off to 0.51 pound per inch squared foot) and this weight is multiplied by the average calorific value (rounded off to 10,400 Btu per pound) to determine the total heat release of the cable insulation in the zone.

2.2 The inventory of combustible and flammable liquids considers both liquid fuels and lubricants. The quantity of lubrication oil includes that contained in large electric motors as well as reservoirs, conditioning equipment, and oil coolers. The quantity of fuel oil within a zone is assumed to be the rated capacity of the storage or day tank.

The calorific value of lubricating oils is a variable dependent upon the formulation of the various petroleum fractions and the additives. A rounded off value of 145,000 Btu per gallon is used in the analysis based on the heat of combustion of SAE 40 lubricating oil of 144,606 Btu per gallon derived from Table 3-11G in the NFPA Fire Protection Handbook, 14th Edition. Table 7-3B in the handbook lists a range of 135,800 to 141,800 Btu per gallon for No. 2 fuel oil. A rounded off value of 142,000 Btu per gallon is used as a conservative heat release for the diesel oil.

2.3 The transient combustible inventory for a zone is an estimate of the quantity of materials present that are not a part of the permanent installation. The materials include wood and paper products used for packaging and crating, clean and used

protective clothing, containers of solvents and lubricants, temporary barricades, and sheet plastic shrouding.

The estimated weight of ordinary Class A combustibles, including nominal amounts of sheet plastic used for wrapping or bagging, is tabulated and an average calorific value of 8,000 Btu per pound is used to determine the estimated heat release.

The quantity of protective clothing in the various change areas is tabulated by sets based on the estimated number of coveralls observed. The total estimated weight of coveralls, hoods, cotton gloves, rubber gloves, and plastic shoe covers with the calorific values for cotton, rubber, and PVC determined a combined heat release of 14,281 Btu per set. The total heat release of one pair of rubber overshoes and rubber gloves was calculated to be 7,900 Btu. Based on one pair of overshoes and gloves for each five sets of coveralls, etc, a composite heat release of 15,861 Btu per set was determined. A rounded off value of 16,000 Btu per set is used in the analysis.

Other transient combustibles are identified and tabulated by container size or estimated weight. Containers of flammable or combustible liquids are assumed to be filled to capacity and a conservative value of 145,000 Btu per gallon is used for determining the expected heat release as this value is the highest of all such liquids observed. The quantity of sheet plastic shrouding is estimated considering both the material in use and stocks in the zone available for additional shrouding. A conservative heat release of 20,000 Btu per pound is used for shrouding based on the value for high-density polyethylene.

SECTION III

DETAILED FIRE HAZARDS ANALYSIS

III. Detailed Fire Hazard Analysis

Fire Zone 1-A

Reactor Building - El 716'-9" - FHA-M-1 - 10,815 square feet - Torus Area

Description of Zone

Concrete floor and walls with 36 inch concrete slab ceiling. Nonrated watertight doors communicate with Zones 1-B and 1-D and nonrated hollow steel door communicates with Zone 1-C. Ventilation ducts are provided with 1-1/2 hour fire dampers at wall penetrations.

Equipment in Zone

Torus
Safety-related cable trays, Divisions I and II

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	485 lb	5,038,800
Miscellaneous transients (planks)	500 lb (est)	4,000,000
	Total	9,038,800

Combustible loading - 836 Btu/sq ft
Equivalent severity - 0.01 hr

Fire Protection Equipment

None provided within the zone. Portable extinguishers available in adjacent zones. Hose stations in Zones 2-A and 2-B on the 757'-6" level available for fire brigade use with additional hose lengths. During any welding operations, portable extinguishers will be brought to the vicinity of the operations.

Design Basis Fire

Ignition of transient combustibles due to welding operations with the possibility of involvement of nearby cable in trays of one division.

Consequences of Design Basis Fire

The extremely low combustible loading precludes the propagation of the DBF beyond the immediate vicinity of ignition. The safety related cable trays of either division are sufficiently remote from the other division to preclude loss of function of redundant equipment required for safe shutdown of the plant. The water within the torus will dissipate sufficient heat to prevent damage to the torus shell. The normal ventilation system is capable of removing smoke generated by the DBF.

Conclusion

The DBF will not affect the capability to achieve cold shutdown and no modifications are proposed or needed.

Fire Zone 1-B

Reactor Building - El 716'-9" - FHA-M-1 - 644 square feet - Northwest Corner Room

Description of Zone

Reinforced concrete floor and walls with 24 inch concrete ceiling slab on fluted metal decking supported on lower flange of structural steel beams. A nonrated watertight door communicates with torus area, Zone 1-A, and a 1-1/2 hour fire door in stair enclosure communicates with Zone 2-A above. Ventilation duct penetrations are provided with 1-1/2 hour fire dampers.

Equipment in Zone

Division II RHR pumps and heat exchanger
Division II core spray pump
Room air cooler
Associated instrumentation, controls, and cable trays

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	78.1 lb	812,240
Lubricating oil	32.5 gal	4,712,500
	Total	5,524,740

Combustible loading - 8,579 Btu/sq ft
Equivalent severity - 0.11 hr

Fire Protection Equipment

Portable extinguisher within the zone. Portable extinguishers available in Zone 2-A above. Hose station in Zone 2-A available for fire brigade use with additional hose lengths.

Design Basis Fire

Ignition of lubricating oil spill from one RHR pump motor resulting in possible involvement of cable insulation and oil in the other two motors.

Consequences of Design Basis Fire

The low combustible loading based on all combustibles within the zone is insufficient to cause breaching of the barrier defining the zone. The DBF may cause loss of function of Division II RHR and core spray pumps. Redundant Division I RHR and Core Spray pumps will provide means to achieve orderly safe shutdown. The normal ventilation system provides means to evacuate smoke from the zone.

Conclusions

The DBF will not affect the capability to achieve and maintain cold shutdown. The proposed addition of ionization smoke detection within the space and additional attached length of hand hose in Zone 2-A will provide early warning of a fire in Zone 1-B and enhance the capability for early control and extinguishment.

Fire Zone 1-C

Reactor Building - El 716'-9" - FHA-M-1 - 644 square feet - Northeast Corner Room

Description of Zone

Reinforced concrete floor and walls with 10-1/2 inch concrete slab ceiling on fluted metal decking on top of structural steel supporting beams. Nonrated metal door communicates with Zone 1-A at elevation 735'-7-1/2" and a 1-1/2 hour door in stair enclosure communicates with Zone 2-A above. Ventilation ducts are provided with 1-1/2 hour fire dampers at wall and ceiling penetrations.

Equipment in Zone

Torus vacuum breakers and isolation valves
Safety-related cable trays, Divisions I and II
Recirculation system instrument rack 1C57

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	803.7 lb	8,358,480

Combustible loading - 12,979 Btu/sq ft
Equivalent severity - 0.16 hr

Fire Protection Equipment

None within the zone. Portable extinguishers and standpipe hose available in Zone 2-A above.

Design Basis Fire

Ignition of cable insulation in one cable tray resulting in total involvement of all cable within the tray with probable involvement of adjacent or nearby trays. Because of the absence of combustible pathways between groups of trays, three separate DBFs are postulated but total involvement of all cabling within the zone is not postulated.

Consequences of Design Basis Fire

1. The low combustible loading within the zone precludes the propagation of the DBF beyond the boundaries of the zone.

2. Cable trays 2H2D and 2H8A are at elevation 730'-1" and are separated by 1'-6". One tray contains the 4,160 volt power feeders from Division II emergency diesel generator, 1G21, and the other carries 600 volt or less power and control cable for the generator and auxiliaries. A fire involving either tray is expected to cause loss of function of the Division II emergency diesel generator. The DBF involving the Division II trays is not postulated to involve the Division I trays because of the horizontal separation of 13'-5" between the two divisions with no combustible path. The DBF will not affect the availability of the two separate sources of offsite power for Division II safety functions.

3. Trays 1H1A, 1H1B, and 1H5A are at elevation 730'-1" also and serve the Division I emergency diesel generator, 1G31, with DBF consequences similar to those for Division II. Additionally, a fire involving tray 1H5A may expose cables serving the RCIC system causing loss of automatic control of the RCIC system. No adverse effects will result because the HPC1 system and the Division II core standby cooling system components will remain functional.

4. The third DBF would be one involving one or more of three vertical trays, 1H1C, 1H1D, and 1H1E, which are in close proximity to each other but separated by 12'-0" from the nearest of the second group of trays in Division I and by 20'-0" from the nearest Division II tray. The DBF involving these three trays is expected to cause loss of power to Division I RHR and core spray pumps and loss of Division I 4,160 volt power from standby transformer 1X4.

5. Two of the three DBFs may cause heating of conduits with degradation of controls to the vacuum breaker isolation valves. The isolation valves will "fail open" and thus not cause loss of function of the vacuum breakers.

6. Although the space is not vented by the normal reactor building exhaust system, the space may be effectively vented through the doorway at elevation 735'-7-1/2" into Zone 1-A.

Conclusions

None of the three separate DBFs postulated will affect the capability to achieve and maintain cold shutdown. The door to the torus area at elevation 735'-7-1/2" is used for normal access to the torus area and from time to time used protective clothing may be discarded in the vicinity creating a source of ignition. No additional fire protection has been proposed for this area in previous evaluations; however, the installation of an ionization smoke detector and provision of a portable fire extinguisher in the zone are recommended to provide early detection and prompt control of any fire that may develop.

The proposed portable smoke ejectors will effectively purge smoke from the zone.

Fire Zone 1-D

Reactor Building - El 716'-9" - FHA-M-1 - 644 square feet - Southeast Corner Room

Description of Zone

Reinforced floor and walls with 24 inch concrete ceiling slab on fluted metal decking supported on the lower flange of the structural steel beams. A nonrated watertight door communicates with the torus area, Zone 1-A, and 1-1/2 hour fire doors communicate with stairwell 3 at elevation 747'-0" and the HPCI room, Zone 1-E, at elevation 716'-9". The ventilation duct penetrations are provided with 1-1/2 hour fire damper.

Equipment in Zone

Division I RHR pumps and heat exchanger
Division I core spray pump
Room air cooler
Associated instrumentation, controls, and cable trays

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	203.8 lb	2,119,520
Lubricating oil	32.5 gal	4,712,500
	Total	6,832,020

Combustible loading - 10,608 Btu/sq ft
Equivalent severity - 0.133 hr

Fire Protection Equipment

Portable extinguisher within the zone. Portable extinguishers available in adjacent Zone 1-E and in 2-A above. Hose station in Zone 2-A above available for fire brigade use with additional hose lengths.

Design Basis Fire

Ignition of lubricating oil spill from one pump motor resulting in possible involvement of cable insulation and oil in the other pump motors.

Consequences of Design Basis Fire

The low combustible loading is insufficient to breach the boundaries of the zone. The DBF may cause loss of function of Division I RHR and core spray pumps. Redundant Division II equipment will provide means to achieve safe shutdown. The normal ventilation exhaust by exfiltration may not effectively remove the smoke. The heat from the DBF may damage cable in conduit supplying power to supply fans 1V-SF-10B and 22B resulting in loss of function of the fans. No adverse effects will result as redundant fans are available.

Conclusions

The DBF will not affect the capability to achieve and maintain cold shutdown. The proposed addition of ionization smoke detectors within the space, the additional hose station in corridor 353 at elevation 747', and the additional hose length on the hose reel in Zone 2-B will provide early warning of a fire in the zone and enhance the extinguishing capability. The proposed portable smoke ejectors will effectively remove the smoke.

Fire Zone 1-E

Reactor Building - El 716'-9" - FHA-M-1 - 1,428 square feet - HPCI Room

Description of Zone

Below grade room with concrete floor, concrete block and reinforced concrete walls, and 36 inch reinforced concrete ceiling on fluted metal decking supported on lower flange of supporting structural steel. A steel grating platform at elevation 747'-0" communicates with corridor 353 via a nonrated hollow steel door. A 1-1/2 hour fire door communicates with the stairway entrance at elevation 716'-9". Ventilation penetrations are provided with 1-1/2 hour fire dampers.

Equipment in Zone

HPCI pump and turbine
Space air cooler
Associated instrumentation, controls, and cable trays

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	879.9 lb	9,150,960
Lubricating oil	155 gal	22,475,000
	Total	31,625,960

Combustible loading - 22,147 Btu/sq ft
Equivalent severity - 0.277 hr

Fire Protection Equipment

Automatic deluge sprinkler system with rate of rise thermal actuation. Portable extinguisher within the zone and portable extinguishers available in adjacent zones.

Design Basis Fire

Ignition of oil spill with possible involvement of cable insulation.

Consequences of Design Basis Fire

1. The installed automatic deluge sprinkler system is expected to actuate shortly following ignition of the DBF and promptly control the spread of the fire. Actuation of the system will be annunciated in the control room alerting the fire brigade for final extinguishment if required. Floor drains will carry off the discharged water. Since the ventilation exhaust from the space is by exfiltration, the normal ventilation system may not effectively remove the smoke.

2. In the unlikely event the automatic system does not actuate, portable extinguishers may be effective in controlling and extinguishing the fire. In event the DBF is not controlled, loss of function of the HPCI system is to be expected. If the DBF were to involve cable tray 2K6A it is possible to lose the function of one of the redundant off-gas stack dilution fans.

3. The low combustible loading is insufficient to breach the zone boundaries.

Conclusions

The DBF will not affect the capability to achieve and maintain cold shutdown because other systems will be available. The redundant dilution fan will be available to effectively discharge the off-gas from the stack. The proposed relocation of the deluge valve manual actuator to corridor 353 will provide means for discharging the system from outside the space should the detection system fail to trip the deluge valve. The proposed addition of a hose station in corridor 353 at elevation 747'-0" will provide the fire brigade with ready means for control and extinguishment should the deluge system be impaired. The proposed portable smoke ejectors will effectively remove the smoke.

Fire Zone 1-F

Reactor Building - El 716'-9" - FHA-M-1 - 840 square feet - RCIC Room

Description of Zone

Below grade room with concrete floor and walls and 30 inch reinforced concrete slab ceiling on fluted metal decking with partially exposed structural steel beams. Open metal stairway communicates with Zone 1-H above with a 1-1/2 hour fire door isolating both zones from corridor 353 at elevation 747'-0". Ventilation opening above fire door provided with 1 1/2 hour fire damper.

Equipment in Zone

RCIC pump and turbine
Space air cooler
Floor and equipment sumps and sump pumps
Associated instrumentation, controls, and cable trays

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	230.7 lb	2,399,280
Lubricating oil	2.5 gal	362,500
	Total	2,761,780

Combustible loading - 3,288 Btu/sq ft
Equivalent severity - 0.04 hr

Fire Protection Equipment

Automatic deluge sprinkler system with rate of rise thermal actuation. Portable extinguisher within the zone and portable extinguishers available in nearby zones.

Design Basis Fire

Ignition of oil spill with possible involvement of cable insulation.

Consequences of Design Basis Fire

1. The installed automatic deluge sprinkler system is expected to actuate shortly following ignition of the DBF and promptly control the spread of the fire. Actuation of the system will be annunciated in the control room alerting the fire brigade for final extinguishment if required. Floor drains will collect the discharged water and conduct it to the floor drain sump for pumping to the radwaste collection tank. Since the ventilation exhaust from the space is by exfiltration, the normal ventilation system will not effectively remove the smoke.

2. In the unlikely event the automatic deluge system does not actuate, portable extinguishers may be effective in controlling and extinguishing the fire. If the DBF is not controlled, loss of function of the RCIC system is to be expected. The limited amount of lubricating oil will not develop a spill sufficient to cause exposure damage to the floor drain sump pumps or the

equipment drain sump pumps. Cable tray 1K5A may become involved and interrupt the power supply to one set of redundant pumps. The power supply for the other set of pumps is in conduit and independent of tray 1K5A.

3. The extremely low combustible loading is insufficient to cause propagation of the DBF beyond the confines of the zone and expose other equipment.

Conclusions

The DBF will not affect the capability to achieve and maintain cold shutdown because other systems will be available. The DBF will not cause loss of function of the waste collection system because redundant pumps are available. The proposed relocation of the deluge valve manual actuator outside the zone will provide for safe manual tripping of the deluge valve should the detection system fail to function. The proposed addition of a hose station in corridor 353 will provide the fire brigade with ready means for control and extinguishment should the deluge system be impaired. The proposed portable smoke ejectors will effectively vent the smoke from the zone.

Fire Zone 1-G

Reactor Building - El 735'-7-1/2" - FHA-M-1 - 524 square feet - Southwest Corner Room

Description of Zone

Concrete block and reinforced concrete walls with 12 inch reinforced concrete floor on fluted metal decking on exposed structural steel. Reinforced concrete ceiling 2'-0" thick on fluted metal decking supported on lower flange of structural steel beams. Concrete block enclosed stairwell with 1-1/2 hour fire doors communicates with waste and floor drain pump room 203 below and Zone 2-B above. Ventilation exhaust opening into Zone 1-A provided with 1-1/2 hour fire dampers. Ventilation air inlet in stairwell wall provided with back draft dampers without fire dampers.

Equipment in Zone

CRD water pumps A and B
Recirculation system instrument rack 1C58
Space air cooler
Associated instrumentation, controls, and cable trays

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	15.33 lb	159,432
Lubricating oil	1.5 gal	217,500
	Total	428,620

Combustible loading - 818 Btu/sq ft
Equivalent severity - 0.01 hr

Fire Protection Equipment

Portable extinguisher within zone. Portable extinguishers available in room below and in Zone 2-B above. Hose stations in Zone 2-B available with additional hose length.

Design Basis Fire

Ignition of oil spill from one pump motor without involvement of other motor or any cabling.

Consequences of Postulated Fire

The combustible loading in the space is insufficient to breach the boundaries of the zone. The physical separation of the two CRD pump motors is in excess of 9 feet with a 4 inch floor drain in the spill path. The DBF, involving only 3 quarts of oil, is of insufficient intensity to involve the other motor or to involve the cabling in the trays or conduit. The redundant CRD pump and the accumulators provide means to insert the control rods. Any smoke generated by the DBF will be exhausted by the normal building ventilation system.

Conclusions

The DBF will not affect the capability to achieve and maintain cold shutdown. The proposed addition of ionization smoke detectors and additional attached length of hose for the hose stations in Zone 2-B will provide early warning of a fire and increase the capability to extinguish any fire that may develop in the zone.

Fire Zone 1-H

Reactor Building - El 736'-4" - FHA-M-1 - 616 square feet - Radwaste Tank Room

Description of Zone

Reinforced concrete floor and walls with 36 inch concrete ceiling on fluted metal decking supported on the lower flange of partially exposed structural steel beams. Nonrated hollow steel door communicates with open steel stairway to Zone 1-F below with a 1-1/2 hour fire door separating both zones from corridor 353. Ventilation is provided by exhaust from the off-gas retention building, Zone 15-A (4,700 cfm), and the recombiner building, Zone 2-E above (5,700 cfm), passing through the zone and exhausting through a 36 square foot opening into the torus area, Zone 1-A. The 30 inch diameter duct from Zone 15-A is provided with isolation dampers. No other dampers are provided in the ventilation system.

Equipment in Zone

Radwaste and floor drain collector tanks
Radwaste and floor drain collector pumps
Associated instrumentation, controls, and cable trays

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	233.4 lb	2,427,360
	Total	2,427,360

Combustible loading - 3,941 Btu/sq ft
Equivalent severity - 0.05 hr

Fire Protection Equipment

None provided within the zone. Portable extinguishers available in nearby zones.

Design Basis Fire

Ignition of cable insulation from electrical overload.

Consequences of Design Basis Fire

Cable tray 1K5D contains low voltage power and control cable for the collector pumps within the space and for one of the redundant off-gas stack dilution fans. The DBF caused by electrical overload of a cable within tray 1K5D is expected to cause loss of function of the two collector pumps and one of the stack dilution fans. The normal ventilation system will effectively remove smoke from the zone. Cable tray 1K5D is a minimum of 7'-0" from the near edge of the 36 square foot opening. The low combustible loading is insufficient to cause propagation of the DBF beyond the boundaries of the zone.

Conclusions

The DBF will not affect any systems essential for achieving or maintaining cold shutdown. The redundant dilution fan will be available to effectively discharge the off gas from the stack. The proposed addition of a hose station in corridor 353 will enhance the capability to extinguish any fire that may develop within the zone.

Fire Zone 2-A

Reactor Building - El 757'-6" - FHA-M-2 - 6,164 square feet - North CRD Module Area

Description of Zone

North half of reactor building. Reinforced concrete floor. Three hour rated concrete walls on west, north, and east sides separate the zone from the radwaste, control, office, and turbine buildings. The south wall is reinforced concrete separating the zone from the main steam valve chamber and the primary containment. A 30 inch concrete block wall with a nonrated door separates the RHR valve room, Zone 2-D, from the zone. Exposed structural steel with 1-1/2 inch fluted metal decking supports reinforced concrete ceiling varying in thickness from 9 to 36 inches. The separation between Zones 2-A and 2-B is not a wall but is defined by a 9 foot wide masonry walled pipe tunnel extending 6'-6" below the bottom of the embedded 36 inch structural steel beams. The cable trays between the zones pass through the masonry walls and are fire stopped. Stair enclosures and the air lock communicating with access control are provided with 1-1/2 hour fire doors. The doors to the CRD repair room, Zone 1-C, and the stair enclosure down to the northeast corner room, Zone 1-C, are nonrated hollow metal. Nine 4 inch floor drains are dispersed throughout the zone. Ventilation for the zone is provided by 2,700 cfm outside air from the supply fan room, Zone 4-E. The exhaust from the zone is provided by 6,525 cfm air ducted to the torus area and 2,400 cfm air through three wall penetrations to zones of higher radiation levels. The excess is made up by natural flow from Zone 2-B. No fire dampers are provided but all exhaust openings are provided with backdraft dampers.

Equipment in Zone

North CRD modules with associated instrumentation and controls
250 volt MCC 1D42 - Essential
480 volt MCC 1B43 - Nonessential
480 volt MCC 1B44 - Essential
Safety-related cable trays, Divisions I and II
Drywell cooling system backwash pump
Racks and panels 1C-121A,B - jet pump racks
1C-126A - main steam rack
1C-208 - remote shutdown panel
1C-55 - reactor vessel level and pressure instruments
1C-55A - reactor vessel level and pressure instruments
1C-64 - SRM-IRM drive control cabinet
1C-76A - SRM preamplifier cabinet
1C-77A,C - IRM preamplifier cabinet
1C-183 - reactor building vent stack radiation monitor A
1C-184 - reactor building vent stack radiation monitor B
1C-193B,D - main steam line leak detection
1C-145 - MSIV leakage control system rack
Drywell purge fan

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	15,939 lb	165,765,540
Miscellaneous transient combustibles	2,000 lb(est)	16,000,000
Anti-contamination clothing	500 sets	8,000,000
	Total	189,765,540

Combustible loading - 30,786 Btu/sq ft
Equivalent severity - 0.38 hr

Fire Protection Equipment

Portable extinguishers and two hose stations within the zone. Portable extinguishers available in adjacent zones. Hose station in Zone 2-B available for fire brigade use with additional hose length.

Design Basis Fire

Ignition of transient combustibles resulting in involvement of cable insulation in one or more cable trays.

Consequences of Design Basis Fire

1. The equivalent severity of the DBF is insufficient to breach the boundaries of the zone with the exception of the approximate 300 square foot open communication with Zone 2-B. Propagation through this opening is highly unlikely because of the normal airflow patterns and the lack of a combustible pathway. The cable tray penetrations through the suspended pipe tunnel form an effective fire stop to prevent propagation along the cables.

2. The DBF is postulated to involve one or more cable trays in the zone. The majority of the tray runs within the zone are Division II or nondivisional. However, there are five Division I trays in two separate areas of the zone. Three Division I trays carry low voltage (600 V) power and control cables from Zone 3-A above to drywell electrical penetrations. These three stacked trays are separated by a minimum of 13 feet horizontally from any Division II tray and 9 feet horizontally and 11 feet vertically from tray L6T serving the north CRD modules. These separations are sufficient to prevent tray-to-tray propagation. The CRD modules occupy the floor space between the three Division I trays and the other trays, thus precluding the accumulation of transient combustibles sufficient to cause involvement of the two divisions in the same fire.

3. Two low voltage (600 V) power feeder trays are located near the cast wall of the zone. These two trays, 1L3A and 1M3A, are stacked and run parallel to a stack of three Division II trays and are separated by 5'-6" horizontally and are 5'-3" below the Division II trays. Both sets of trays cross the main access corridor to the turbine building airlock and pass over the roof of the CRD repair room. The narrowness of the passage precludes the accumulation of transient combustibles beneath the trays and the separation is sufficient to prevent exposure of the Division I trays to a fire in the Division II stack of trays. An accumulation of transient combustibles on the roof of the CRD

repair room is highly unlikely because of the lack of fixed means of access to the 14'-4" high roof top. In event sufficient transients were to accumulate and ignite, damage to trays in both divisions is possible. Tray 1L3A contains 480 volt power feeders to essential MCC 1B34. Tray 1M3A carries 125 volt dc power feeders to MCC 1D14 (RCIC system) and 480 volt ac power feeders to Division I HVAC chiller starter and nonessential MCCs 1B35, 1B53, and 1B54. It must be postulated that a fire involving either tray 1L3A or 1M3A will cause loss of function of one or more of the MCCs or equipment listed above and may propagate to the nearby Division II trays. This improbable fire is not considered the DBF.

4. It must be postulated that the DBF will cause exposure damage to one or more safety-related MCCs, instrument racks, control panels, or cable trays, resulting in loss of function of one or more Division II safety-related systems.

5. The normal building ventilation system will effectively remove smoke generated by the DBF. Increased exhaust capacity may be provided by operation of both reactor building exhaust fans and an additional building exhaust stack fan. Isolation of the exhaust from the off-gas retention building to the torus area will further increase the airflow from the involved zone. The power supply and controls for the exhaust fans do not run through the zone. The exhaust is monitored for radioactive release to the environs.

Conclusions

1. The DBF, if undetected or if suppression activities are not undertaken, has the capability of causing loss of function of redundant systems and equipment essential for achieving and maintaining cold shutdown. However, since the concerned area is the main controlled access to the reactor building and the turbine building, a fire of any consequence would be detected by plant personnel in their normal activities. A normal delay in fire brigade response would not result in the DBF exposing redundant circuits in both Division I and Division II because of a minimum separation of 43 feet between the redundant power feeders and 13 feet minimum between Division I and Division II low voltage power and control cable trays. With normal fire brigade response, the DBF will not affect the capability to achieve and maintain cold shutdown.

2. The proposed installation of smoke detection throughout the zone will provide early warning of the existence of a fire condition. The proposed increase in the length of the hose attached to the two hose station in the zone will increase the capability for early extinguishment of any fire that may develop.

3. The high level of transient combustibles observed in the zone was due to the survey being conducted during a refueling outage. The quantity will be less during periods of normal operation.

Fire Zone 2-B

Reactor Building - El 757'-6" - FHA-M-2 - 6,164 square feet - South CRD Module Area and Railroad Bay

Description of Zone

South half of reactor building. Basic construction of the zone is similar to Zone 2-A. A 3 hour door isolates the airlock to the turbine building. An open stairwell leads down to Zones 1-D and 1-E with isolation provided by both nonrated and 1-1/2 hour fire rated doors and provides direct communication with corridor 353 at elevation 747'-0". An open stairwell communicates with Zone 1-G below with 1-1/2 hour fire doors isolating the stairwell from all spaces below the top of the stairs. Nonrated hollow steel doors communicate with the drywell access space, the neutron monitor room, the recombiner building HVAC room, and an airlock providing egress to the exterior. The airlock communicates with a stairway to the upper floors through a 1-1/2 hour fire door, and to the recombiner building exhaust fan room, Zone 2-E, and to the exterior through nonrated doors. Oversized, airtight doors, provided with a nonrated mandoor, communicate with the railroad airlock, Zone 2-F. An enclosed elevator shaft with nonrated doors communicates with all levels above Zone 2-B. An open equipment hatch, 19 feet square, penetrates the ceiling and each floor level above including the refueling floor. Ten 4 inch floor drains are dispersed throughout the zone. Ventilation for the zone is provided by 6,900 cfm outside air ducted from the supply fan room, Zone 4-E, and 24,045 cfm controlled airflow from the floors above. Exhaust from the zone is by induced flow through various zones, generally of higher radiation levels, for eventual discharge through the torus area, Zone 1-A, or direct ducting to the exhaust fan room. Approximately 6,200 cfm natural airflow crosses the open separation between Zone 2-B and Zone 2-A prior to being ducted to the torus area. Backdraft dampers are provided in wall penetrations and ducted exhaust paths with isolation dampers provided in ducts penetrating the reactor building wall. No fire dampers are provided in any ductwork other than the fire dampers at the penetrations from the open stairwell into the HPCI, RCIC, and RHR pump rooms, Zones 1-D, 1-E, and 1-F.

Equipment in Zone

South CRD modules with associated instrumentation and controls
CRD master control
CAD nitrogen compressor, associated instrumentation, and controls
TIP drive mechanism
250 V dc MCC 1D41 (HPCI)
Panels and racks 1C-122A,B,C - jet pump racks
1C-126B - main steam rack
1C-76B - SRM preamplifier cabinet
1C-77B,D - IRM preamplifier cabinet
1C-181 - steam tunnel cooling unit
1C-193A,C - main steam line leak detection
1C-218A - primary containment oxygen analyzer
1C-219A - primary containment radiation monitoring rack
Main steam valve chamber air coolers

Safety-related cable trays, Division II

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	8,267 lb	85,976,800
Anti-contamination clothing (dirty)	200 sets (est)	3,200,000
Miscellaneous transient combustibles	1,500 lb (est)	12,000,000
	Total	101,176,800

Combustible loading - 16,414 Btu/sq ft
Equivalent severity - 0.21 hr

Fire Protection Equipment

Portable extinguishers and one hose station within the zone. Portable extinguishers and hose station available in adjacent Zone 2-A. Hydrant hose lines available through egress airlock and railroad airlock along south wall of the zone.

Design Basis Fire

Ignition of transient combustibles resulting in involvement of cable insulation in one or more safety-related cable tray.

Consequences of Design Basis Fire

1. The equivalent severity of the DBF is insufficient to breach the boundaries of the zone with the possible exception of the approximate 300 square foot open communication to Zone 2-A and the open equipment hatch communicating with floors above. Propagation of a cable fire along the trays into Zone 2-A is highly unlikely as the trays pass through the suspended pipe tunnel which forms an effective fire stop. The normal airflow is from Zone 2-B toward Zone 2-A with a velocity of approximately 21 feet per minute and accounts for approximately 20% of the normal exhaust from the zone. In the event the DBF were to originate in transient combustibles sited in the vicinity of the open division between the zones, the airflow may be sufficient to cause propagation into Zone 2-A.

2. One tier of three 24 inch trays is routed along the north edge of the open equipment hatch approximately 6 inches from the edge for a distance of approximately 10 feet. The total loading of the tier is approximately 23.6 pounds of cable insulation per linear foot. The normal airflow downward through the hatch and thence northward toward Zone 2-A will tend to cause the heated products of combustion to be directed away from the hatch. The top tray in the tier, at elevation 781'-2", is 20'-8" below the plane of the nearest trays in Zone 3-B above which are routed 5'-8" from the east edge of the hatch. Additionally, the trays in Zone 3-B are in excess of 44 feet above the floor of Zone 2-B. This spatial separation of the nearest exposure in Zone 3-B precludes the propagation of any postulated fire in Zone 2-B through the hatch into the adjacent Zone 3-B.

3. It is postulated that the DBF will expose and cause damage to certain Division II cable trays, instrument racks, and panels resulting in loss of function of some Division II safeguard

systems. No adverse effects are postulated because of the availability of redundant Division I safeguard systems. In addition, the DBF may expose and cause loss of function of the CAD system nitrogen compressor and the TIP drive units.

4. The normal building ventilation system will effectively remove smoke generated by the DBF as described for Zone 2-A.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The proposed installation of ionization smoke detection within the zone will provide early warning of an incipient fire in the zone. The proposed increase in the attached hose length will enhance the capability for early control and extinguishment.

3. The hose station nearby in Zone 2-A will be effective in preventing propagation of a fire from this zone into Zone 2-A.

4. The inventory of transient combustibles tabulated in this analysis during a refueling outage will be less during periods of normal operation.

Fire Zone 2-C

Reactor Building - El 757'-6" - FHA-M-2 - 962 square feet - CRD Repair Room

Description of Zone

A low room inside Zone 2-A with reinforced concrete floor, reinforced concrete and concrete block walls, and a 6 inch reinforced concrete ceiling formed by fluted metal decking supported on 18 inch exposed structural framing. A 6 foot wide doorway with double nonrated hollow steel doors communicates with Zone 2-A. The top of the roof is 14'-4" above the floor and approximately 10 feet below the structural framing of Zone 2-A. Ventilation is provided by a wall penetration from Zone 2-A and a ducted exhaust into the torus area below with an airflow of 900 cfm. Both are equipped with backdraft dampers but no fire dampers are provided. The zone is provided with one 4 inch floor drain.

Equipment in Zone

Accumulators 1R-2A,B,C,D (outboard MSIVs)

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	None exposed	Nil
Plastic packaging (parts)	5 lb	100,000
Cleaning solvent (transient)	5 gal	657,800
	Total	757,800

Combustible loading - 788 Btu/sq ft
Equivalent severity - 0.01 hr

Fire Protection Equipment

None within the zone. Portable extinguishers and hose station nearby in Zone 2-A.

Design Basis Fire

Ignition of transient cleaning solvent spill with involvement of the plastic bag shrouding equipment.

Consequences of Design Basis Fire

The combustible loading, consisting of transients, is insufficient to breach the boundaries of the zone. The 4 inch floor drain discharges into a sump below the waterline to form an effective fire stop to preclude propagation of the DBF into other zones via the drainage system. The small quantity of solvent present in the zone at any time is insufficient to cause any exposure damage to the outboard main steam isolation valve (MSIV) nitrogen accumulators.

Conclusions

1. The DBF will not affect the capability to achieve and maintain safe cold shutdown. In the incredible event the DBF were to cause damage to one of the accumulators and release the

nitrogen pressure, the MSIV will slowly close due to spring force. Such MSIV closure will not affect the capability to achieve and maintain safe cold shutdown.

2. No modifications to the fire protection for the zone are proposed or needed.

Fire Zone 2-D

Reactor Building - El 757'-6" - FHA-M-2 - 673 square feet - RHR Valve Room

Description of Zone

Concrete floor with concrete block and reinforced concrete walls. Ceiling construction is a continuation of Zones 2-A and 2-B. A single nonrated hollow steel door communicates with Zone 2-A with a radiation shield wall blocking line-of-sight from the doorway to the interior of the room. Ventilation at a rate of 800 cfm is supplied through wall sleeves provided with backdraft dampers and exhausted through pipe penetrations into the torus area, Zone 1-A. No fire dampers are provided in the wall penetration sleeves. The zone is provided with two 4 inch floor drains.

Equipment in Zone

Six motor operated valves (MOV) - RHR systems, Divisions I and II
Safety-related cable trays, Divisions I and II
Drywell purge and CAD control valves

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	27.5 lb	286,000
	Total	286,000

Combustible loading - 425 Btu/sq ft
Equivalent severity - 0.01 hr

Fire Protection Equipment

None within the zone. Portable extinguishers and hose station available nearby in Zone 2-A.

Design Basis Fire

Ignition of cable in one of the two cable trays within the zone.

Consequences of Design Basis Fire

1. The combustible loading is insufficient to cause propagation beyond the boundaries of the zone. Involvement of more than a single cable tray is not postulated because of a separation distance of 31'-9" between the nearest edge of the trays with no combustible pathway between the trays.

2. The DBF involvement of either of the two trays is postulated to cause loss of the power supplies required for operation of the normally closed RHR system outboard isolation MOVs for the concerned division. Because of the DBF involvement of only one tray, the redundant RHR system and associated MOVs will remain functional.

3. The drywell purge and CAD system control valve cabling is routed through conduit physically separated from both cable trays and will not be affected by the DBF.

4. The normal ventilation system is adequate to remove any smoke generated by the DBF.

Conclusions

The DBF may cause minor inconvenience but will not affect the overall capability to achieve and maintain safe cold shutdown. The loss of operating power to one division's RHR valves will not prevent manual operation of the concerned valves. No modification to the zone fire protection is proposed or needed.

Fire Zone 2-E

Reactor Building - El 757'-6" - FHA-M-2 - 1,376 square feet - Off-Gas Recombiner

Description of Zone

1. A six compartment reinforced concrete walled structure contiguous with the south wall of reactor building Zone 2-B. The concrete roof of the HPCI and RCIC rooms, Zones 1-E and 1-F, form the concrete floor of the zone. The off-gas condenser and the catalytic recombiners are in three cells surrounded by minimum 3'-5" concrete walls with a 4'-6" reinforced concrete roof on fluted metal decking supported on the lower flange of embedded structural steel beams. The walls separating the cells are 1'-6" reinforced concrete. The HVAC equipment rooms on the east and west sides of the cells are surrounded by minimum 1'-6" reinforced concrete walls with 1'-0" ceiling slabs on fluted metal decking on top of the exposed structural steel framing. The east wall of the exhaust fan compartment is 12 inch concrete block forming the emergency airlock egress to the exterior from reactor building Zone 2-B, and is equipped with a nonrated hollow steel door. The east compartment contains the recombiner building air cooler and supply fan with a nonrated hollow steel door communicating with the southwest corner of reactor building Zone 2-B. Reinforced concrete roof hatches provide the only access to the three cells and to the compartment containing the closed cooling water system for the off-gas condenser.

2. Ventilation for the zone is provided by a once-through system taking supply from Zone 2-B and discharging through Zone 1-H into the torus area, Zone 1-A, for eventual exhaust.

The air is ducted into the individual cells and the cooling water heat exchanger compartment and exhausted through wall openings between the cells and into the exhaust fan compartment for discharge into Zone 1-H. Balancing dampers are provided to distribute the airflow but no fire dampers or back draft damper are provided either within the zone or between the zone and adjacent zones. Drainage is provided by 4 inch floor drains in each compartment piped to the floor drain sump in Zone 1-F for further processing. Cable tray penetrations between the three cells are not fire stopped. Other wall penetrations are through 5 inch conduit bends and are sealed.

Equipment in Zone

Catalytic recombiners (2)
Off-gas preheaters (2)
Off-gas condenser
Off-gas steam jet compressor
Closed cooling water system
Air handling units
Associated instrumentation, controls, and cables

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	985.7 lb Total	10,251,280

Combustible loading - 7450 Btu/sq ft
Equivalent severity - 0.09 hr

Fire Protection Equipment

None within the zone. Portable extinguishers in adjacent Zone 2-B. Hose station in Zone 2-B available for use in exhaust fan compartment and is also available, with additional hose lengths, for use in supply fan room. The three cells and the cooling water heat exchanger compartment are inaccessible except by removal of the roof hatch plugs.

Design Basis Fire

Ignition of cable insulation with consumption of all insulation in the involved tray and any adjacent tray.

Consequences of Design Basis Fire

1. The combustible loading is insufficient to cause propagation beyond the boundaries of the zone. The cable tray runs are separated into four distinct groups with no combustible pathway between the group. It is highly improbable that the air movement could cause propagation from one group of trays to any other group.

2. The DBF will affect the proper operation of one or more of the components of the recombiner system. One of the two recombiners is in operation at all times during normal plant operation. Each train is controlled by a motor operated valve. The loss of power to either MOV will not affect the valve alignment and thus the DBF will not cause interruption of the gas flow through the system. The preheaters are steam heated and remain functional following the DBF. The electrically heated catalytic recombiners may lose efficiency due to loss of power and cause an excessive hydrogen content in the recombiner discharge. This could result in a combustible mixture, and consequently a fire or explosion, within the system in the presence of an ignition source. Power to the closed cooling water system will cause loss of function of the off-gas condenser and permit an excess of moisture to accumulate in the holdup line to the off-gas retention building. Loss of power to the air supply and/or exhaust fan will cause a significant reduction in the airflow resulting in an increase in the ambient temperature in the various spaces and a decrease in the smoke purge capability.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The driving force to move the off gas is provided by the steam jet air ejectors, supplemented by the off-gas steam jet compressor, and adequate steam flow is provided to maintain the

hydrogen concentration below the flammable limit. The gaseous radwaste system piping and equipment is designed to contain explosions of near stoichiometric mixtures of hydrogen and oxygen, thus maintaining the system's capability to control radioactive release to the environs.

3. The proposed increase in the connected length of hose in Zone 2-B will provide hose coverage for the supply fan room. The proposed portable smoke exhauster for fire brigade use will enable the smoke generated to be purged from the zone and then exhausted through the plant's normal ventilation system.

4. No additional fire protection modifications are proposed or needed.

Fire Zone 2-F

Reactor Building - El 757'-6" - FHA-M-2 - 1,672 square feet - Railroad Airlock

Description of Zone

Concrete floor on grade. Precast 7 inch concrete walls secured to exposed steel columns. Exposed structural steel roof framing with metal roof decking and insulated built-up UL Class A roof. A nonrated hollow steel double door, 14 feet wide and 22 feet high, separates the zone from Zone 2-B. A nonrated hollow steel mandoor is provided in one leaf. The entire door assembly is essentially airtight. A similar door, without the mandoor, is in the exterior south wall. Nonrated doors in the west wall communicate with the machine shop, Zone 14-A, and the off-gas retention building, Zone 15-B. The zone is provided with four 4 inch floor drains discharging into the recombiner building floor drain sump. No ventilation is provided for the zone.

Equipment in Zone

Nonsafety-related cable tray

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	32.8 lb	341,120
Miscellaneous Class A transients	2,700 lb	21,600,000
Miscellaneous drums, Class B transients	220 gal	29,734,320
	Total	51,675,440

Combustible loading - 30,906 Btu/sq ft
Equivalent severity - 0.39 hr

Fire Protection Equipment

Portable extinguisher in zone. Portable extinguishers and hose station available in Zone 2-B. Yard hydrant hose streams available through exterior door.

Design Basis Fire

Ignition of transient combustibles with total involvement of all combustible material in the zone including the cabling.

Consequences of Design Basis Fire

1. The combustible material in the zone, excluding the cable insulation, consists of varying amounts of transient material necessary for orderly operation of the plant. The placement and quantity of the transients will vary from day to day creating an infinite variety of possible configurations for the DBF. The worst case situation would be a concentration in the vicinity of a structural steel column resulting in possible deformation of the structural frame with a resultant degradation of the roof and wall integrity.

2. The DBF is presumed to involve the cabling in the zone with resultant loss of the power feeders to MCC-1-B56 in the off-gas retention building. This power supply is required for proper operation of the off-gas system and may result in a gradual increase in the radioactive release to the environs, as discussed in the consequences of Zone 15-B.

3. Although the DBF is capable of degrading the seals on the airlock doors, the combustible loading and equivalent severity are insufficient to postulate propagation of the fire beyond the boundaries of the zone.

4. Plywood boxes with a capacity of approximately 112 cubic feet are used as collecting and shipping containers for low specific activity contaminated materials. Combustion of the boxes and contents may result in the release of contaminated smoke beyond the exclusion zone.

5. The exterior doors provide a ready means of venting the fire and purging the smoke. However, by isolating the supply to the machine shop and the off-gas retention building, Zones 14-A and 15-B, from reactor building Zone 2-B, and opening the door separating the zone from Zone 15-B, the smoke can be purged through Zone 15-B and Zone 1-H into the torus area, Zone 1-A, for disposal by the normal ventilation system.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The proposed installation of a wet pipe sprinkler system will provide an automatic means of detecting and controlling any fire that may occur in the zone.

3. The ready response of the automatic sprinklers will control the combustion of the contaminated waste material and permit the use of the exterior doors for venting and purging without concern of excessive radioactive release to the environs. The four 4 inch floor drains have the capability of carrying off 300 gpm without excessive water buildup. The drains ultimately discharge into the liquid radwaste system.

4. The automatic sprinkler system will be activated at a lower temperature than the ignition temperature of the cable insulation and thus protect the integrity of the power supply to MCC-1-B56.

5. Other than the proposed installation of an automatic sprinkler system, no additional modifications are proposed or needed.

Fire Zone 2-G

Reactor Building - El 757'-6" - FHA-M-2 - 792 square feet Main Steam Valve Chamber

Description of Zone

Concrete floor and 48 inch reinforced concrete ceiling with imbedded structural steel. North, south, and east walls minimum 48 inch thick reinforced concrete. West wall is 3 inch thick steel plate with a non-rated door communicating Zone 7-F at the mezzanine level and provided with blow-out panels. Ventilation for the zone is provided by 4,300 cfm minimum induced flow ducted to the main exhaust trunk. No fire dampers are provided. Drainage is provided by 2 4-inch floor drains.

Equipment in Zone

Four outboard main steam isolation valves
Two outboard feedwater valves
Outboard HPCI and RCIC steam isolation valves
HPCI and RCIC pump discharge valves
Outboard primary steam line drain valve
Associated instrumentation and controls
Safety-related conduits - Division II

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	Nil	Nil
Lubricants	Nil	Nil
Transient materials	Nil	Nil
	Total	

Combustible loading - Nil
Equivalent severity - Nil

Fire Protection Equipment

None provided within the zone. Portable extinguishers and hose stations available in adjacent Zone 7-F.

Design Basis Fire

A fire is not postulated to occur in the zone during normal plant operation. A minimal amount of transient materials may be brought into the zone during maintenance operations and ignition may occur.

Consequences of Design Basis Fire

The lack of combustible material within the zone precludes the possibility of a fire during normal plant operation. The reactor will be shutdown during maintenance operations. A fire during these periods may result in damage to the equipment within the zone or cabling in the conduit passing through the zone. Redundant inboard isolation valves will maintain the primary containment integrity and redundant Division I safety systems will be available in event of damage to Division II cabling. The normal ventilation system will remain available to remove any

smoke generated and the drainage system will remove any hose steam water.

Conclusion

The DBF will not affect the capability to achieve and maintain cold shutdown. No modifications are proposed or needed.

Fire Zone 3-A

Reactor Building - El 786'-0" - FHA-M-3&5 - 3,798 square feet - Laydown Area

Description of Zone

North half of reactor building. Reinforced concrete floor, north and east walls. West wall is 36 inch thick concrete block separating the zone from the cleanup phase separators, spent resin, and cleanup sludge pump rooms with nonrated hollow steel doors isolating the rooms from the zone. The south boundary of the zone is defined by the primary containment and an open area 18 feet wide at the floor line, 27 feet wide at the ceiling, and approximately 22 feet high from floor to bottom of exposed structural steel communicating directly with Zone 3-B. The ceiling is 9 inch thick reinforced concrete on fluted metal decking welded to the top flange of exposed structural steel beams and girders. The zone is isolated from the standby gas treatment room, Zone 3-C, and the MG set room, Zone 3-D, by airlocks with nonrated hollow steel doors. A third airlock communicates with the radio chemistry laboratory in the administration building, the control room, Zone 12-A, and a second entrance to Zone 3-C. The door to the control room, Zone 12-A, is rated at 3 hours but the other three are nonrated hollow steel. The low roof of the standby gas treatment room forms a mezzanine at elevation 796'-0" with two concrete block walled rooms containing fans and filters for exhausting air from the administration building access control area and hot labs. The rooms are isolated from the zone by airlocks with nonrated hollow steel doors. A masonry enclosed stairway with 1-1/2 hour rated fire doors at 786'-0" level and the mezzanine level provides access to Zone 2-A below and Zone 4-A above.

Ventilation for the zone is provided by 3,500 cfm of outside air ducted from the supply fan room, Zone 4-E. Air is exhausted from the zone at 740 cfm into an exhaust duct, 700 cfm through a wall penetration with a backdraft damper into the mezzanine filter room and by 2,185 cfm infiltration into the cleanup separator and spent resin tank rooms. The 125 cfm difference is made up by natural flow from Zone 3-B through the open boundary between the zone. No fire dampers are provided in the zone. Six 4 inch floor drains are dispersed throughout the zone.

Equipment in Zone

Safety-related cable trays, Divisions I and II
480 volt MCC 1B35
480 volt MCC 1B53
Reactor building closed cooling water pumps
Panels and racks 1C-56 - reactor protection system instrument rack
1C-56A - reactor protection system instrument rack
1C-78 - spent resin tank instrument rack
1C-127 - cleanup phase separator instrument rack
1C-147 - RB floor drain sumps instrument panel
MOV 1901 - reactor vessel head spray outboard valve - normally closed
MOV 2135 - core spray outboard valve - normally open
MOV 2137 - core spray outboard valve - normally closed

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	9,502 lb	98,820,800
Solvent (Agitene)	30 gal drum	4,020,000
	Total	102,840,800

Combustible loading - 27,078 Btu/sq ft
Equivalent severity - 0.39 hr

Fire Protection Equipment

Portable extinguisher and hose station within zone. Portable extinguisher and hose stations in adjacent Zone 3-B.

Design Basis Fire

Ignition of transient solvents used in maintenance operations with involvement of cable insulation in one or more safety-related cable trays.

Consequences of Design Basis Fire

1. The equivalent severity of the DBF is insufficient to breach the boundaries of the zone with the exception of the open division between Zones 3-A and 3-B. Propagation between the zones may occur along the cable trays passing through the open separation.

2. The DBF is postulated to involve the cable insulation in one or more safety-related cable trays with the resultant loss of function of one or more Division I safety systems. No adverse effects are postulated due to the availability of redundant Division II systems.

3. Cable trays 2L4B and 2LA8 pass through the zone vertically from Zone 2-A below to 4-A above. Tray 2L4B carries one cable, the main power feeder to the Division II HVAC chiller starter. The power supply for the redundant system is run in tray 1M3A as discussed for Zone 1-A and is not exposed to the same DBF and thus the redundant Division I chiller power will remain available. Tray 2L8A carries a large number of Division II low voltage power and control cables for operation and control of the Division II chillers, RHR and core spray valves, HVAC and CAD valves, and certain nonessential systems. These two trays are separated by a clear distance of 7'-6" from the nearest Division I safety-related tray and 10'-9" from the nearest tray carrying redundant Division I circuits with no combustible pathway between. The lowest tray in the stack carrying the redundant Division I circuits is 13'-8" above the floor in the vicinity of the vertical Division II trays. Two floor drains in the vicinity will effectively carry off any solvent spill in the vicinity. The space below the 7'-6" separation is a normal passage and is maintained free of accumulations of transients. The involvement of the redundant circuits in the same fire is highly improbable.

4. The normal building ventilation system will exhaust smoke from the zone to a limited extent but cannot be considered an effective system for the purpose.

Conclusions

1. The DBF, if undetected and if no suppression activities are undertaken, has the capability of causing loss of function of several redundant safety-related systems. However, the MOVs in the RHR and core spray systems are capable of being manually aligned, the chillers are provided with local control at the local starters, and the HVAC and CAD system valves fail in the closed position, thus retaining the capability to achieve and maintain safe cold shutdown.

2. The proposed installation of ionization smoke detectors throughout the zone will provide early warning of an incipient fire.

3. The proposed acquisition of portable smoke ejectors will provide capability to purge excess smoke from the zone for exhaust through the building ventilation system.

4. The "Agitene" solvent is used during times of plant shutdown, and administrative procedures to assure its removal during periods of normal operation will prevent the severity of the DBF.

5. The proposed installation of reactor recirculating pump trip (RPT) circuit breakers will not significantly alter the fire hazard in the zone nor will the loss of function of the breakers due to the DBF mitigate the ability to achieve and maintain cold shutdown.

Fire Zone 3-B

Reactor Building - El 786'-0" - FHA-M-3 - 3,794 square feet - Corridor and Waste Tank Area

Description of Zone

South half of reactor building. Reinforced concrete floor with concrete block and reinforced concrete walls. The north boundary of the zone communicates with Zone 3-A through an open area 18 feet wide at the floor line, 27 feet at the ceiling, and 22 feet high. The ceiling is minimum 9 inches thick on fluted metal decking supported by structural steel framing, generally welded to the top flange of the exposed structural steel framing. An open equipment hatch, 19 feet square, communicates with Zone 2-B below and Zone 4-B above. A 3 hour fire door in the west wall communicates with the radwaste building Zone 13-C airlock. An airlock communicates with the turbine operating floor, Zone 9-A, with a 3 hour fire door at the turbine end, and a nonrated hollow steel door at the reactor end. Two airlocks with nonrated hollow steel doors communicate with the MG set room, Zone 3-D, one at the 786'-0" floor level and one at elevation 796'-0", providing access to the MG set room air supply filters. The reactor water cleanup pumps and heat exchanger rooms are isolated from the zone by full height concrete block walls with nonrated hollow steel doors. An elevator shaft with a nonrated door and a stair shaft with a 1-1/2 hour door provide communication with Zone 2-B below and the floors above.

Ventilation for the zone is provided by 6,950 cfm of outside air ducted from the supply fan room, Zone 4-E. Air is exhausted from the zone by 3,400 cfm infiltration into the reactor water cleanup rooms, 2,525 cfm through the equipment hatch into Zone 2-B below, 900 cfm via the sampling sink exhaust head, and 125 cfm natural flow into Zone 3-A. Five 4 inch floor drains are dispersed throughout the zone.

Equipment Zone

Safety-related cable trays, Division I
125 volt MCC 1D14 - RCIC system controls
480 volt MCC 1B34 - Division I essential
MOV 2,000 - RHR containment spray header isolation valve
Chemical waste sample tank and pump
Cleanup sampling sink hood and exhaust fan
Panel 1C-52 - reactor water cleanup system instrument rack
Panel 1C-125 - reactor water cleanup sample panel

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	7,083 lb	73,666,320
Miscellaneous transient materials	500 lb (est)	4,000,000
	Total	77,666,320

Combustible loading - 20,470 Btu/sq ft
Equivalent severity - 0.26 hr

Fire Protection Equipment

Two portable extinguishers and two hose stations within the zone. Additional hose station available in Zone 3-A for fire brigade use with additional hose lengths. Portable extinguishers available in adjacent zones.

Design Basis Fire

Ignition of transient combustibles with involvement of cable insulation in one or more safety-related cable trays.

Consequences of Design Basis Fire

1. The equivalent severity of the DBF is insufficient to breach the boundaries of the zone with the exception of the arbitrary open space separation between Zones 3-A and 3-B and the open equipment hatch. Propagation from the zone into Zone 3-A may occur along the cable trays between the zones.

2. Two cable tray runs are in the vicinity of the open equipment hatch. One tier of four trays is routed 5'-8" from the east edge of the opening and a single tray is routed 2'-9-1/2" from the south edge. Propagation of a fire, in either tray run through the opening and into Zone 4-B above, is not postulated as evidenced by the cable tray fire tests performed by Sandia Laboratories.

3. The DBF is postulated to involve the cable insulation in one or more Division I cable trays resulting in the loss of function of one or more Division I safeguard systems including the RCIC system. Redundant Division II safeguard systems are postulated to remain functional. With concurrent loss of offsite power to the reactor feedwater pumps and loss of function of the RCIC system, the CRD and core spray pumps and the HPCI system are available to maintain the reactor water at a safe level.

4. The normal building ventilation system will effectively remove smoke from the zone.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The proposed installation of ionization detectors throughout the zone will provide early warning of an incipient fire. The presently provided fire extinguishers and connected hand hose are adequate to control and extinguish the DBF.

3. No further modifications are proposed or needed.

Fire Zone 3-C

Reactor Building - El 786'-0" - FHA-M-3 - 1,463 square feet - Standby Gas Treatment System Room

Description of Zone

Concrete floor with reinforced concrete north and east walls. Other walls are concrete block. A 12 inch thick concrete block wall extends from floor to ceiling providing physical separation beyween the two SGTS trains. The ceiling is 24 inch thick reinforced concrete on fluted metal decking supported on lower chord of the embedded structural framing. Two separate airlocks separate the SGTS rooms from Zone 3-A with nonrated hollow steel doors. Ventilation for the zone is provided by 1,000 cfm outside air ducted from the supply fan room, Zone 4-E, and with 1,000 cfm exhausted by direct ducting to the exhaust fan room, Zone 4-C, for discharge. No fire dampers are provided in the ductwork but backdraft dampers are provided in the supply duct at the supply fan room wall penetration and in the exhaust outlet within the zone. Two 4 inch floor drains and two 4 inch equipment drains are provided within the zone.

Equipment in Zone

Safety-related cable trays
Standby gas treatment system, trains A and B
HVAC instrument air compressor systems A and B
Associated instrumentation and controls

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	14.2 lb	147,680
Charcoal adsorber media	5,000 lb	61,450,000
	Total	61,597,680

Combustible loading - 42,103 Btu/sq ft
Equivalent severity - 0.53 hr

Fire Protection Equipment

Continuous thermal detector (Fenwal CFD) in carbon beds with dual setpoint alarm. Automatic deluge sprinkler system in carbon bed chamber to actuate on higher setpoint of detector. Portable extinguishers and hose station available outside airlock entrances.

Design Basis Fire

Ignition of charcoal in carbon bed filter of one train due to excessive heating of media by radioactive decay.

Consequences of Design Basis Fire

1. The DBF is an unlikely event because of the design of the system. The dual setpoint thermal detector is expected to alarm at 255F. By operator action, cooldown air may be introduced into the train from the room air to maintain the carbon bed temperature below a dangerous level. In the event the temperature continues to rise, the detector high setpoint of 310F

will automatically open the deluge valve and discharge the water spray on to the carbon beds. A remote hand switch, located in the control room, is provided to actuate the deluge valve manually if the automatic controls malfunction. In event of impairment of the water supply to the deluge valve header, backup suppression capability is provided by the hose station nearby with a water supply connection to the yard fire main loop independent of the deluge valve header connection. The 12 inch concrete block wall separating the two trains provides effective protection against radiant exposure of the redundant train to the DBF.

2. The floor drains and equipment drain pans discharge into a sump within the zone which in turn ultimately discharges into the floor drain radwaste system. The sump discharge capacity is 360 gpm which will adequately dispose of fire protection water discharge.

3. The products of combustion resulting from the DBF will be contained within the system equipment and associated ductwork. The deluge valve actuation signal is interlocked with the involved SGTS controls to shut down the fan, deenergize the electric heating element, close the service air valve between the filter and the 8 inch diameter cross-connection, close the cooldown air valve, and open the intake air valve. The redundant train will start and its operation will create a negative pressure within the involved train and exhaust the potentially contaminated products of combustion that will develop prior to the water reaching the seat of the DBF. The exhausted products of combustion will be treated by the active SGTS prior to release to the environs.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The existing fire protection provisions are adequate for the hazard and no modifications are proposed or needed.

Fire Zone 3-D

Reactor Building - El 786'-0" - FAH-M-3&5 - 3,063 square feet - MG Set Room

Description of Zone

Concrete floor with reinforced concrete and concrete block walls. The ceiling is 9 inch thick reinforced concrete on fluted metal decking welded to top flange of structural steel framing. Two airlocks communicate with adjacent Zones 3-A and 3-B. The four airlock doors are all nonrated hollow steel. Ventilation is provided by two axial flow fans with a combined capacity of 200,000 cfm. Exterior wall mounted variable louvers control outside air intake and adjustable dampers control recirculation. Exhaust from the zone is provided by a 72 square foot opening in the ceiling with a direct, undampered duct passing vertically through the supply fan room, Zone 4-E, to a roof penthouse discharging to the atmosphere. Drainage for the zone is provided by five 4 inch floor drains discharging into the turbine building oily waste system.

Equipment in Zone

Safety-related cable trays, Division I
Recirculation pump MG sets
MG set lube oil system
Ventilation supply fans
Air filters, UL Class 1
Associated instrumentation and controls

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	2,824 lb	65,715,520
Lubricating oil	2,320 gal	336,400,000
	Total	402,115,520

Combustible loading - 131,282 Btu/sq ft
Equivalent severity - 1.64 hr

Fire Protection Equipment

Two automatic deluge water spray systems, one over each oil reservoir and cooling system. Portable extinguishers and hose stations available outside airlock entrances in adjacent Zones 3-A and 3-B.

Design Basis Fire

Ignition of oil spill with possible involvement of cable insulation in safety-related cable trays.

Consequences of Design Basis Fire

1. The installed automatic deluge system is expected to actuate shortly following ignition of the DBF and promptly control the spread of the fire. Actuation of the system will be annunciated in the control room alerting the fire brigade for final extinguishment if required. The floor drains will dispose of the excess deluge water and spilled oil. The ventilation

system will exhaust the smoke directly to the atmosphere with no significant radioactive release to the environs.

2. In the event the water supply to the deluge system is impaired, the hose stations in the wet standpipe system, independently connected to the yard fire main loop, are available for fire brigade use to manually fight the fire.

3. The equivalent severity of the DBF, assuming involvement of the total inventory of combustibles, is sufficient to cause possible breaching of the boundaries of the zone due to the nonrated doors in the airlock entrances to the zone. The heat venting capability of the 72 square foot free exhaust stack will, however, tend to mitigate this possibility.

4. It must be postulated that the DBF will involve one or more cables in the Division I safety-related cable trays with the possible loss of power supply feeders to essential 480 volt MCC 1B34 and 125 volt dc MCC 1D14 causing loss of function of Division I safety-related systems and the RCIC pump. In addition, the controls of one or both of the MG sets may become involved causing loss of function of the reactor recirculation pumps.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown as redundant Division II systems will be available in the event of loss of function of Division I safety related systems.

2. The proposed replacement of one of the doors on each of the two airlocks with a 3 hour rated fire door and the provision of oil spill retaining curbs within the zone will upgrade the barrier and effectively prevent degradation of the secondary containment boundary by the DBF.

3. The proposed installation of ionization detectors within the zone will provide early warning of a fire condition both in the cable trays and in the vicinity of the installed deluge systems.

Fire Zone 4-A

Reactor Building - El 812'-0" - FHA-M-4 - 4,820 square feet - HVAC Heat Exchanger and Chiller Area

Description of Zone

North half of reactor building and east side corridor. Reinforced concrete floor with reinforced concrete and concrete block walls and ceiling construction similar to Zone 3-A below. South boundary of zone on west side, an open area communicating with Zone 4-B at column line 8.1, approximately 18 feet wide and 18 feet high from the floor to the bottom of the exposed structural steel. The space is partially blocked by noncombustible pipeway tunnel suspended approximately 3 feet below the steel and extending to within approximately 10 feet of the floor. No combustible pathway exists through the space above the suspended tunnel. The west boundary of the zone is a concrete black wall with a single nonrated hollow steel door isolating various filter system holding pumps. An enclosed stairway with a 1-1/2 hour fire door communicates with Zone 3-A below and Zone 5-A above. Two airlocks with nonrated doors isolate the exhaust fan room, Zone 4-C, heating pumps room, Zone 4-D, and supply fan room, Zone 4-E, from the secondary containment. An open stairway leads up to a stair enclosure at the 833'-6" level with a nonrated hollow steel door providing access to the contaminated equipment storage area. A concrete block shield wall with a nonrated door isolates the drywell exhaust valves from the zone. A 16 inch thick concrete block barrier, 28 feet long, separates the redundant chillers, starter panels, and pumps.

Ventilation for the zone is provided by 2,700 cfm of outside air ducted from the supply fan room. Air is exhausted from the zone at 1,850 cfm through transfer ducts into the filter holding pump area and 850 cfm natural flow through Zone 4-B to the equipment hatch. The transfer ducts are provided with back draft dampers. No fire dampers are provided in either the supply ducts or the transfer ducts. Ten 4 inch floor drains are dispersed throughout the zone.

Equipment in Zone

Safety-related cable trays, Division II
Reactor building cooling water heat exchangers
Essential HVAC chillers, Trains A and B
480 volt MCC 1B14 - nonessential HVAC
480 volt MCC 1B64
Chiller starter panels
Instrument racks and sample racks

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	3,421 lb	35,576,320
Transient materials	Nil	Nil
	Total	35,576,320

Combustible loading - 7,381 Btu/sq ft
Equivalent severity - 0.09 hr

Fire Protection Equipment

Two hose stations and one portable extinguisher within the zone. Portable extinguisher available in adjacent zones.

Design Basis Fire

Ignition of cable insulation involving one or more safety-related cable trays.

Consequences of Design Basis Fire

1. The equivalent severity of the design basis fire is insufficient to breach the boundaries of the zone. The cable tray runs in the vicinity of the open separation terminate within the zone and does not provide a combustible pathway into Zone 4-B.

2. The DBF is postulated to involve the cabling in the Division II safety-related cable trays causing loss of function of the Division II essential HVAC chiller, as well as the MOVs controlling wellwater and emergency service water supplies to the chiller. Power supply to the redundant Division I chiller is routed from the floor below through metallic conduit and is not exposed to the DBF. The balance of the safety-related circuits control and indicate the position of the Division II ventilation supply and exhaust isolation dampers, all of which will fail in the closed position on loss of control power. The power supply cables for the main air supply and exhaust fans are routed in nonsafety-related cable trays within the zone. A fire involving these cables will cause loss of function of one or more of the supply or exhaust fans.

3. The normal ventilation system may be degraded by damper closure and loss of fans to the extent that the standby gas treatment system will be required to operate. The SGTS is not effective for smoke and heat removal because only a small portion of the 4,000 cfm system capacity will infiltrate through the boundaries of the zone.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown. The redundant chiller will be available to provide chilled water to the control room HVAC system as well as nonessential cooling systems.

2. The proposed installation of ionization detectors will provide early warning of a fire condition. The prompt response of the fire brigade will permit early control and extinguishment limiting the propagation of the fire along the cable trays to the vicinity of ignition. The tray tiers are routed along the walls of the zone for a distance of approximately 240 feet from end to end with the concerned circuits in various tray sections along approximately 200 feet. At no place does a tier of tray sections contain all of the concerned cables. The power supplies for the redundant exhaust fans are fed from opposite directions with the cables in a common tier of trays for a run of only approximately

6 feet, making it unlikely that a fire will completely degrade the smoke exhaust capability.

3. Any smoke generated by the fire will be dissipated by the normal air supply and exhausted by the normal exhaust system until such time that the fan and/or damper circuits are involved. Degradation of the exhaust system will cause realignment of the air supply in order to maintain the secondary containment negative pressure until such time that complete failure will cause the SGTS to operate and normal air supply to cease. The lack of airflow through the zone will cause stratification of the smoke. However, the slow burning characteristics of the cable insulation and the prompt response of the fire brigade will permit control and extinguishment prior to the involvement of sufficient cable insulation to cause unacceptable smoke obscuration. No modification to the presently installed ventilation is proposed or needed.

Fire Zone 4-B

Reactor Building - El 812'-0" - FHA-M-4 - 2,368 square feet - Equipment Hatch Area

Description of Zone

Portion of south half of reactor building. Basic construction of the zone is similar to Zone 4-A. The north boundary is the open area 18 feet wide and 18 feet high communicating with Zone 4-A. An open equipment hatch, 19 feet square, communicates with Zone 3-B below and Zone 5-A above. A nonrated door communicates with a low room having reinforced concrete ceiling and concrete block walls within the zone containing the fuel pool heat exchangers. The elevator shaft with nonrated doors and enclosed stairway with a 1-1/2 hour rated door communicate with the floors above and below the zone. Ventilation for the zone is provided by 2,600 cfm outside air ducted from the supply fan room, Zone 4-E, and 850 cfm natural flow from Zone 4-A. Air is exhausted by 2,000 cfm induced flow into the fuel pool heat exchanger room and 1,450 cfm down the equipment hatch through Zones 3-B and 2-B into the torus area, Zone 1-A, and thence ducted to the exhaust fan room, Zone 4-C. Three 4 inch floor drains are provided within the zone.

Equipment in Zone

No mechanical equipment, panels, or cable trays. Two portable prefabricated metal utility sheds (backyard type).

Combustible Material	Quantity	Heat Release - Btu
Utility shed contents:		
Dirty anti-contamination clothing	200 sets	3,200,000 (Note 1)
Laboratory "glassware"	500 lb	7,000,000 (Note 2)
	Total	10,200,000

Combustible loading - 4,307 Btu/sq ft
Equivalent severity - 0.054 hr

Note 1: Utility shed used for sorting dirty anti-contamination clothing with wide variation in quantity. Estimate 200 sets maximum.

Note 2: Utility shed used as a storage cabinet for chemical laboratory equipment in packages in varying amounts. Assuming 50% packaging at 8,000 Btu per pound and 50% plastics at 20,000 Btu per pound, the estimated average heat release used is 14,000 Btu per pound.

Fire Protection Equipment

One portable extinguisher within the zone. Portable extinguishers available in adjacent zones. Hose station available in Zone 4-A for fire brigade use with additional hose lengths.

Design Basis Fire

Ignition of transient anti-contamination clothing.

Consequences of Design Basis Fire

1. The equivalent severity of the DBF is insufficient to breach the boundaries of the zone except in the vicinity of the open equipment hatch. The lack of a combustible path and the spatial separation between the clothing sorting area and the cable tray termination in Zone 3-A preclude propagation of the fire through the open boundary between the zones.

2. The spatial separation of the two utility sheds and the intervening open hatch make it highly unlikely that the DBF will involve the contents of both utility sheds. A fire in either shed will probably consume all combustibles within the shed, destroy the shed, and possibly cause ignition of any transient combustibles adjacent to the shaft in Zone 5-A above.

3. The smoke generated by the combustible anti-contamination clothing may contain radioactive particulates. No unacceptable release to the environs is postulated because the normal ventilation system is designed to detect and control such release. The DBF will not affect the functioning of the system.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The proposed installation of ionization detectors and additional hose station within the zone will provide early warning of a fire and assist the responding fire brigade in controlling and extinguishing the DBF.

3. No additional modification to the fire protection provisions is proposed or needed.

Fire Zone 4-C

Reactor Building - El 812'-0" - FHA-M-4 - 975 square feet - Main Exhaust Fan Room

Description of Zone

Reinforced concrete floor with reinforced concrete and concrete block walls. Reinforced concrete roof, 1'-0" thick, on fluted metal decking supported by partially exposed structural steel framing. An airlock with nonrated hollow steel doors communicates with the heating hot water pump room, Zone 4-D. The zone is the main exhaust plenum for the plant ventilation system and, as such, is adequately vented. One 4 inch floor drain is provided in the zone.

Equipment in Zone

Three main exhaust fans
Two reactor building exhaust fans
Two turbine building exhaust trunk fans
One refueling pool exhaust fan
Secondary containment isolation dampers - safety related
Associated fan dampers, instrumentation, and controls

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	29.3 lb	304,720
	Total	304,720

Combustible loading - 312 Btu/sq ft
Equivalent severity - Nil

Fire Protection Equipment

None within the zone. Portable extinguisher available in nearby zone. Hose station in nearby Zone 3-A available through two airlocks.

Design Basis Fire

Ignition of cable insulation from electrical overload.

Consequences of Design Basis Fire

1. The equivalent severity of the DBF is insufficient to breach the boundaries of the zone.

2. The exposed cables within the zone supply power to the various exhaust fans and associated fan dampers, position switches, and controls, all of which are nonsafety related. The DBF is postulated to cause loss of function of the main exhaust system. Redundant safety-related differential pressure switches all sense the loss of negative pressure, causing the safety-related isolation dampers to close and requiring the SGTS to operate to maintain reactor building negative pressure.

3. All safety-related circuits within the zone are routed through metallic conduit. Damage to these circuits resulting from the DBF may cause loss of control of the isolation dampers

but with no adverse effects as the isolation dampers fail in the closed position.

4. The smoke generated by the DBF will be exhausted directly to the atmosphere until such time as the main exhaust fans fail and the associated dampers close. No adverse effects will occur because the smoke will be confined to the zone.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The normal circuit protection devices make it highly unlikely that the DBF will occur.

3. The presently available fire protection measures are adequate for the hazard. No modifications are proposed or needed.

Fire Zone 4-D

Reactor Building - El 812'-0" - FHA-M-4 - 646 square feet - Heating Hot Water Pump Room

Description of Zone

Reinforced concrete floor with reinforced concrete and concrete block walls. Metal roof decking on exposed structural steel framing with UL Class A built-up roofing. Two airlocks, one communicating with the exhaust fan room, Zone 4-C, and the other communicating with both the supply fan room, Zone 4-E, and the secondary containment at Zone 4-A, are provided with nonrated hollow metal doors. Ventilation is provided by 500 cfm outside air ducted from the supply fan room, Zone 4-E, and 500 cfm vented to the exhaust fan room, Zone 4-C, through a transfer grill equipped with a backdraft damper. No fire dampers are provided. Two 4 inch floor drains are provided.

Equipment in Zone

480 volt MCC 1B24
Six heating hot water pumps
One coil backwash pump
Associated instrumentation and controls

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	252 lb	2,618,720
Lubricants	Minimal	Nil
	Total	2,618,720

Combustible loading - 4,054 Btu/sq ft
Equivalent severity - 0.05 hr

Fire Protection Equipment

None within the zone. Portable extinguisher and hose station available outside zone.

Design Basis Fire

Ignition of cable insulation from electrical overload.

Consequences of Design Basis Fire

1. The equivalent severity of the DBF is insufficient to breach the boundaries of the zone.

2. All circuits from MCC 1B24 to various HVAC supply and exhaust fans and heating system hot water pumps are routed through cable trays within the zone. The DBF is postulated to involve the cabling in these trays and the loss of function of the fans and pumps must be assumed. Redundant fans, controlled by MCC 1B14, will remain available. The redundant hot water pumps, also controlled by MCC 1B14, are powered by cables routed through a conduit in the vicinity of the trays associated with MCC 1B24 and a short tray section separated by approximately 18 feet from the MCC 1B24 trays. The separation is adequate to

prevent tray-to-tray propagation but the proximity of the conduit could cause degradation of the circuits for the redundant pumps.

3. The inoperability of the hot water pumps will result in loss of heating capability for the reactor building unit heaters and the main plant air supply heating coils.

4. Adequate smoke venting will be provided by the redundant exhaust fans.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The normal circuit protection devices make it highly unlikely that the DBF will occur.

3. The loss of hot water supply to the main air supply heating coils may require extraordinary measures to prevent freezing during cold weather.

4. No modification to the existing fire protection provision is proposed or needed.

Fire Zone 4-E

Reactor Building - El 812'-0" - FHA-M-4 - 2450 square feet - Plant Air Supply Fan Room

Description of Zone

Reinforced concrete floor with reinforced concrete and concrete block walls. Metal roof decking on exposed structural steel framing with UL Class A built-up roofing. Two airlocks with nonrated hollow metal doors communicate with the secondary containment, Zone 4-A, one being common with Zone 4-D. The exterior automatic air intake louvers are mounted in the south wall of the zone. The intake airflow passes through a bank of heating and cooling coils and a filter bank with UL Class 1 bag filters into the main supply fan plenum. Seven fans discharge air from the zone, three through isolation dampers into the secondary containment and three into the turbine building. The seventh fan supplies 500 cfm to the heating hot water pump room, Zone 4-D, and 1,000 cfm to the SGTS room, Zone 3-C, through ducting routed through Zone 4-D and the reactor building vent shaft directly to the SGTS room. A backdraft damper is provided in this duct at the exterior of the zone boundary. No fire dampers are provided in any of the duct penetrations through the zone boundaries. The exhaust duct from the MG set room, Zone 3-D, passes vertically through the zone adjacent to the north wall. An abandoned in-place duct 64 square feet in cross section runs the length of the fan chamber. This duct is connected to the Zone 3-D exhaust duct but the air dampers at the connection are sealed closed to preclude air transfer between the zones. The zone is provided with four 4 inch floor drains.

Equipment in Zone

Three reactor building air supply fans
Three turbine building air supply fans
One SGTS outside air supply fan
UL Class 1 filter bank
Secondary containment isolation dampers
Associated instrumentation and controls

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	14.5 lb	150,800
Lubricants	Minimal	Nil
	Total	150,800

Combustible loading - 62 Btu/sq ft
Equivalent severity - Nil

Fire Protection Equipment

None within the zone. Portable extinguisher and hose station available in adjacent Zone 4-A.

Design Basis Fire

Ignition of cable insulation resulting from electrical overload.

Consequences of Design Basis Fire

1. The equivalent severity of the DBF is insufficient to breach the boundaries of the zone.

2. The exposed cabling within the zone is routed through four tray sections, each 3 feet long. The minimum separation between the sections is 13 feet, thus precluding the propagation of fire from one section to any other. The trays variously contain cables for power supply to the fan motors, fan discharge damper operation, and for annunciation of "no flow" from individual fans. No single tray section contains power supply circuits for more than one reactor building fan and one turbine building fan, and one tray section contains only annunciation and damper control circuits. One tray with fan power circuits also contains circuits controlling the coil backwash system valves with the valve controls failing in the heating and cooling mode. The worse case condition is the DBF occurring in tray N8L with the resultant loss of power to one set of fans, closure of discharge damper on a second turbine building supply fan, and loss of flow annunciation circuit for a second reactor building supply fan. A minimum of one set of fans will remain fully operational. The SGTS outside air supply fan power circuit is in conduit routed directly through the zone boundary into Zone 4-D with a separation of 28 feet from the nearest tray section.

3. The SGTS outside air supply will provide adequate smoke venting capacity and alternate paths are available through the turbine building or reactor building environment to the main exhaust plenum.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The normal circuit protection devices make it unlikely that the DBF will occur.

3. Smoke resulting from the DBF may be introduced into the air supply ducts but the heated products of combustion will be diluted by the large airflow to a safe level.

4. No modifications to the existing fire protection provisions are proposed or needed.

Fire Zone 5-A

Reactor Building - El 833'-6" - FHA-M-4 - 5,818 square feet - Laydown Area

Description of Zone

West side of reactor building reinforced concrete floor and walls with a 12 inch thick reinforced concrete ceiling on fluted metal decking supported on structural steel framing. Two enclosed stairways with 1-1/2 hour rated doors and an elevator shaft with nonrated doors communicate with the refueling floor, Zone 6-A, above and the floors below. An open equipment hatch, 19 feet square, communicates with the floors above and below. Ventilation is provided by 4,000 cfm outside air ducted from the supply fan room, Zone 4-E, and exhausted down through the equipment hatch for eventual discharge to the atmosphere. Fourteen 4 inch floor drains are dispersed throughout the area. A chain link fence encloses the southwest corner of the zone between the elevator shaft and the equipment hatch isolating an area of approximately 460 square feet.

Equipment in Zone

Safety-related cable trays, Divisions I and II
Standby liquid control system
Reactor building cooling water surge tank
Panel 1C 69 - SBLC system storage tank instrument rack
Panel 1C 79 - condensate phase separator instrument rack

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	6.7 lb	69,680
Anti-contamination clothing	500 sets (est)	800,000,000
Change racks and benches	300 lb (est)	2,400,000
Wood work benches	600 lb (est)	4,800,000
LSA transients	200 drums	Nil (Note 1)
	Total	15,269,680

Combustible loading - 2,625 Btu/sq ft
Equivalent severity - 0.03 hr

Note 1: The combustible material sealed in the LSA drums is not available to contribute fuel to a fire.

Fire Protection Equipment

Two portable extinguishers within the zone. Portable extinguishers available in zones above and below. Hose station in Zone 4-A below is available for partial protection of change area near the north stairwell.

Design Basis Fire

Ignition of transient combustibles in change area with involvement of all combustibles in the vicinity.

Consequences of Design Basis Fire

1. The equivalent severity of the DBF is insufficient to breach the boundaries of the zone. The concentration of the transient combustibles is in the vicinity of the north stairway and is remote from the equipment hatch.

2. The standby liquid control system is in a 15 by 30 foot curbed area adjacent to the north wall of the zone. The power supply for the Division I SBLC pump and explosion actuated valve is routed through a tray section and conduit in the vicinity of the northeast corner of the curbed area in excess of 10 feet from the south curb. The tray section containing the cable for the redundant Division II equipment is 20 feet south of the south curb, and the conduit runs to the equipment are not less than 5 feet from the Division I tray. The separation is sufficient to preclude damage to Division II cabling from exposure to a fire in the Division I tray which contains 2.07 pounds of insulation with a heat release of approximately 21,500 Btu. The curbed area is maintained free of transient combustible material, thus precluding an exposure fire in the curbed area.

3. A clothing change area is maintained in the vicinity of the north stairway. Metal drums for discarding protection clothing are provided in a space approximately 10 feet south of the SBLC curbed area. The clean clothing on metal shelving and the wood change racks and benches are located a minimum of approximately 20 feet south of the curbed area. The estimated 500 sets of clothing tabulated were present during refueling operations. During periods of normal plant operations a nominal stock is maintained in the area. The discarded clothing is periodically removed from the vicinity and stored in capped metal drums prior to removal.

4. The DBF is postulated to occur in the change area resulting in the possible involvement of the cables in the Division II cable tray. The minimum separation between the Division I cables and equipment and the discarded clothing drums of 20 feet, or 30 feet from the clean clothing supply, renders it highly unlikely that the DBF will involve both divisions of the SBLC system.

5. The capped metal 55 gallon drums will effectively prevent the contained solid combustibles from contributing fuel to the DBF.

6. The wooden work benches are stored in the chain link fenced area in the south portion of the zone when not in use. The lack of an ignition source in the storage area combined with the remote location without a combustible path makes it highly unlikely that the benches will contribute to the occurrence or intensity of the DBF.

7. The normal building ventilation system will effectively remove smoke from the zone.

Conclusions

1. The DBF will not affect the ability to achieve and maintain cold shutdown.

2. The proposed installation of ionization smoke detectors and two hose stations will provide early warning of a fire and will provide effective backup for the presently provided portable extinguishers.

3. The chain link fence provides adequate isolation to prevent the involvement of the wooden work benches in the DBF.

4. No additional modifications are proposed or needed.

Fire Zone 6-A

Reactor Building - El 855'-0" - FHA-M-5 - 14,240 square feet - Refueling Floor

Description of Zone

Entire top floor of the reactor building. The boundaries of the zone consist of a reinforced concrete floor, insulated metal wall panels, and a metal roof deck with 1-1/2 inch rigid insulation and UL Class A built-up roof covering. The girts and purlins are unprotected structural steel sections attached to unprotected structural steel rigid frames and end wall columns. An open 19 foot square equipment hatch communicates with the floors below. Two stairways with 1-1/2 hour fire doors and the elevator with nonrated doors provide access to the zone. The elevator shaft, machine room, and the stairways are enclosed by 8 inch concrete block walls and 4 inch reinforced concrete ceiling slabs cast on fluted metal decking. Ventilation for the zone is provided by 37,320 cfm outside air ducted from the supply fan room, Zone 4-E, and 2,400 cfm infiltration through the exterior walls. Exhaust is provided by direct ducting of 23,650 cfm to the main exhaust fan room, Zone 4-C, and indirect flow of 16,070 cfm down the equipment hatch through the floors below and into the torus area, Zone 1-A. No fire dampers or backdraft dampers are provided in the ductwork. Twenty 4 inch floor drains are dispersed throughout the zone.

Equipment in Zone

100 ton bridge crane
Movable refueling platform
Movable new fuel inspection platform
Panels 1C - 182A,B,C - exhaust stack radiation monitor instrument racks
Panel 1C - 165 - exhaust stack airflow monitor instrument rack

Combustible Material	Quantity	Heat Release - Btu
Cable insulation (in tray)	1.3 lb	13,520
Cable insulation (take-up reel)	79.0 lb (est)	419,120
Transient combustibles	5,000 lb (est)	100,000,000(Note 1)
	Total	100,432,640

Combustible loading - 7,053 Btu/sq ft
Equivalent severity - 0.088 hr

Note 1: A conservative estimate of 5,000 pounds of combustible materials, plastics, packaging, flammable and combustible liquids, etc, with a heat release based on the flammable liquids of 20,000 Btu per pound

Fire Protection Equipment

Two portable fire extinguishers are provided in the zone. Portable extinguishers available in Zone 5-A below. One hose station with a 2 inch connection accessible to the well cooling

water and emergency service water systems is available for partial protection.

Design Basis Fire

Ignition of transient combustibles with possible involvement of other transients nearby. Total involvement of all combustibles in the zone is not postulated.

Consequences of Design Basis Fire

1. The equivalent severity of the DBF is insufficient to breach the boundaries of the zone.

2. A large quantity of sheet plastic is used for shrouding during refueling operations. A fire occurring in such shrouding may consume the entire shroud with a heat release in the order of 200 to 300 Btu per square foot. This low heat release is not considered capable of propagating fire from one shroud to another in the absence of a combustible path.

3. The large number of 4 inch floor drains dispersed throughout the zone will collect and dispose of flammable or combustible liquid spills and effectively limit the spill area and depth. A fire originating in such a spill will be of limited duration and size due to rapid fuel exhaustion.

4. The limited amount of exposed cabling installed in the zone makes it highly unlikely that a fire originating in the cable insulation will propagate beyond the tray or reel involved. Portable extension cords are used from time to time; however, a fire originating in an extension cord is expected to be localized and not to propagate beyond the immediate zone of ignition.

5. The conduit containing the bridge crane power supply cable may be exposed to a fire involving shrouding in the laydown area for the drywell vent ducts. The low heat release anticipated from such a fire is not expected to result in degradation of the cable insulation. The crane is designed to permit safe lowering or holding of any load in the unlikely event of a power failure due to the DBF.

6. The normal ventilation system is adequate to dissipate the heat of the DBF and remove any smoke generated. The floor drains are capable of removing any fire protection water discharged in the zone.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The DBF may cause smoke or heat damage to certain equipment associated with refueling operations; however, suitable safeguards are provided to protect the fuel assemblies from the effects of the DBF and the fire fighting operations.

3. The proposed installation of early warning fire detection and the installation of two fire protection hose stations within

the zone will mitigate any consequences of the DBF. No additional fire protection modifications are proposed or needed.

Fire Zone 7-A

Turbine Building - El 734'-0" - FHA-M-1 - 4,116 square feet - Reactor Feed Pump Area

Description of Zone

North of turbine building basement. Concrete floor with reinforced concrete and concrete block walls. Nine inch reinforced concrete ceiling on fluted metal decking welded to top flange of exposed structural steel framing. An open area 21 feet wide and 22 feet high communicates with Zone 7-C in line with the west end of the lube oil reservoir and the southwest corner of the lower nonessential switchgear room, Zone 7-B. A 3 hour fire door communicates with Zone 3-B. An open stairway communicates with Zone 8-A above. Ventilation for the zone is provided by 5,300 cfm outside air ducted from the turbine building main supply duct. The supply fans are located in Zone 3-E in the reactor building auxiliary bay. Air is exhausted from the zone by induced flow through transfer grills with backdraft dampers into the condenser area for eventual exhaust to the atmosphere. The exhaust fans are located in the main exhaust fan room, Zone 4-C, in the reactor building auxiliary bay. Approximately 1,800 cfm is exhausted through grills within the zone with the balance passing through Zone 7-C to other grills spaced around the condenser area shield wall. Five 4 inch floor drains are provided in the zone with discharge into the oil separater sump.

Equipment in Zone

Safety-related cable trays
480 volt MCC 1B22 nonessential
480 volt MCC 1B33 nonessential
Reactor feed pumps 1A and 1B
Electrohydraulic fluid power unit
Oily waste and oil sump pumps
Nonessential switchgear rooms cooling unit
Associated instrumentation and controls
Condenser area cooling units instrument racks 1C-110 U and V

Combustible Material	Quantity	Heat Release - Btu	
Cable insulation	3,854 lb	40,083,680	
Lubricating oil	84 gal	12,180,000	
Fire resistant hydraulic fluid	650 gal	88,834,850	(Note 1)
	Total	141,098,530	

Combustible loading - 34,280 Btu/sq ft
Equivalent severity - 0.43 hr

Note 1: "Fyrquel EHC" hydraulic fluid 136,669 Btu/gal (specific gravity 1.21 and 13,559.4 Btu/lb) with 455F flash point, 665F fire point and 1,100F autoignition temperature - Stauffer Chemical Co.

Fire Protection Equipment

Two automatic deluge sprinkler systems, one over each reactor feed pump, and associated lubricating oil system. The oily waste sump and the oil sump are covered by the RFP 1-A system.

Portable extinguishers and hose station are within the zone. Portable extinguishers available in adjacent Zone 7-C and in Zone 8-A above. Hose station in Zone 7-C available for fire brigade use with additional hose lengths.

Design Basis Fire

Ignition of lubricating oil spill with possible involvement of cable trays.

Consequences of Design Basis Fire

1. The installed automatic deluge systems are expected to operate shortly following ignition of an oil spill fire and control or extinguish the fire. Actuation of the deluge system will be alarmed locally and in the control room alerting the fire brigade for final extinguishment. Loss of function of the involved RFP is assumed due to loss of lubrication. Prompt actuation of the deluge system is expected to protect the cable trays in the vicinity from exposure due to the cooling effect of the deluge system water spray.

2. The floor drainage system is adequate to collect and dispose of the discharge of the largest of the two deluge systems. In event both systems are in operation, the combined discharge of 921 gpm will cause ponding over the drains in excess of 2 inches after approximately 5 minutes and result in water migration into adjacent Zones 7-B and 7-C. If retaining curbs are provided at the zone boundaries, the depth over the high points of the floor will be approximately 1 inch after a 13 minute discharge and 2.65 inches after a 30 minute discharge.

3. In event the water supply to the deluge systems is impaired, the wet standpipe hose station independently connected to the yard main, is available for fire brigade use and a single hose stream is capable of controlling and extinguishing the DBF.

4. The ventilation system has sufficient capacity to disperse and exhaust any smoke generated by the DBF.

5. The safety-related cable trays are routed along the north wall of the zone and may be exposed to the DBF resulting in damage to certain Division I power, control, or instrumentation circuits. The systems and equipment involved are river water supply system, RHR service water pumps, emergency service water pump, and associated auxiliary equipment and instrumentation. Cabling for redundant Division II systems and equipment is not exposed to the DBF.

6. The equivalent severity of DBF is not sufficient to breach the boundaries of the zone with the exception of the 462 square foot open communication with Zone 7-C. Propagation through this path is not postulated because of the floor drainage configuration and the remote location of the source of fuel for the DBF.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The proposed curbing in the vicinity of the turbine lube oil reservoir, Zone 7-C, and at the doors to the switchgear room, Zone 7-B, will prevent water migration from the zone into adjacent zones.

3. The proposed extensions of the automatic sprinkler system in the vicinity of the turbine lube oil reservoir will provide a water curtain to cool any heated products of combustion exhausted from the zone through the open communication with Zone 7-C.

4. The fire resistant properties of the "Fyrquel" EHC hydraulic fluid and separation from other hazards make it highly unlikely that any involvement in the DBF will occur.

Fire Zone 7-B

Turbine Building - El 734'-0" - FHA-M-1 - 1,134 square feet - Lower Switchgear Room

Description of Zone

Northeast corner of the turbine building basement. Concrete floor with reinforced concrete and concrete block walls. Nine inch reinforced concrete ceiling on fluted metal decking welded to top flange of exposed structural steel framing. Three hour fire doors communicate with adjacent Zones 7-A and 7-C. Fire dampers rated for 1-1/2 hours are provided in ventilation ducts and transfer grill penetrating the concrete block walls. No fire dampers are provided in the two exhaust ducts from Zone 8-B above that penetrate the ceiling. Ventilation for the zone is provided by 7,200 cfm from a recirculation system, common with Zone 8-B, with 1,100 cfm outside air supply, and with 1,100 cfm exhaust into Zone 7-C through a transfer grill. No floor drainage is provided within the zone.

Equipment in Zone

Safety-related cable trays, Division I
4,160 volt switchgear 1A2 - nonessential
480 volt load center 1B2 - nonessential
480 volt load center 1B6 - nonessential

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	3,087 lb	32,104,800
Transient (plywood work surface)	10 lb	80,000
	Total	32,184,800

Combustible loading - 28,382 Btu/sq ft
Equivalent severity - 0.35 hr

Fire Protection Equipment

None within the zone. Hose station and portable extinguisher available in adjacent Zone 7-A.

Design Basis Fire

Ignition of cable insulation from electrical overload.

Consequences of Design Basis Fire

1. The equivalent severity of the DBF is insufficient to breach the zone boudaries common with Zones 7-A and 7-C.

2. The lack of fire dampers in the recirculation exhaust ducts from Zone 8-B above that penetrate the ceiling of Zone 7-B may permit propagation of the DBF into Zone 8-B. The heated products of combustion from the DBF will cause closure of the fire dampers in the transfer grill and exhaust ducts at the penetrations in the walls of Zone 7-A, but the cooled recirculated air will delay closure of the supply duct fire damper. The air supply could cause backflow through the exhaust duct into Zone 8-B exposing the cabling in the upper switchgear

room to possible involvement. The consequences of any involvement are addressed under Zone 8-B. The recirculating air temperature is displayed in the control room and high temperature is alarmed and annunciated.

3. The safety-related circuits described under Zone 7-A are routed through Zone 7-B and are assumed to be involved in the DBF resulting in loss of function of the described systems and equipment.

4. The DBF is assumed to involve power, control and instrumentation circuits associated with 4,160 volt switchgear 1A2 and 480 volt load centers 1B2 and 1B6 with the resultant loss of function of the equipment and connected loads, all of which are nonessential.

5. The 1,100 cfm outside air makeup to the recirculating ventilation system will provide the driving force to exhaust smoke from the zone either through the transfer grill prior to fire damper closure or through the doors. In event the supply duct fire damper closes, the 1,100 cfm makeup air will flow into the zone through the exhaust registers in the common duct as no backflow dampers are provided in the recirculating system. Smoke exhaust from the zone will be diluted and removed from the adjacent zones by the normal exhaust system.

6. Any fire protection water discharged in the zone will be retained in the zone by the curbing addressed under Zones 7-A and 7-C. A fire hose stream discharging 100 gpm will cause ponding of 2 inches following approximately 12 minutes of operation.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown. Redundant Division II safeguard equipment and certain nonessential systems will remain available.

2. The slow burning characteristics of the cable insulation make it highly unlikely that the DBF will be undetected prior to the fire damper closures, because the fusible links are higher rated than the recirculating air temperature alarm high setpoint. Prompt investigation of the problem will permit visual detection of the fire and proper action can be initiated to provide fire brigade response. Installation of backdraft dampers in the two exhaust registers in Zone 8-A and in the two in Zone 7-A connected to the common duct will effectively prevent backflow between the zones and retard any possibility of propagation between the zones prior to supply fire damper closure. Alternatively, fire dampers installed at the two floor penetrations will isolate the two zones from each other.

3. The proposed portable smoke ejectors will provide adequate means to vent the zone in event the supply air duct fire damper closes.

4. A 5 to 10 minute hose stream discharge is more than sufficient to control and extinguish the DBF. The resultant ponding will be within tolerable limits.

Fire Zone 7-C

Turbine Building - El 734'-0" - FHA-M-1 - 1,932 square feet - Turbine Lube Oil Tank Area

Description of Zone

Part of northeast area of turbine building basement. Concrete floor with concrete and concrete block walls. Nine inch reinforced concrete ceiling on fluted metal decking welded to top flange of exposed structural steel framing. One 3 hour rated door communicates with the lower switchgear room, Zone 7-B. Zone 7-C is an L-shaped area open at the west end to Zone 7-A and open at the south end to the tube removal space portion of Zone 8-E at column line 9. The ceiling over the tube removal space is removable steel grating approximately 33 feet long and 20 feet wide. No communication is provided in the 8 inch concrete and concrete block wall forming the lube oil storage tanks' vault, Zone 7-D. Ventilation for the zone is provided by approximately 3,500 cfm flow through the zone from Zone 7-A and 1,100 cfm from Zone 7-B. Exhaust from the zone is induced flow through transfer grills, with backdraft dampers, into the condenser area, Zone 7-F. Three 4 inch floor drains are provided in the zone. Two drains discharge into the oily waste sump and one into the turbine building auxiliary floor drain sump. The 6 inch curbed area containing the purifying equipment is not drained.

Equipment in Zone

Safety-related cable trays, Division II
Turbine lube oil reservior
Turbine lube purifier equipment
Associated instrumentation and controls

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	1,339 lb	13,925,600
Lubricating oil	5,550 gal	884,750,000 (Note 1)
	Total	818,675,600

Combustible loading - 423,307 Btu/sq ft
Equivalent severity - 5.29 hr

Note 1: The lube oil quantity is based on the contents of the 5,450 gallon capacity reservior plus an additional 100 gallon drainage from the system. No allowance is made for floor drainage.

Fire Protection Equipment

Automatic deluge sprinkler system at underside of the lube oil reservoir. Automatic wet pipe sprinkler system over the lube oil centrifuge area. Portable extinguisher and hose station in Zone 7-A approximately 10 feet outside this zone at the west end.

Design Basis Fire

Ignition of lube oil spill in the purifier equipment area with possible involvement of cable insulation.

Consequences of Design Basis Fire

1. The installed automatic sprinkler system is expected to actuate shortly following ignition and control or extinguish the fire prior to fire brigade response. The deluge system protecting the lube oil reservoir may be actuated, depending on the intensity of the DBF, and provide additional exposure protection to the reservoir and supports. The cabling exposed to the DBF is not safety related nor is it protected by the installed sprinkler system.

2. Failure of the installed sprinkler system to actuate will permit continued burning until the intensity of the DBF is sufficient to actuate the lube oil reservoir deluge system and cause a fire alarm signal to alert the control room.

3. Both systems are supplied by a common connection to the yard fire main loop and an impairment in this connection will prevent operation of both systems. The fire alarm for the zone is dependent upon water flow in either system and the impairment will prevent an alarm to be initiated and transmitted to the control room. The wet standpipe system is independently connected to the loop and will remain functional for backup manual suppression operations.

4. The 6 inch curbing surrounding the purification area will retain approximately 462 gallons of oil and fire protection water discharge prior to overflow.

5. The normal ventilation system, with airflow of approximately 4,600 cfm through the zone, will dilute the heated smoke and exhaust it through the condenser area into the main exhaust system. Any smoke migrating into the zones above, through the ceiling gratings, may be exhausted through the turbine building powered roof vents.

6. A rupture of the lube oil reservoir will cause up to 5,550 gallons of oil to be discharged on the floor. The lack of curbing will permit oil migration into adjacent Zone 7-A, the switchgear room, Zone 7-B, and the south portion of Zone 7-C. Ignition of this massive spill may expose the Division II safety-related cabling in the south end of Zone 7-C as well as the Division I cabling in Zone 7-A and possibly the switchgear and load centers in Zone 7-B.

Conclusions

1. The DBF, limited to spillage or leakage involving the purification system, will not affect the ability to achieve and maintain safe shutdown.

2. The proposed addition of curbing in the vicinity of the lube oil reservoir of sufficient capacity to retain the entire oil inventory will prevent migration of the oil to areas exposing safety-related cabling. Providing a standpipe above the level of the curbing for any floor drain within the curbed area will provide means of controlling the drainage and preventing oil migration from other drains in the same system. Provision for manual control of the drainage from the curbed areas assures that

the rate of drainage will not exceed the capacity of the auxiliary floor drain and oily waste sumps.

3. The provision of curbing at the doors to the switchgear room, Zone 7-B, will prevent oil and water migration into the switchgear room.

4. A curb has been proposed at column line 10. This curb should be relocated to the vicinity of column line 11 to prevent any oil migration toward the south end of the zone in the vicinity of the Division II cabling.

5. The proposed extension of the presently installed wet pipe sprinkler system will provide adequate automatic suppression for the areas of potential oil spills. The system should be designed to provide a density of 0.30 gpm per square foot for the entire area north of column line 10 and east of column line N excluding the switchgear room.

Fire Zone 7-D

Turbine Building - El 734'-0" - FHA-M-1 - 389 square feet - Oil Storage Tank Vault

Description of Zone

The zone is a vault with a reinforced concrete floor and a 9 inch reinforced concrete ceiling on fluted metal decking welded to the top flange of exposed structural steel framing. One wall is the concrete shield wall of the condenser area. The other three walls are 12 inch reinforced concrete to a height of 8 feet with 8 inch concrete block above to the ceiling. Access to the vault is from a hatch in the ceiling accessible from Zone 8-A above. No ventilation is provided for the zone. One 4 inch floor drain is provided within the zone with a 4 inch valve exterior to the zone to control flow to the oil sump in Zone 7-A.

Equipment in Zone

Clean lube oil storage tank, 10,200 gallon capacity
Dirty lube oil storage tank, 11,400 gallon capacity

Combustible Material	Quantity	Heat Release - Btu	
Lubricating oil	21,600 gal	3,132,000,000	(Note 1)
Combustible loading	8,051,000 Btu/sq ft		(Note 2)
Equivalent severity	100 + hr		

Note 1: The quantity and heat release are based on the total possible inventory with both tanks filled.

Note 2: The combustible loading and equivalent severity figures are unrealistic but are included for continuity of the methodology.

Fire Protection Equipment

Automatic wet pipe sprinkler system within the zones. Hose station available in Zone 8-A above within 20 feet of the access hatch. Hydrant hose streams available.

Design Basis Fire

Ignition of oil leakage from unknown sources.

Consequences of Design Basis Fire

1. The installed automatic sprinkler system is expected to operate shortly following ignition and to extinguish the fire.

2. In event the sprinkler system is impaired and fails to discharge water, the fully developed fire will continue to burn until the available oxygen is depleted. Based on the gross volume of the vault with no allowance for the volume of oil or the enclosed tanks, theoretical oxygen depletion should occur after the complete combustion of less than 7 gallons of lube oil. The standpipe hose stream will be available to cool the hatch

until the atmosphere within has cooled below the flash point of remaining unburned oil.

3. Following extinguishment, smoke can be removed from the zone by the proposed portable smoke ejectors.

4. Excess oil and fire protection water can be removed at a controlled rate by means of the valve in the floor drainage system.

Conclusions

The DBF will not affect the capability to achieve and maintain cold shutdown.

Fire Zone 7-E

Turbine Building - El 734'-0" - FHA-M-1 - 7,730 square feet - Water Treatment and Condensate Pumps Area

Description of Zone

South position of turbine building basement including tube removal space south of column line 9. Reinforced concrete floor with reinforced concrete and concrete block exterior and shield walls. Reinforced concrete ceiling, 9 inch minimum thickness, on fluted metal decking welded to top flange of exposed structural steel framing. An enclosed stairwell with a 1-1/2 hour rated fire door communicates with the floor above at the south wall. Nonrated hollow metal doors communicate through shield walls to rooms containing the floor and equipment drain sump pumps, condensate vacuum pump, and the steam jet air ejectors. An open stairway at the west side of the zone communicates with the floor above and an airlock with one 3 hour rated door into reactor building Zone 2-B. The ceiling of the tube removal space, 19 feet wide by 60 feet long, is an open metal grating. Ventilation for the zone is provided by 9,000 cfm outside air ducted from the main supply plenum, Zone 4-E. Air is exhausted at an induced rate of approximately 7,000 cfm through backdraft damper equipped transfer grills into areas of higher radioactive potential for discharge through the main exhaust plenum. The balance of the exhaust is by infiltration into the above mentioned zones or up through the open metal grating. Drainage for the zone is provided by eleven 4 inch floor drains dispersed throughout the zone.

Equipment in Zone

480 volt MCC 1B62-nonessential
Two condensate pumps
Two condensate service pumps
Makeup demineralizing system
Two air compressors and air receivers
Instrument air dryer
Two diesel oil transfer pumps-inactive
Associated instrumentation and controls

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	3,417 lb	35,536,800
Lubricating oil	76 gal	11,020,000
Miscellaneous Transients	200 lb (est)	1,600,000 (Note 1)
	Total	48,156,800

Combustible loading - 6,230 Btu/sq ft
Equivalent severity - 0.08 hr

Note 1: Transient combustibles consist of used protective clothing, charts, logs, and packaging materials. Average heat release is 8,000 Btu/lb.

Fire Protection Equipment

Two hose stations and portable extinguishers within the zone. Portable extinguishers available in adjacent Zone 7-C and in Zones 8-D and 8-E above.

Design Basis Fire

Ignition of transient combustibles with possible involvement of cable insulation.

Consequences of Design Basis Fire

1. The concentration of combustibles and the equivalent severity are insufficient to breach the boundaries of the zone. No combustible path exists into Zone 7-C.

2. The cable trays within the zone are generally routed a minimum of 16 feet from the floor making it highly unlikely that the cable insulation will become involved in a transient material fire. No safety-related cabling is routed in the cable trays within the zone.

3. The power and control cables for the two emergency diesel generators are routed through the zone from the DG rooms above to the base slab through 4 inch metallic conduit. The Division II circuits are routed above the water treatment area and are a minimum of 7 feet from the nearest cable tray. The Division I control and auxiliary circuits are routed in conduit that crosses a cable tray and could be degraded by a fire in the tray. A minimum separation of 29 feet exists between conduits containing redundant circuits. The intervening floor space is a curbed area containing the makeup demineralizing system, making it improbable that sufficient transients or any oil spillage will occur in the space to produce a fire of sufficient intensity to degrade the circuits of both Division I and Division II.

4. The area in the vicinity of the condensate pumps is provided with sufficient floor drainage to prevent migration of any spilled lubricating oil beyond the immediate vicinity and thus limiting the extent of any fire that may involve such a spill.

5. The two diesel oil transfer pumps were provided to supply fuel to the radwaste evaporation system boiler which has been deactivated and abandoned in place. The pumps are not used for any other purpose and do not create a hazard in the zone. The pumps are in a curbed area located a minimum of 30 feet from the diesel generator power and control cable conduit.

6. The two air compressors and air receivers are not exposed to any concentration of combustibles but loss of function may be expected as a result of a cable tray fire.

7. The normal ventilation system will effectively remove any smoke generated by a fire in the zone.

8. The drainage system is adequate to dispose of any fire protection water.

Conclusions

1. The DBF will not affect the capability to achieve and maintain safe shutdown.

2. The hose stations and portable extinguishers within the zone provide adequate fire protection for the hazard present.

3. The fire hazard analysis of the zone does not indicate the need for automatic fire detection within the zone, as sufficient separation exists to preclude exposure of the redundant DG power and control cabling to a single fire. The proposed installation of ionization smoke detectors will, however, provide for early detection of a fire that may expose one of the two redundant systems.

Fire Zone 7-F

Turbine Building - El 734'-0" - FHA-M-1 - 12,901 square feet - Condenser Area

Description of Zone

The zone comprises the entire area below the operating floor surrounded by the shield wall. The shield wall is reinforced concrete and concrete block varying in thickness between 36 and 48 inches. The ceiling is 9 inch thick reinforced concrete on fluted metal decking welded to the top flange of exposed structural steel framing. A mezzanine at elevation 757'-6" extends the full length of the zone between column line L and the west wall of the zone. The mezzanine construction is similar to the zone ceiling construction. A 3 hour fire door at the north end of the mezzanine communicates with a corridor which affords access to Zone 8-A and an enclosed stairwell. Other doors, nonrated hollow metal, communicate with zones not addressed in the analysis because they do not contain safety-related equipment and contain an insignificant amount of combustible material. Ventilation for the zone is provided by 35,200 cfm ducted exhaust to the main exhaust plenum, Zone 4-C. Supply air is provided by induced flow of 14,000 cfm from the operating floor, Zone 9-A, in the vicinity of the turbine, 14,630 cfm through backdraft damper equipped transfer grilles in the shield wall, and the balance by infiltration through door cracks and walls. No fire dampers are provided in the penetrations. Drainage is provided by eleven 4 inch floor drains at the 734'-0" level and six 4 inch floor drains at the mezzanine level.

Equipment in Zone

Safety-related cable trays, Division II
Main steam stop valves
Main steam bypass valve
Main condensers
Feedwater heaters
Air cooling units
Associated instrumentations, MOVs, and controls

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	8,434 lb	87,713,600
Lubricating oil	5,550 gal	804,750,000 (Note 1)
EHC fluid, Fyrquel	650 gal	88,834,850 (Note 2)
	Total	981,298,450

Combustible loading - 76,064 Btu/sq ft
Equivalent severity - 0.96 hr

Note 1: Quantity is based on rupture of lube oil guard pipe and spillage of entire contents of turbine lube oil reservoir.

Note 2: Quantity is based on rupture of EHC fluid piping and spillage of entire contents of EHC fluid power unit.

Fire Protection Equipment

The entire zone, with the exception of the area above and below the mezzanine, is provided with an automatic wet pipe sprinkler system. Three hose stations are provided at the floor level and two hose stations at the mezzanine level. Portable extinguishers are provided in the vicinity of each hose station and two additional portable extinguishers are provide on grating platforms.

Design Basis Fire

Ignition of lubricating oil spill from contact with heated piping or equipment.

Consequences of Design Basis Fire

1. The installed automatic sprinkler system is expected to actuate shortly following ignition and to control the fire. The sprinkler alarm will alert the fire brigade for final extinguishment if required.

2. Impairment of the water supply to the sprinkler system will prevent operation of the system and no fire alarm will be transmitted. An increase in the ambient temperature within the zone due to a fire will be detected by the temperature sensors at the inlet to the air cooling units with display, high temperature alarm, and annunciation in the control room. The wet standpipe system hose stations are supplied by a connection to the yard fire main, remote from the sprinkler system supply, and will remain functional during the sprinkler impairment. Hose streams from exterior hydrants are available for additional fire fighting.

3. The DBF is postulated to involve cable insulation in one or more cable trays in the zone. One safety-related tray is routed through the zone but contains only instrumentation circuits. The only identified safeguard circuit is the RHR service water wet pit water level indicator; the redundant element and circuits are not exposed to the zone.

4. The DBF may cause loss of function of certain valves or instrumentation essential to the operation of the turbine generator.

5. It is unrealistic to postulate a rupture or other condition that could cause spillage of the entire contents of either the EHC system or the turbine lube oil system. The height of the zone, approximately 45 feet in the vicinity of possible oil spills, makes it highly unlikely that any conceivable fire could breach the boundaries of the zone.

6. The normal exhaust system is adequate to effectively remove any smoke generated by a fire in the zone.

7. The drainage system will effectively remove oil spillage and fire protection water from the zone.

Conclusions

1. The DBF will not affect the capability to achieve and maintain safe cold shutdown.

2. The presently installed automatic sprinkler system and backup equipment provide adequate fire protection for the zone.

3. No further modifications are proposed or needed.

Fire Zone 8-A

Turbine Building - El 757'-6" - FHA-M-2 - 6,306 square feet - Ground Floor - North Portion

Description of Zone

North portion of turbine building ground floor outside of condenser area excluding the switchgear room. Reinforced concrete floor and minimum 9 inch reinforced concrete ceiling on fluted metal deck supported on exposed structural steel framing. Interior walls are reinforced concrete and concrete block with thickness varying from 8 to 48 inches. Exterior walls are 7-inch precast reinforced concrete panels clipped to exposed structural steel columns. Five 3 hour rated fire doors provide access to the upper switchgear room, control building corridor, Division I emergency switchgear room, and the corridor providing access to the reactor building airlock and stairwell between the operating floor and condenser area. The only other door in the zone is a 12 foot wide roll-up door in the north exterior wall. The south boundary of the zone is an approximate 400 square foot open area at the grating floor of Zone 8-C. An open stairwell communicates with Zone 7-A below. Ventilation is provided by 2,200 cfm outside air ducted into the north portion of the zone with exhaust provided by induced flow through backdraft dampered transfer grills into the condenser area, Zone 7-F. Approximately 400 cfm will flow into the south portion of the zone from Zone 8-C. No fire dampers are provided in the ventilation system. Eighteen 4 inch floor drains are provided in the zone.

Equipment in Zone

MCC-1B12-nonessential
Carbon dioxide system storage tank
Turbine lube oil system pumps and coolers
Auxiliary transformer isophase bus ducts
Two 1,200 A 4,160 V bus ducts
Feedwater and miscellaneous turbine instrument racks

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	12,884 lb	133,993,600
Anti-contamination clothing	250 sets	4,000,000
Miscellaneous transients (est)	200 lb	16,000,000
	Total	153,993,600

Combustible loading - 24,420 Btu/sq ft
Equivalent severity - 0.31 hr

Fire Protection Equipment

Hose station and portable extinguisher within the zone. Hose station and portable extinguisher at boundary of adjacent Zone 8-B. Exterior hydrant hose streams available through exterior door. The turbine lube oil reservoir and pumps are provided with an automatic deluge sprinkler system.

Design Basis Fire

Ignition of transient combustibles with possible involvement of cable insulation.

Consequences of Design Basis Fire

1. The equivalent severity of the DBF is insufficient to breach the boundaries of the zone. A single tier of four 24 inch cable trays is routed through the south end of the zone into Zone 8-C. A fire involving one or more of these trays could propagate into Zone 8-C with no adverse effects other than to the involved cabling.

2. In event the DBF were to originate in or expose the lube oil reservoir equipment, the installed deluge system is expected to actuate and protect the lube oil equipment from direct or exposure fire damage.

3. Because of the presence of the exterior door and its proximity to the general warehouse, the zone is utilized extensively for personnel and material access into the turbine building and varying amounts of transients will generally be present. It is postulated that the DBF will involve these transients and propagate to cabling in the vicinity. The major hazard due to transients will occur during shutdown maintenance periods.

4. The 4,160 volt bus ducts are separated by a minimum of 23.5 feet and provide offsite power from the startup transformer to each division of 4,160 volt essential switchgear. Redundant offsite power sources are available from the standby transformer to the essential switchgear. The isophase bus ducts connect the auxiliary transformer to the main generator. Exposure damage to any of these bus ducts will not affect the plant safety.

5. The cabling within the zone is all nonsafety-related and includes power feeders to various nonessential MCCs throughout the plant, as well as power and control circuits for various nonessential systems and equipment. MCC 1B12 operates the turbine building roof exhaust fans, turbine building crane, and various systems and equipment associated with the turbine operation. Exposure damage to the MCC or the cabling will not affect plant safety.

5. The carbon dioxide storage tank provides automatic suppression for the cable spreading room, Zone 11-A, and main generator purge carbon dioxide. Loss of power to the refrigeration equipment or the suppression system master valve may result from exposure. The storage tank will self-refrigerate by controlled vaporization through mechanical relief valves. The master valve is normally energized and loss of power will open the valve and charge the system up to the selector valve controlling the Zone 11-A system. No degradation of the suppression system will occur.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The proposed addition of a live hose reel with booster hose and low capacity nozzle near the entrance to Zone 10-F will provide additional suppression capability, especially to the vicinity of the clean anti-contamination clothing storage racks.

3. No further modifications are proposed or needed.

Fire Zone 8-B

Turbine Building - El 757'-6" - 1,161 square feet - Upper Switchgear Room

Description of Zone

Northeast corner of turbine building ground floor. Reinforced concrete floor with 9 inch reinforced concrete ceiling on fluted metal decking welded to top flange of exposed structural steel framing. Interior walls are 8 inch concrete block provided with two 3 hour rated fire doors communicating with adjacent Zone 8-A. Three ventilating duct penetrations in the wall are provided with 1-1/2 hour fire dampers. The exterior walls are 7 inch precast reinforced concrete panels clipped to structural columns. Ventilation for the zone is provided by 100% recirculation of 7,200 cfm through an air cooling unit in Zone 7-A below. The same unit handles air for the lower switchgear room, Zone 7-B, and is further addressed under Zone 7-B. No fire dampers are provided in the two exhaust duct penetrations through the floor into Zone 7-A. No floor drainage is provided in the zone. Three heavy metal bus ducts penetrate the interior walls into Zone 8-A and are provided with 1/4 inch metal closure plates. Two similar bus ducts penetrate the exterior wall for direct connection to the startup transformer and one similar duct penetrates the floor into Zone 7-B. The space between the precast panels exposing the supporting columns is covered with insulated metal siding panels. The exterior face of the walls is designed to provide a 2 hour resistance to a transformer fire exposure.

Equipment in Zone

4,160 volt switchgear 1A1
480 volt load center 1B1
480 volt load center 1B5

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	2,658 lb	27,643,200
Transient material	Minimal	Nil
	Total	27,643,200

Combustible loading - 23,810 Btu/sq ft
Equivalent severity - 0.30 hr

Fire Protection Equipment

None provided within the zone. Portable extinguishers and hose stations available in adjacent Zone 8-A.

Design Basis Fire

Ignition of cable insulation from electrical overload.

Consequences of Design Basis Fire

1. The equivalent severity of the DBF is insufficient to breach the boundaries of the zone with the exception of the floor penetrations.

2. The lack of fire dampers in two of the four exhaust ducts, those penetrating the floor, will result in heated products of combustion being introduced into Zone 7-B following the closure of the common duct fire damper in Zone 7-A. Continued powered supply air, prior to closure of the supply duct fire damper, will cause the smoke to be exhausted through the Zone 7-B transfer grill into Zone 7-C. The presence of heated products of combustion will be detected and alarmed as addressed in Zone 7-B. The heat may expose cabling in Zone 7-B with the consequences addressed in Zone 7-B.

3. The 4,160 volt bus ducts within the zone supply all offsite power to the plant from both the auxiliary and startup transformers and damage to any one or more of the ducts may cause loss of offsite power to switchgear not accessible to the standby transformer.

4. The cabling within the zone is nonsafety related. The DBF is assumed to involve circuits passing through the zone as well as those power, control, and instrumentation circuits associated with 4,160 volt switchgear 1A1 and 480 volt load centers 1B1 and 1B5, causing loss of function of the equipment and the connected loads with no safeguard systems affected.

5. The normal ventilation system will dilute and exhaust smoke until the air flow is stopped by fire damper closure. Portable smoke ejectors will effectively evacuate smoke from the zone through the doors.

6. Any fire protection water used will drain through the doorways into the drainage system in Zone 8-A for disposal.

Conclusions

1. The DBF will not affect the ability to achieve and maintain safe cold shutdown. The redundant offsite power supply from the standby transformer and the availability of the emergency diesel generators will supply power to both divisions of the essential 4,160 volt switchgear and associated loads.

2. The installation of backdraft dampers in the interconnected exhaust ducts will retard any possible propagation of the DBF into Zone 7-B. The installation of the fire dampers at the floor penetration will provide the same protection. The high ambient temperature alarm discussed under Zone 7-B will alert the operator to an overheat condition.

3. Provision of fire resistive insulating board on the room side of the two bus duct penetrations from the startup transformer will upgrade the exterior wall to resist the effects of a transformer fire should its deluge system fail to actuate.

4. The modification described in Conclusions 2 and 3 above will provide increased protection from property damage and prolonged plant outage but are not necessary for achieving and maintaining safe cold shutdown.

Fire Zone 8-C

Turbine Building - El 757'-6" - FHA-M-2 - 1,400 square feet - Tube Pulling Area

Description of Zone

Grade level corridor between the north and south portions of the turbine building. The zone is open at the north and south ends communicating with Zones 8-A and 8-C, and is defined by the grating floor above Zones 7-C and 7-E. The east wall is the 7 inch thick precast concrete exterior wall and the west wall is the 42 inch concrete and block shield wall of the condenser area. The ceiling is 36 inch thick reinforced concrete on fluted metal decking welded to the web of partially exposed structural steel framing. Ventilation for the zone is provided by natural airflow from adjacent zones with approximately 3,400 cfm induced exhaust into the condenser area through two backdraft dampered transfer grills. The grating floor of the zone provides drainage.

Equipment in Zone

Isophase bus ducts supplying the auxiliary transformer
Nondivisional cable trays

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	2,042 lb	21,236,800
	Total	21,236,800

Combustible loading - 15,169 Btu/sq ft
Equivalent severity - 0.19 hr

Fire Protection Equipment

One hose station and portable extinguisher at north boundary of zone. Hose station available from Zone 8-D and portable extinguishers are available in both adjacent zones.

Design Basis Fire

Ignition of cable insulation from electrical overload or propagation from trays in adjacent zones.

Consequences of Design Basis Fire

1. The equivalent severity of the DBF will not degrade the boundaries of the zone. Propagation into adjacent zones is possible along the continuous cable tray runs.

2. The cabling routed through the zone is not safety-related, but involvement could cause loss of power feeders to nonessential turbine building MCCs, 1B52 and 1B62, as well as power, control, and instrumentation circuits involving other turbine building nonessential systems.

3. The horizontal separation, in excess of 6 feet, between the cable tray tier and isophase bus duct, to the auxiliary transformer, is adequate to prevent damage to the bus duct.

4. The normal building exhaust system will remove smoke from the zone.

5. Any fire protection water will drain through the grating floor into Zones 7-C and 7-E and be collected by the drainage system in those zones.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The zone provides a fire break between the north and south portions of the turbine building for both levels below the operating floor by providing means for smoke and heat removal capability.

3. No additional fire protection provisions are proposed or needed.

Fire Zone 8-D

Turbine Building - El 757'-6" - FHA-M-2 - 5,519 square feet - Ground Floor - South Portion

Description of Zone

The zone comprises the grade level portion of the turbine building south of the condenser area shield wall excluding the plant heating boiler room, the diesel generator rooms, and the cells containing the condensate demineralizing pumps and tanks. Reinforced concrete floor and 9 inch minimum concrete ceiling on fluted metal decking welded to top flange of exposed structural steel framing. An open equipment hatch, 24 feet wide by 60 feet long, above the railroad bay communicates with the operating floor, Zone 9-E, above. An open stairwell in an alcove to the west of the railroad bay communicates with Zone 7-E below. The shield walls to the north and west of the zone are 18 to 36 inch reinforced concrete and concrete block. The exterior walls are 7 inch thick precast concrete panels clipped to exposed structural steel columns. Two 3 hour rated fire doors in 12 inch reinforced concrete and concrete block walls communicate with the two diesel generator rooms, Zones 8-F and 8-H. The boiler room, Zone 8-E, is isolated by an 8 inch concrete block wall with a 3 hour rated fire door. An enclosed stairwell with 1-1/2 hour rated fire door communicates with the floors above and below and provides egress to the exterior. The access door to the railroad bay is a 17 foot wide roll-up steel door. The open area communicating with Zone 8-C is approximately 20 feet in height and width and is defined by the open grating floor. Ventilation for the zone is provided by approximately 8,000 cfm natural flow into the zone through the equipment hatch from the operating floor with induced exhaust into the condenser area through backdraft dampered transfer grills in the zone and adjacent Zone 8-C. Eighteen 4 inch floor drains are dispersed through the zone.

Equipment in Zone

Hydrogen seal oil unit
480 volt MCC 1B45
480 volt MCC 1B52
Stator winding cooling system
Isophase bus ducts, coolers, and associated
Associated instrumentation and controls

Combustible Material	Quantity	Heat Release - Btu	
Cable insulation	4,155 lb	43,212,000	
Lube oil (H2 seal unit)	160 gal (est)	23,200,000	
Transients (55 gal oil drums)	8 drums	63,800,000	(Note 1)
Transients (miscel-laneous Class A)	900 lb	72,000,000	(Note 2)
	Total	137,412,000	

Combustible loading - 24,898 Btu/sq ft
Equivalent severity - 0.31 hr

Note 1: eight drums stored in railroad bay

Note 2: three plywood trash containers in railroad bay

Fire Protection Equipment

An automatic deluge water spray system with design density of 0.30 gpm per square foot of surface protects the hydrogen seal oil unit. A hose station and portable extinguisher are located outside the DG room doors with an additional portable extinguisher located in the vicinity of the railroad bay. Hose stations are available in the vicinity of the enclosed stairway in Zones 9-A above and 7-E below. Additional portable extinguishers are located in adjacent zones. Effective hydrant hose streams are available through the exterior doors.

Design Basis Fire

Three DBFs are considered:

DBF-1 Ignition of an oil spill in the hydrogen seal oil unit area with possible involvement of cable insulation in the vicinity

DBF-2 Ignition of an oil spill from lube oil piping leak with possible involvement of cable insulation in the vicinity

DBF-3 Ignition of transient combustibles in the railroad bay with involvement of other combustibles and cabling in the vicinity

Consequences of Design Basis Fire

1. The installed water spray system is expected to actuate shortly following ignition of DBF-1 and to control or extinguish the fire. The system alarm will alert the fire brigade for final extinguishment if required. The curbing surrounding the unit will confine the spill and fire protection water discharge (approximately 90 gpm) until approximately 600 gallons is collected. Overflow will migrate to four 4 inch floor drains within 10 feet of the curb and be conducted to the auxiliary turbine building floor drain sump for disposal. Failure of the water spray system to actuate, either automatically or by manual trip, may cause damage to the seal oil unit and the nearby cable tray resulting in damage to circuits controlling the stator winding cooling system. Migration of oil overflow from the curbed area is discussed in considering DBF-2.

2. DBF-2 is the ignition of oil spills resulting from leakage in the lube oil piping that is routed in the area extending from the generator centerlines approximately 31 feet easterly and between the condenser area shield wall and the diesel generator room wall. Six 4 inch floor drains are within or immediately outside this area. The floor slopes toward the drains and nominal leakage is expected to migrate toward the nearest drain with a minimal film thickness. The heat sink capability of the floor will cool the oil and prevent sustained combustion. In event the leakage is sufficient to exceed the drainage capacity of one floor drain, approximately 30 gpm, ponding may develop of sufficient size and depth to sustain combustion and DBF-2 may develop with sufficient intensity to expose cabling in the vicinity, and also expose nearby equipment or systems to damage by radiant heat or direct impingement. No safety-related cabling

or system is within the zone. The cabling exposed to DBF-2 includes power, control, or instrumentation circuits associated with three of the eight turbine building roof exhaust fans, the generator stator cooling system, the hydrogen seal oil unit, and other systems important to plant operations but not essential for safe shutdown or fire fighting operations. The equipment exposed to possible damage is all associated with the main generator cooling system, isophase bus duct cooling, and power generation.

3. Rupture of a lube oil supply pipe may result in sufficient discharge of oil to overtax the drainage system and permit ponding to the extent that oil may flow into the adjacent diesel generator rooms through the door cracks and also through the grating floor area of Zone 8-C into Zone 7-E below with possible propagation of DBF-2 into these zones. The turbine generator lubrication system instrumentation will alert the operators to the condition permitting early discovery of a fire and prompt fire brigade response. Large hose streams from the exterior hydrants will permit effective control and extinguishment of the fire. The 3 hour fire doors and walls surrounding the emergency diesel generators will effectively resist breaching by DBF-2.

4. The railroad bay, having grade level access from the exterior, is expected to have varying amounts of transient combustibles present from time to time, especially during periods of extensive maintenance. DBF-3 postulates ignition of transients in this area with involvement of all combustibles in the vicinity. The walls of the railroad bay are sufficiently fire resistive to retain their integrity during the course of DBF-3. The open hatch above the bay will vent the fire causing the majority of the smoke and heat to rise into the operating floor area, Zone 9-A. The cable trays exposed to DBF-3 contain the main power feeders to nonessential MCC-1B45 and control circuits for two of the turbine building roof exhaust fans which are expected to sustain loss of function. Other than the exhaust fans, the only exposed circuit affecting the fire brigade operations is the railroad bay door operating motor. The equipment exposed to possible radiant or impingement damage due to DBF-3 is limited to MCC 1B45, the generator excitation control cubicle, and possibly the stator cooling unit.

5. No structural damage is postulated as a result of DBF-1. In the event DBF-2 were to involve the massive spill described above and active fire fighting operations were to be delayed for an extended period of time, some structural damage may result. The exposed structural steel supporting the ceiling could deform causing degradation of the ceiling slab with possible collapse. The 36-inch, 300 pound per foot, wide flange column 7-Q supporting the roof will resist deformation for an extended period but will eventually fail and may cause partial collapse of the turbine building roof. Columns 4-L, 5-L, and 6-L are exposed to DBF-3 but failure is not postulated. The columns are partially encased in the railroad bay wall for a height of 22'-6", with 6 inches of reinforced concrete covering the column faces. The open hatch provides natural venting to effectively prevent excessive heating of the balance of the height of the column.

6. The normal building ventilation system will effectively remove smoke developed by DBF-1 prior to and following actuation of the water spray system. The normal system is inadequate to effectively remove smoke and heat from DBF-2 and DBF-3. A minimum of five powered roof exhaust vents, each with a capacity of 9,000 cfm, will remain functional for exhausting the smoke up through the equipment hatch and the roof to the atmosphere. Additionally, the roof is provided with six 30 square foot automatic smoke vents. The roof exhaust and smoke vents will adequately vent the zone.

7. The floor drainage system, in conjunction with the exterior door and the Zone 8-C grating floor is adequate to dispose of any fire protection water from the automatic water spray system and both standpipe and hydrant hose streams.

8. The boundaries of the zone are sufficiently fire resistive to prevent horizontal propagation of the DBFs except for possible propagation along the cable trays into Zone 8-C. The grating floor may permit propagation of burning oil into 7-E below. The floor drainage in 7-E will collect the oil and confine the fire to the immediate vicinity. DBF-3 will vent upward into Zone 9-A with no adverse effects because no fixed combustible material is in the vicinity of the open hatch.

Conclusions

1. A fire in the zone is not expected to affect the capability to achieve and maintain cold shutdown. The loss of function of the main generator will cause loss of function of the auxiliary transformer but will not affect the availability of offsite power from two sources because the startup and standby transformers will remain functional.

2. The proposed curbing of the doors to the diesel generator rooms will prevent the flow of oil and fire protection water from the zone into the diesel generator rooms. The 3 hour rated fire wall separating the diesel generators from the zone will prevent exposure by DBF-2.

3. The lube oil piping in the zone is a moderate energy piping system with an operating pressure of 25 to 40 psig in the supply piping and gravity flow in the drainage piping. A portion of the supply piping in the zone is routed through a guard pipe. The largest unguarded supply pipe is 6 inches in diameter. An analysis of the maximum postulated leakage in this piping established by the criteria outlined in SRP 3.6.1 (BTP MEB 3-1 and APCSB 3-1) with no credit for viscosity, indicates a maximum leakage rate of approximately 68 gpm. The four 4 inch floor drains in the vicinity of the 6 inch lube oil supply piping will prevent the excessive ponding described in Consequence 3 above making it highly unlikely that the potential damage due to DBF-2 described in Consequence 5 above will occur.

4. The use of the railroad bay as a temporary holding area for transients is necessary for efficient operation of the plant because of the grade level access. Administrative controls can be developed to limit the accumulation of excess waste materials and to limit the quantity of combustible liquids in drums within

the area at any given time. The installation of automatic sprinklers to protect the area is not technically practical and is not proposed.

5. The existing conditions and proposed modifications provide adequate fire protection for systems and equipment required for safe shutdown and no additional modifications are proposed or needed.

Fire Zone 8-E

Turbine Building - El 757'-6" - FHA-M-2 - 909 square feet - Heating Boiler Room

Description of Zone

Reinforced concrete floor with 9 inch reinforced concrete ceiling on fluted metal decking welded to top flange of exposed structural steel framing. The ceiling over the north 4 feet of the zone is the underside of the south portion of the T-6 pedestal supporting the alternator. The north and west walls of the zone are 8 inch concrete block separating the zone from Zone 8-D and the enclosed stairwell between Zone 7-E and the operating floor, Zone 9-A. The south wall is the turbine building exterior wall consisting of 7 inch precast concrete panels clipped to supporting steel columns. The east wall is 12 inch reinforced concrete separating the zone from the diesel generator and day tank rooms, Zones 8-F and 8-G. Access to the zone is through two 3 hour rated fire doors communicating with the stairwell and the railroad bay in Zone 8-E. A louver in the exterior wall provides ventilation and combustion air for the zone. No mechanical ventilation is provided. Two 4 inch floor drains are provided within the zone, one discharging into the turbine building auxiliary floor drain sump, and the other, located in the vicinity of the fuel oil pump and the burner area discharge, to an exterior holding tank. The drain line is provided with a backwater valve upstream of other drain lines. An HVAC duct, passing vertically through the zone, is completely isolated by an 8 inch concrete block enclosure.

Equipment in Zone

Heating boiler 1S-61
Fuel oil pump 1P-53
Boiler air compressor 1K-5
Boiler feed pumps 1P-54A and B
Associated instrumentation and controls
Heating hot water circulating pumps 1P-52A and B
Secondary hot water pumps 1V-HP-20A and B, 21, and 22

Combustible Material	Quantity	Heat Release - Btu	
Cable insulation	51 lb	530,400	
No. 2 fuel oil	Minimal	Nil	(Note 1)
	Total	530,400	

Combustible loading - 584 Btu/sq ft

Equivalent severity - Nil

Note 1: The fuel oil within the zone is limited to that within the fuel oil piping system. No day tank is provided.

Fire Protection Equipment

Ordinary hazard wet pipe sprinkler system throughout the zone with local alarm and control room annunciation. Portable extinguisher within the zone and adjacent zones. Hose stations available in adjacent zones.

Design Basis Fire

Ignition of oil spill from fuel oil piping system leakage.

Consequences of Design Basis Fire

1. The installed automatic wet pipe sprinkler system is expected to operate shortly following ignition of the DBF and to control or extinguish the fire. Annunciation in the control room will alert the fire brigade for final extinguishment if required.

2. The fuel supply for the boiler is contained in an exterior underground storage tank and is fed to the burner by pump 1P-53 within the zone with excess fuel returned to the underground storage tank. In event of failure of the automatic sprinkler system to actuate, the leakage will continue to provide fuel to the fire until such time that the fire causes loss of power to the fuel pump and stops the flow of fuel or the pump is manually shut off. The boiler controls will annunciate the failure in the control room.

3. The intensity and duration of the DBF are insufficient to breach the boundaries of the zone either with or without the actuation of the sprinkler system.

4. The cable tray within the zone is not exposed to the DBF. The tray contains power and control circuits for the main heating hot water pumps for the entire plant, as well the boiler fuel pumps and turbine building secondary heating loop. A fire involving this tray is postulated to cause loss of function of one or more of these pumps prior to actuation of the sprinkler system.

5. Smoke will vent from the zone through the louver in the exterior wall. The louver will open on temperature rise and will fail open.

6. The floor drains will adequately dispose of any fire protection water discharged. The drain in the vicinity of the boiler fuel piping will collect and discharge any fuel oil leakage and thus mitigate the consequences of the DBF.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. No modifications are proposed or needed.

Fire Zones 8-F and 8-H

Turbine Building - El 757-6 - FHA-M-2 - 1,212 square feet (each room) - Emergency Diesel Generator Rooms

Description of Zones

The two zones are, with minor exceptions, identical in construction and contain identical equipment. The floors are the 9 inch reinforced concrete ceiling over the water treatment area, Zone 7-E. The ceilings are 9 inch reinforced concrete on fluted metal decking welded to the top flange of 24 inch exposed structural beams supported by 36 inch structural steel girders. The walls exposed to the exterior of the building are 7 inch reinforced concrete panels clipped to the main roof supporting columns. The interior face of the wall panels are completely covered by 8 inch concrete blocks forming a composite wall 15 inches thick. The interior walls separating the two rooms, Zones 8-F and 8-H, and that separating Zone 8-F from the boiler room, Zone 8-E, are 12 inch reinforced concrete. The north wall of the two zones is a combination of 12 inch reinforced concrete and 12 inch concrete block. The north wall of each room contains a 3 hour fire door providing access from Zone 8-D. The east exterior wall of Zone 8-H is exposed to a potential fire involving the main transformer. The interior surfaces of the structural steel framing of this wall are fireproofed with a protective coating. A fuel oil day tank room is provided in the southwest corner of each diesel generator room, suitably cut off and provided with a curbed 3 hour rated fire door. The day tank rooms are addressed under Zones 8-G and 8-J.

Ventilation for each zone is provided by an independant Seismic Class 1 system. An axial flow fan within the zone discharges 38,000 cfm into the zone. The outside air intake is an undampered louver mounted approximately 37 feet above the operating floor in the turbine building wall. An emergency supply is provided by a backdraft dampered inlet to the supply duct at the operating floor level within the building protected by a 20 inch concrete block wall. The exhaust louvers are located in the exterior wall approximately 41 feet below the main intake. Air is recirculated or exhausted to the exterior by means of automatically controlled dampers set to maintain a maximum room temperature of 140F. The supply and exhaust dampers fail open and the recirculating damper fails closed. A steel air baffle extends the full width of each zone from the ceiling to approximately 12 feet above the floor. The engine combustion air intake is within the zone and located on the generator side of the baffle. Drainage for each zone is provided by five 4 inch floor drains discharging into headers provided with backflow valves arranged to isolate the zones from each other and other parts of the plant. The waste discharges into an exterior underground holding tank.

A cross connection between the fuel supply lines from the underground supply tank to the individual day tanks is routed through both zones; the line is normally unpressurized and provided with normally closed valves at each end.

The piping supplying lubricating oil to main generator bearing 8 and the alternator, as well as the alternator gravity drain, is routed partially through the northwest portion of Zone 8-F.

Equipment in Zones

Equipment	Zone 8-F	Zone 8-H
Emergency diesel generator	1G-21	1G-31
Backup fuel supply pump	1P-41B	1P-41A
Electric driven air compressor	1K-10B	1K-10A
Diesel driven air compressor	1K-10D	1K-10C
Air supply axial flow fan	1V-SF-21	1V-SF20
Diesel generator gage board	1C-92	1C-91
Diesel generator control cabinet	1C-94	1C-93
Diesel generator control relay and terminal board	1C-118	1C-117
Diesel generator neutral grounding transformer	1G-211	1G-311

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	Nil	Nil (Note 1)
Lubricating oil (crankcase)	465 gal	67,425,000
Lubricating oil (compressor)	3 gal	435,000
Fuel oil (air compressor)	2.5 gal	355,000
	Total	68,215,000

Combustible loading - 56,283 Btu/sq ft
Equivalent severity - 0.70 hr
Note 1: All cabling is in conduit.

Fire Protection Equipment

Each zone is provided with four infrared fire detectors alarming locally and annunciated by zone in the control room. No portable extinguishers are provided within the zones. Portable extinguishers and a hose station are available nearby in adjacent Zone 8-D.

Design Basis Fire

Ignition of oil spill from leakage in fuel oil supply or return lines.

Consequences of Design Basis Fire

1. The equivalent severity of the DBF is insufficient to breach the boundaries of either zone and expose the redundant equipment.

2. The installed infrared fire detectors are positioned to detect flames in any portion of the room and are expected to detect a fire in its earliest stages. The alarm in the control room will alert the fire brigade for manual extinguishment.

3. The arrangement of the floor drains and floor slopes is such that most leakage will be confined to immediate vicinity and

a portion of the oil will enter the drain and reduce the quantity of fuel available for combustion.

4. The engine combustion air intake is positioned on the generator side of the room air baffle. The engine fuel system is on the opposite end of the engine. The recirculating air control dampers close when the engine is running causing the airflow to direct the smoke away from the combustion air intake and exhaust it through the wall louvers to the exterior. The engine will continue to operate until such time that the fuel supply is interrupted by the DBF or the engine is stopped by other action. The fuel supply to the DBF will be stopped when the engine ceases to run.

5. It must be postulated that loss of function of the involved diesel generator will result, regardless of the cause or location of the DBF.

6. An analysis has been performed that demonstrates that the smoke exhausted from one zone will not be inducted into the elevated air intake of the other zone in sufficent quantity to degrade the function of the redundant emergency diesel generator.

7. The doors in each room communicating with Zone 8-D are not curbed. A possibility exists that a large oil spill in Zone 8-D or oil carried by fire protection water discharged in Zone 8-D could cause oil to migrate through the doorway into either or both Zones 8-F and 8-H. Ignition of this oil could cause loss of function of the emergency diesel generator in the involved zone.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown. A fire in either zone will not cause loss of function of the redundant emergency diesel generator. The fire will not affect the availability of offsite power sources

2. The proposed curbing of the doors communicating with Zone 8-D will prevent migration of oil or water into the zones

3. The proposed rerouting of the main generator and alternator lube oil piping will eliminate the potential hazard in Zone 8-F.

4. The proposed installation of a preaction automatic sprinkler system in the area on the engine side of the air baffle will provide rapid automatic control of the DBF. The design of the preaction system will be such that the water discharge will not degrade the operability of the diesel generator either from inadvertant actuation or during and following extinguishment of the DBF. The proposed preaction system will be designed as a conversion and extension of the existing wet pipe sprinkler system protecting the associated day tank room.

5. The proposed repair of the damaged fireproofing on structural steel members within Zone 8-H will restore the 3 hour rating of the exterior wall exposed to a potential transformer fire.

Fire Zones 8-G and 8-J

Turbine Building - El 757'-6" - FHA-M-2 - 88 square feet - Diesel Generator Day Tank Rooms

Description of Zones

The zones are identical compartments in the southwest corner of each diesel generator room, Zones 8-F and 8-J. The floor, west wall, and exterior wall construction is identical to that of Zones 8-F and 8-J. The walls separating the day tank room from the diesel generator rooms are 8 inch concrete block with a 3 hour rated fire door with the doorsill elevated 30 inches above the floor. The ceiling is 12 inch reinforced concrete on fluted metal decking supported on and dowelled into the walls forming a 3 hour fire barrier. The 30 inch sill height is sufficient to retain approximately 1,645 gallons. The day tanks are vented to the exterior but no other ventilation is provided for the zones. No drainage is provided within the zones.

Equipment in Zones

	Zone 8-G	Zone 8-J
Diesel fuel oil day tank	1T-37B	1T-37A
Lubricating oil makeup tank	1T-114B	1T-114A

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	Nil	Nil
Diesel fuel oil	1,000 gal	142,000,000
Lubricating oil	250 gal	36,250,000
	Total	178,250,000

Combustible loading - 2,025,558 Btu/sq ft
Equivalent severity - 25.3 hr

Fire Protection Equipment

Each zone is provided with an automatic wet pipe sprinkler system consisting of one sprinkler head connected to a 2-1/2 inch alarm valve. A common local alarm is provided with the zones separately annunciated in the control room. No other fire protection equipment is provided in either zone. Portable extinguishers and a hose station are available in Zone 8-E accessible through the diesel generator rooms, Zones 8-F and 8-H.

Design Basis Fire

Ignition of fuel oil spill from leakage in fuel oil piping.

Consequences of Design Basis Fire

1. The installed automatic sprinkler is expected to actuate shortly following ignition and to extinguish the fire.

2. In event the sprinkler system is impaired the fully developed fire is expected to continue burning until extinguished

by oxygen starvation. Theoretically this would occur prior to the consumption of 1 gallon of diesel oil. Air infiltration through the door cracks will prolong the fire but it is highly unlikely that sufficient oxygen will become available to sustain the fully developed fire long enough to degrade the boundaries of the zone.

3. The absence of an ignition source in the zone makes it highly unlikely that the DBF will occur.

4. The 1,645 gallon capacity of the zone below the doorsill is sufficient to retain the contents of both tanks and approximately 8 minutes of discharge of the automatic sprinkler system. In event the sprinkler discharge and spilled oil were to exceed the zone rentention capacity, the excess would flow under the door and be drained off by the adjacent zone drainage system.

5. Smoke developed by the fire will infiltrate into the adjacent diesel generator room and can be exhausted by the diesel generator room ventilation system.

Conclusions

1. The DBF will not affect the ability to achieve and maintain cold shutdown. The associated emergency diesel generator may become unavailable due to degradation of its fuel system or automatic lubricating oil makeup system, but the redundant generator will remain functional. The DBF will not affect the availability of offsite power sources.

2. The proposed conversion of the existing system to a preaction system to protect the associated diesel generator room will require the installation of a fire detector in the day tank room. This detector will provide early warning of a fire and permit rapid manual action in event of impairment of the automatic system water supply.

3. The ventilation louvers previously recommended in the evaluation responding to Appendix A of Branch Technical Position APCSB 9.5-1 may expose the zone to flood damage. In lieu of the exterior louvers, a transfer grill, equipped with a 3 hour rated fire door damper, in the interior wall will adequately vent the space.

4. No further modifications are proposed or needed.

Fire Zone 9-A

Turbine Building - El 780'-0" - FHA-M-3 - 33,616 square feet - Turbine Operating Floor

Description of Zone

Reinforced concrete floor with reinforced concrete wall adjacent to the reactor building and the control building. The balance of the walls an insulated metal panels supported by exposed columns and girts. The roof is a metal deck with 1-1/2 inch rigid insulation and UL Class A built-up roof covering. A 3 hour fire door communicates with the reactor building through an airlock. Enclosed stairwells with 1-1/2 hour fire doors communicate with the floors below. A 24 by 60 foot open equipment hatch communicates with the railroad bay in Zone 8-E below. Concrete and block shield walls with a minimum height of 17 feet extend from the east wall to the west wall to isolate the turbine and equipment associated with the steam cycle. Entry to the shielded area is through nonrated hollow metal doors at the four corners of the shielded area. Four 80 square foot openings communicate with the condenser area, Zone 7-F, below for valve space and ventilation airflow. Ventilation for the zone is provided by a normal supply of 19,200 cfm outside air ducted into the zone with 14,000 cfm induced exhaust into the condenser area through the stop valve openings and around the turbine. Approximately 8,000 cfm induced exhaust airflow passes through the railroad bay equipment hatch into Zone 8-D below. The balance of supply air is made up by infiltration through the walls. The exhaust is removed from the building through the main exhaust plenum, Zone 4-C.

Additional exhaust capacity of 72,000 cfm is provided by eight 9,000 cfm capacity powered roof exhaust vents with makeup air supplied by twelve 6,000 cfm capacity dampered registers connected to the main turbine building air supply ducts. Six 30 square foot automatic smoke vents are provided in the roof. Drainage for the zone is provided by twenty-three 4 inch floor drains.

Equipment in Zone

Main turbine generator and alternator
125 ton bridge crane
Moisture separators and reheaters
Low pressure feedwater heaters
Combined stop and intermediate valves (4)
Condensate demineralizer system mixing tanks and pumps
Panel 1C-50 A-E - condenser demineralizer solenoid valve racks
1C-51 - condenser demineralizer precoat rack
1C-80 - condenser demineralizer control panel
1C-204 - feedwater heater instrument rack
1C-206 - main steam and reheater drain tank instrument rack
1C-213 - turbine building sample rack
Emergency diesel generator rooms intake air plenum

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	64.216 lb	667,680
Crane lubricating oil	40 gal	5,800,000
Transient combustibles	10,000 lb (est)	80,000,000
	Total	86,467,680

Combustible loading - 2,572 Btu/sq ft
Equivalent severity - 0.03 hr

Fire Protection Equipment

Six hose stations and seven portable extinguishers throughout the zone. Additional portable extinguishers available in adjacent zones. Exterior hydrant hose streams available for fire brigade use.

Design Basis Fire

Ignition of transient combustibles

Consequences of Design Basis Fire

1. The combustible loading and equivalent severity are not sufficient to breach the boundaries of the zone.

2. A service supply of resins and "Ecodex" are maintained in the vicinity of the condensate demineralizing system mixing tanks. A fire involving these transients may involve the only cable tray in the zone. The circuits subject to damage are those involving the demineralizing system. The quantity and combustibility of the transients and cabling are insufficient to degrade the structural integrity of the building and will have no effect on the plant safety.

3. The operating floor is expected to contain boxed or crated equipment from time to time especially prior to and during refueling periods. The dispersal of these transients precludes a concentration sufficient to degrade the structural integrity of the building.

4. The emergency diesel generator room air intake plenum is designed and supported to Seismic Category 1 criteria. The transients are located remote from plenum and will not degrade the air intake to the diesel generators.

5. The normal ventilation system will remove a nominal amount of smoke that may be generated by the DBF. In event excessive smoke or heat is generated, the roof fans are capable of providing adequate venting. The six smoke vents are fusible link operated and will provide backup in event the exhaust fans fail.

6. The drainage capacity is sufficient to remove any expected fire protection water discharge.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The hose station in the vicinity of the demineralizing equipment will provide adequate coverage if provided with the proposed additional hose lengths.

3. A modification is proposed to provide noncombustible containers or an enclosure for storage of the service supply of resins and "Ecodex."

4. The ventilation system is monitored to control radioactive release. During periods of maintenance, certain contaminated combustibles may become involved in the DBF but not in sufficient quantity to endanger the public.

5. No further modifications are proposed or needed.

Fire Zone 10-A

Control Building - El 757'-6" - FHA-M-2 - 813 square feet - Corridor

Description of Zone

Reinforced concrete floor, reinforced concrete and concrete block walls, reinforced concrete ceiling slab on fluted metal deck supported on top flange of exposed structural steel. The zone communicates with adjacent Zones 8-A, 10-B, 10-C, 10-D, and 10-E through 3 hour rated doors and with the corridor in the administration building through a nonrated hollow metal door. The zone is exhausted through adjacent switchgear room Zone 10-E and directed to discharge to the atmosphere. No floor drainage is provided for the zone.

Equipment in Zone

Cable trays
Emergency shower and eye wash

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	91.7 lb	953,680
	Total	953,680

Combustible loading - 1,173.04 Btu/sq ft
Equivalent severity - 0.015 hr

Fire Protection Equipment

Hose reel, portable extinguisher

Design Basis Fire

Ignition of cable insulation in one tray with possible involvement of all cable insulation.

Consequences of Design Basis Fire

The low combustible loading, considering all combustibles within the zone, is insufficient to breach the barriers defining the zone. The DBF may actuate the ionization detection system in the adjacent switchgear room Zone 10-E. A fire may cause possible loss of function of one or more circuits for balance of plant systems or equipment, and possible loss of function of one or more circuits for switchyard circuit breakers. The normal ventilation of the zone will provide a means of smoke removal.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The proposed replacement of the existing hose reel with a live reel booster hose and low flow capacity nozzle will enhance the capability to control and extinguish the fire.

Fire Zones 10-B, 10-C, and 10-D

Control Building - El 757'-6" - FHA-M- 2 - Zones 10-B and D 224 square feet - Zone 10-C 448 square feet - Battery Rooms

Description of Zone

Reinforced concrete floor, reinforced concrete and concrete block walls, reinforced concrete ceiling slab on fluted metal deck supported on top flange of exposed structural steel frame. Each zone communicates with adjacent Zone 10-A through 3 hour rated fire doors. Exhaust from each zone (150 cfm each for Zones 10-B and 10-D, 400 cfm for Zone 10-C) is ducted to the atmosphere by dedicated exhaust fans. Supply air for each zone is through transfer grills with 1-1/2 hour rated fire dampers from adjacent Zones 10-E and 10-F. No floor drainage is provided in either zone; each zone has a waste sump with no outlet connection.

Equipment in Zones

Zone 10-B, Division II
125 V dc Battery 11D-2
24 V dc Battery 1D-6
Zone 10-C
250 V dc Battery 1D-4
Zone 10-D, Division I
125 V dc Battery 1D-1
24 V dc Battery 1D-5

Combustible Material	Quantity	Heat Release - Btu
Zones 10-B and 10-D		
Cable insulation	Nominal	Nil
Plastic battery cases	84 each	9,256,800 (Note 1)
Foam plastic dividers	105 lb	126,000 (Note 2)
	Total	9,382,800

Combustible loading - 41,887.5 Btu/sq ft
Equivalent severity - 0.52 hr

Zone 10-C		
Cable insulation	Nominal	Nil
Plastic battery cases	120 each	16,380,000 (Note 3)
Foam plastic dividers	15 lb	180,000 (Note 2)
	Total	16,560,000

Combustible loading - 36,964.3 Btu/sq ft
Equivalent severity - 0.46 hr

Note 1: Based on 60 cases at 8.3 pounds each and 24 cases at 6.8 pounds each at 14,000 Btu/lb
Note 2: Estimated at 1/8 pound/case at 12,000 Btu/lb
Note 3: Based on 9.75 pounds/case at 14,000 Btu/lb

Fire Protection Equipment

Ionization detector in each zone with hose reel and portable extinguisher in adjacent Zone 10-A.

Design Basis Fire

Ignition of one battery case with possible involvement of all batteries and foam dividers within the zone.

Consequences of Design Basis Fire

The installed ionization detector is expected to detect products of combustion from an incipient fire giving an early warning prompting immediate response from the fire brigade to control and extinguish the fire with available equipment. The low combustible loading, considering all combustibles within the zone, is insufficient to breach the barriers defining the zone. An unmitigated fire in a battery room would be limited to loss of function of the division of batteries located therein. The normal ventilation system will provide a means of smoke removal.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The proposed installation of a flow switch in each of the exhaust outlets, annunciating a common alarm in the control room, will detect loss of venting and permit prompt repairs to prevent an unacceptable hydrogen concentration.

3. The proposed replacement of the existing hose reel in adjacent Zone 10-A with a live reel booster hose and a low flow capacity nozzle will enhance the capability to control and extinguish a fire.

Fire Zones 10-E and 10-F

Control Building - El 757'-6" - FHA-M-2 - Zone 10-E 1,530 square feet - Zone 10-F 1,590 square feet - Essential Switchgear Rooms

Description of Zones

Reinforced concrete floor, reinforced and concrete block walls, reinforced concrete ceiling slab on fluted metal deck supported on top flange of exposed steel frame. The zones intercommunicate through a 3 hour rated roll-up door in the separating fire barrier. Zone 10-E communicates with adjacent Zone 10-A through a 3 hour rated roll-up door. Zone 10-F communicates with adjacent Zone 8-A through a 3 hour rated door. A floor to ceiling gap approximately 2 inches wide exists at the south end of the separating block wall. Both zones have ducted exhaust (2,600 cfm each) and exhaust (350 cfm each) through transfer grills with 1-1/2 hour rated fire dampers into the adjacent battery rooms Zones 10-B, 10-C, and 10-D. The exhaust from the battery rooms is then ducted to the atomsphere. No floor drainage is provided for either zone.

Equipment in Zones

Zone 10-E, Division II
4,160 V switchgear 1A-4
480 V MCC 1B-15
480 V MCC 1B-42
480 V load center 1B-4
Safety-related cable trays
Associated instrumentation and controls
Zone 10-F, Division I
4,160 V switchgear 1A-3
480 V MCC 1B-32
480 V load center 1B-3
Safety-related cable trays
Associated instrumentation and controls

Combustible Material	Quantity	Heat Release - Btu
Zone 10-E		
Cable insulation	2,156.4 lb	22,426,560
	Total	22,426,560
Combustible loading - 14,657.9 Btu/sq ft		
Equivalent severity 0.18 hr		
Zone 10-F		
Cable insulation	2,763 lb	28,735,200
	Total	28,735,200

Combustible loading - 18,072.5 Btu/sq ft
Equivalent severity - 0.23 hr

Fire Protection Equipment

Zone 10-E
Ionization detectors
Hose reel and portable extinguisher in adjacent Zone 10-A
Portable extinguisher in adjacent Zone 10-F

Zone 10-F
Ionization detectors, portable extinguisher

Design Basis Fire

Ignition of cable insulation in one tray with possible involvement of all cable insulation within either zone.

Consequences of Design Basis Fire

The installed ionization detection system is expected to detect the products of combustion during the incipent stage of the fire, annunciate in the control room, and prompt response by the fire brigade. Using the portable equipment available, the brigade will control and extinguish the fire. Any fire in either zone may cause loss of function of one or more circuits of divisional systems or equipment, controlled by the equipment within that zone. The low combustible loading, considering all the combustibles within either zone, is insufficient to breach the barriers defining either zone. The normal ventilation system will provide a means of smoke removal from either zone.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown, because redundant divisional systems and equipment are available.

2. The proposed application of a 1 hour fire rated coating on the exposed structural steel column and the sealing of the gap and other penetrations, as well as replacing the fusible link on the roll-up door in the common wall with an electrothermal link actuated by the ionization detectors in either zone, will provide a minimum rating of 1 hour for the barrier between the zones. The proposed addition in adjacent Zone 8-A and the replacement of the existing hose reel in adjacent Zone 10-A with live reel booster hoses and low capacity flow nozzles will enhance the capability to control and extinguish a fire.

Fire Zone 11-A

Control Building - El 772'-6" - FHA-M-5 - 4,794 square feet - Cable Spreading Room

Description of Zone

Reinforced concrete, floor, walls, and ceiling slab supported on exposed structural steel frame. The zone communciates with the adjacent administration building through a 3 hour rated door to a corridor and to a general office area through a 1-1/2 hour rated door. The zone air supply and exhaust ducts are equipped with fire dampers at the zone boundaries. The zone has dedicated supply and exhaust fans. The ducted exhaust (2,350 cfm) is discharged to the atmosphere 32 feet above the cable spreading room ceiling. No floor drainage is provided for the zone.

Equipment in Zone

Safety-related cable trays, Division II

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	27,599,9 lb	287,038,960
	Total	287,038,960

Combustible loading - 59,874.63 Btu/sq ft
Equivalent severity - 0.748 hr

Fire Protection Equipment

Total flooding carbon dioxide system
Ionization detectors
Portable extinguishers outside of each door, hose reel in corridor

Design Basis Fire

Ignition of cable insulation in one tray with possible involvement of all cable insulation within the zone.

Consequences of Design Basis Fire

The installed ionization detection system is expected to detect the products of combustion from an incipent fire, alert the control room, and prompt response by the fire brigade. The brigade locates the alarmed detector on the matrix display board. The brigade then enters the cable spreading room and extinguishes the fire with portable equipment, or manually actuates the carbon dioxide system from pushbutton stations located outside each entrance to the cable spreading room. In the event the fire achieves sufficient intensity, thermal detectors will actuate the carbon dioxide system automatically. Actuation of the carbon dioxide system will give a predischarge alarm, discharge the agent which will exceed the criteria set forth in NFPA 12, and control the fire.

Any fire may cause loss of function of one or more circuits for Division II systems or equipment or loss of function of one or

more circuits of balance of plant systems. The DBF will not breach the barriers defining the zone.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown since redundant Division I systems and equipment are available.

2. The carbon dioxide system will effectively control the DBF. A field operational test has proven that all the carbon dioxide system components function correctly. Total flooding of the cable spreading room is achieved in 3 minutes and 20 seconds, exceeding the minimum 50% design concentration, and is held for 10 minutes. The supply and exhaust fans and damper also functioned properly during the test.

3. The proposed installation of a hose reel outside the southwest entrance to the cable spreading room will enhance the capability to control and extinguish a fire.

4. Upgrading the 1-1/2 hour door to a 3 hour rated door will provide increased exposure protection for the zone.

Fire Zone 12-A

Control Building - El 786'-0" - FHA-M-3 - 4,958 square feet - Control Room Complex

Description of Zone

Top floor of the control building. Reinforced concrete floor with 24 inch reinforced concrete walls on north, east, and west sides and 20 inch solid concrete masonry walls on south side. Roof is 24 inch thick reinforced concrete on fluted metal decking welded to top flange of exposed structural steel supports. A full width mezzanine occupies the north third of the space for HVAC equipment and is addressed as Zone 12-B. The mezzanine floor is of similar construction as the roof with a minimum slab thickness of 12 inches. The zone communicates with the administration building through two 3 hour rated fire doors. The mezzanine area is cut off by a 3 hour rated fire wall. Access to the mezzanine is by a stairwell with a nonrated hollow metal door at the mezzanine level. The back panel area is open to the roof separated from the control room by the bench boards and vertical boards. The balance of the zone is suspended acoustic tile or gypboard rated a minimum of 1 hour. The finished areas are subdivided into control room, offices, computer room, kitchen space, and toilet by walls of 5/8 inch gypsum board on metal studs, and are provided with a vinyl wall covering except the wall separating the control room from the other areas which is a plate glass window wall. Proposed modifications will isolate the computer room and a new secondary alarm station room from the balance of the spaces with a 1 hour rated metal stud-gypsum board wall. A metal grid luminous ceiling is provided over the control room portion of the zone. Ventilation for the zone is provided by recirculation of 8,000 cfm with a capability ranging from total supply from the exterior to isolation with 1,000 cfm makeup through each of the standby air filter units. No floor drainage is provided within the zone.

The unfinished portion of the zone behind the bench boards is utilized as a cable spreading area for Division I safety-related circuits and for auxiliary relay and control cabinets. Division I cabling enters the cabinets through sealed top penetrations. Division II cable entry is into the cabinets through sealed floor penetrations from the cable spreading room, Zone 11-A, below. Separation for redundant systems and wiring within the cabinets is provided by metal barriers.

Metal cabinets and shelving in the back panel area are provided for a nominal amount of Class A combustible material storage essential for efficient operation of the plant. The offices and other support areas within the complex also contain Class A combustibles, such as log books, drawings, procedures, and supplies essential for plant operations.

Equipment in Zone

Safety-related cable trays
Control cabinets, bench boards, annunciators, etc
Computer equipment
Electric domestic water heater

Electric kitchen equipment
Metal office furniture and equipment
Metal file and supplies cabinets

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	9,453 lb	98,311,200
Class A combustibles	6,500 lb	52,000,000 (Note 1)
	Total	150,311,200

Conbustible loading - 30,317 Btu/sq ft
Equivalent severity - 0.38 hr

Note 1: Based on 5 lb/sq ft fire load in 1,300 square feet of support area

Fire Protection Equipment

Ionization detectors in cabling areas. Two carbon dioxide portable extinguishers are within the zone. Wet standpipe hose stations and additional portable extinguishers are provided exterior to the zone.

Design Basis Fire

Ignition of Class A combustibles in the office area. An electrically generated fire is not postulated in the control and instrumentation cabling in the spreading area. Power cabling within the zone is routed through metallic conduit to the equipment isolated in the mezzanine area.

Consequences of Design Basis Fire

1. The zone is constantly manned by operating personnel and any fire in the support areas will be detected by visual observation. A fire in the back panel area will be detected by the installed ionization detectors. In both cases, personnel are available for prompt action to suppress the Class A fire with manual equipment.

2. The existing glass wall may be breached by a fire in the support areas and admit smoke to the control room requiring the use of the readily available breathing apparatus to maintain control of the plant.

3. A fire in the back panel area may result in involvement of the exposed cabling in the lower trays, with possible involvement of cabling in the trays above. Propagation of such a fire into the cabinets will be prevented by the fire stops of Marinite board and Flamemastic provided at the penetrations. Redundant Division II circuits will remain available.

4. In the unlikely event a fire were to develop within a cabinet, detection will be delayed by confinement of the products of combustion. Visual observation of smoke or the installed area fire detectors will eventually detect the fire but sufficient heat may develop to involve redundant circuits or equipment prior to extinguishment.

5. The use of the normal capacity standpipe hose streams in the back panel area may result in damage to equipment or components due to excessive water discharge.

6. Any smoke developed by the DBF can be purged from the zone by damper and fan alignment.

7. Any fire protection water discharge must be removed from the zone by manual means because of the absence of floor drains.

Conclusions

1. The boundaries of the zone are sufficiently fire resistive to protect the zone from an exposure fire.

2. The proposed modification to the computer room wall will provide a 1 hour rated barrier to prevent exposure to the control room from a computer room fire. The proposed ionization detection in the computer room and the provision of a portable Halon extinguisher will provide means for detection and control of a computer room fire.

3. The plate glass window wall does not provide effective protection for the control room from a fire in the office area. Replacing the plate glass with wire glass, although not a rated fire barrier, will provide an effective smoke and heat barrier.

4. The proposed installation of a live reel at each entrance to the zone with 1 inch booster line hose and a low capacity nozzle will provide sufficient water to extinguish any postulated fire within the zone. The valves controlling the water supply to the live reels should be normally closed and located outside the zone.

5. The proposed siting of a large, wheeled, Halon 1211 extinguisher in the back panel area will provide the capability to suppress a fire in the cable trays and cabinets.

6. The proposal to coat the exposed cabling in the trays in the zone with "Flamastic" will prevent ignition of the cable insulation from an exposure fire and prevent tray-to-tray propagation.

7. The proposal to install ionization detection in the safety-related cabinets and control boards will provide for early detection and prompt extinguishment of a fire within the cabinets.

8. Smoke from a fire exterior to the administration building or the yard area may enter the ventilation system outside air intake located above the administration building roof. The proposed provision of an ionization detector in the intake plenum will alarm the conditions and permit operator action to realign the fans and dampers to maintain control room habitability.

Fire Zone 12-B

Control Building - El 800'-4" - FHA M-5 - 1,617 square feet - HVAC Room

Description of Zone

The zone is a mezzanine above the north portion of the control room complex, Zone 12-A. The north, east, and west walls, as well as the roof, are similar to those of the control room, Zone 12-A. The south wall is 18 inch reinforced concrete at the air intake plenum, 8 inch concrete block at the stairwell, and metal studs with metal lath and plaster at the equipment area. The wall qualifies as a 3 hour fire barrier except for the ventilation duct penetrations which are not provided with fire dampers. Ventilation for the zone is provided by 1,200 cfm ducted supply and exhaust as a portion of the entire control building system. Five 4 inch floor drains are provided in the zone.

Equipment in Zone

Air conditioning units	1V-AC-30A,B
Recirculation fans	1V-RF-30A,B
Standby supply air filter units	1V-SFU-30A,B
HVAC unit-computer room	1V-AC-31
HVAC unit-cable spreading room	1V-AC-32
Battery room exhaust fans	1V-EF-30A,B,C
Cable spreading room exhaust fan	1V-EF-33
Corridor exhaust fan	1V-EF-34
Toilet exhaust fan	1V-EF-35
SFU exhaust fans	1V-EF-36A,B
Electric humidifier boiler	1V-H-31

Control building isolation dampers
Associated heating and cooling pumps, instrumentation, and controls

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	Nil	Nil
Transient combustibles	25 lb (est)	200,000 (Note 1)
	Total	200,000 (Note 2)

Combustible loading - 124 Btu/sq ft
Equivalent severity - Nil

Note 1: A minimal amount of transient Class A combustible material was observed.

Note 2: The charcoal adsorber media is not inventoried as it is contained within the equipment.

Fire Protection Equipment

One carbon dioxide portable extinguisher, rated 10-B:C, is located inside the zone. Additional portable extinguishers are available in Zone 12-A below. Each standby supply air filter unit is equipped with a water spray system in the carbon beds.

The system is manually actuated from the HVAC panel in the control room.

Design Basis Fire

Ignition of transient combustibles

Consequences of Design Basis Fire

1. The combustible loading is insufficient to breach the boundaries of the zone.

2. The DBF may cause exposure damage to equipment within the zone but the quantity of combustibles is insufficient to expose the redundant equipment.

3. The heat sensors in the carbon beds will detect an elevated temperature in the beds. Exhaust fans 1V-EF-36A and B are available to cool the beds. In event the beds continue to heat, the water spray system can be actuated manually from the control room, Panel 1C-26A or B, to prevent or extinguish a fire.

4. The normal ventilation system is adequate to purge any smoke from the zone by fan and damper realignment.

5. The drainage system is adequate to remove any fire protection water that may be discharged. The drainage from the carbon bed filter deluge systems is discharged into the radwaste system.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The proposed hose station in the vicinity of the control room entrance will provide additional fire fighting capability.

3. The proposed addition of an air intake smoke detector in the zone is addressed in the conclusions for Zone 12-A.

4. Administrative controls should be developed to prevent the storage of combustible materials in the zone.

5. No additional modifications are proposed or needed.

Fire Zone 13-A

Radwaste Building - El 757'-C" - FHA-M-2 - 5,305 square feet - Drum Filling, Storage, and Shipping Area

Description of Zone

Reinforced concrete floor on grade. The east wall is common with the reactor building west wall. The south wall is common with the north wall of the machine shop consisting of 7 inch reinforced concrete panels with portions having additional thickness of concrete block or reinforced concrete. The north wall is a minimum of 12 inches poured reinforced concrete. The ceiling is reinforced concrete of 18 inches minimum thickness on fluted metal decking welded to exposed structural steel. An open 14 square foot equipment hatch communicates with the floor above, Zone 13-B. An enclosed stairwell with a 1-1/2 hour rated fire door communicates with all floors above. The interior is subdivided into various areas with 24 inch reinforced concrete or block walls for shielding with nonrated hollow metal doors provided to control access to the areas. Ventilation for the zone is provided by a total of 6,470 cfm exhausted through filter units to the torus area, Zone 1-A. Air supply is by 2,750 cfm through an undampered floor transfer grill from Zone 13-B above, and the balance is ducted from moderate radiation areas to the drumming area and filled drum storage area. A total of eighteen 4 inch floor drains are provided throughout the zone and discharge into sumps for disposal by the liquid radwaste system.

Equipment in Zone

Drum filling and capping equipment
Filled drum storage and transfer conveyors
Loadout conveyors
Baling press
Washdown air compressor and receiver
Sump pumps
Associated instrumentation and controls

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	708 lb	7,363,200
Dry radwaste, Class A	1,000 lb (est)	8,000,000 (Note 1)
	Total	15,363,200

Combustible loading - 11,746 Btu/sq ft (Note 2)
Equivalent severity - 0.15 hr

Note 1: The estimated 1,000 lbs of Class A materials is based on an accumulation of contaminated combustibles prior to compaction and drumming.

Note 2: Combustible loading and equivalent severity are based on an area of 1,308 square feet: that portion of the zone containing the cable trays and dry waste.

Fire Protection Equipment

An automatic wet pipe sprinkler system is provided in the entire area used for dry waste storage and baling. Hose station and portable extinguisher are located in the zone, with additional hose and extinguishers available in Zone 13-B above.

Design Basis Fire

Ignition of contaminated combustibles in dry radwaste storage area

Consequences of Design Basis Fire

1. The installed automatic sprinkler system is expected to actuate shortly following ignition and to control or extinguish the fire. The system actuation will be alarmed locally and annunciated in the control room.

2. In event the water supply to the system is impaired, the fire is postulated to involve all the combustible waste material in the vicinity and to involve cable insulation in the trays within the area. All the circuits routed through the trays are associated only with the equipment within the zone.

3. The equivalent severity is insufficient to cause propagation beyond the boundaries of the zone.

4. The floor drainage system will collect the fire protection water discharge and conduct it to the liquid radwaste system.

5. The 2,750 cfm airflow into the area of the postulated fire will dilute the smoke and be exhausted by induced flow through the filter units and into the torus area for eventual discharge. Excessive radioactive release will be prevented by the plant monitoring system causing bypass through the standby gas treatment system.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. Unacceptable radioactive release to the environs will be prevented by retention of the fire protection water discharge within the radwaste building and the control of airborne release by the redundant radwaste building filter units in series with the redundant standby gas treatment system units.

3. No modifications to the presently provided fire protection provisions are proposed or needed.

Fire Zone 13-B

Radwaste Building - El 773-6 - FHA-M-3 - 5,305 square feet - Radwaste Treatment and Access Area

Description of Zone

Reinforced concrete floor and walls. Reinforced concrete ceiling on fluted metal deck welded to exposed structural steel framing. The 14 foot square equipment hatch in the floor communicates with Zone 13-A below. A removable concrete hatch cover is provided for the hatch opening in the ceiling. An enclosed stairway with a nonrated hollow metal door communicates with Zones 13-A below and 13-C and D above. The interior is subdivided into several areas by concrete and block shield walls of varying thickness and is provided with nonrated hollow metal doors for access. Ventilation for the zone is provided by 8,460 cfm induced exhaust with makeup air provided from Zone 13-C above. Makeup air of 4,490 cfm is ducted directly into shielded areas with the balance, 4,150 cfm, entering the zone through a ceiling transfer grill from the access area above. Ten 4 inch floor drains are provided within the zone.

Equipment in Zone

Main exhaust fans	1V-EF-42A,B
Exhaust filter units	1V-F-42A,B
Radwaste sampling instrument rack	1C-207

Radwaste evaporator boiler (deactivated)
Radwaste sludge tanks, hoppers, and sample tanks with associated pumps, instrumentation, and controls

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	307 lb	3,192,800
Protective clothing	200 sets (est)	3,200,000
Filter elements in cartons	1,000 lb (est)	8,000,000
	Total	14,392,800

Combustible loading - 4,355 Btu/sq ft (Note 1)
Equivalent severity - 0.05 hr

Note 1. Based on an area of 3,305 square feet in which the combustibles are sited

Fire Protection Equipment

One hose station and two portable extinguishers are located within the zone with hose and portable extinguishers available in the zones above and below in the vicinity of the stairwell.

Design Basis Fire

Ignition of transients with possible involvement of cable insulation

Consequences of Design Basis Fire

1. The combustible loading and equivalent severity is insufficient to breach the boundaries of the zone.

2. The radwaste sampling instrument rack, 1C-207, may be damaged by exposure to a fire in the clothing change area. All other equipment is effectively shielded from heat radiation by the shielding walls.

3. The ventilation system will remove any smoke generated by the DBF, and conduct it through the filter units into the torus area for eventual discharge.

4. The circuits powering the main exhaust fans, 1V-EF-42A and B, are routed within the shielded filter room space and are not exposed to the DBF. The absence of any transient combustibles within the space makes it highly unlikely that the circuits will be damaged by any fire other than an electrically generated fire within the trays.

5. The floor drainage system will collect any fire protection water discharge and retain it within the radwaste building for proper treatment.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. Unacceptable radioactive release to the environs will be prevented as discussed under Zone 13-A.

3. No modifications to the existing fire protection provisions are proposed or needed.

Fire Zone 13-C

Radwaste Building - El 786'-0" - FHA-M-3 - 1,705 square feet - Precoat and Access Area

Description of Zone

Reinforced concrete floor, reinforced concrete and concrete block walls. Reinforced concrete roof slab on fluted metal deck supported on top flange of exposed structural steel frame. The zone communicates with adjacent Zone 13-D through a nonrated hollow metal door and with Zone 3-B through an airlock, with a 3 hour rated door at the reactor building end of the airlock. The zone also communicates through a metal equipment hatch, grated HVAC floor opening and with a rated stairwell enclosure, through a 1-1/2 hour rated door. The zone exhaust (8,000 cfm) is through the HVAC floor openings to Zone 13-B and is then ducted to the torus area, Zone 1-A. The zone has three 4 inch floor drains piped to a sump in Zone 13-A, from which the drainage is automatically pumped into the liquid radwaste system.

Equipment in Zone

Storage and holding tanks
Surge pumps
Sample pumps
Precoat pumps
Miscellaneous precoat and treatment pumps
Associated instrumentation and controls

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	1,002 lb	10,420,800
Powdered resin in plastic pails	140 ea (Note 1)	Nil
"Ecodex" in cardboard cartons	100 ea (Note 1)	Nil
Lubricants	Nominal	Nil
	Total	10,420,800

Combustible loading - 6,111.91 Btu/sq ft
Equivalent severity - 0.076 hr

Note 1: Not postulated to contribute to combustible loading because media is stored in a wet state.

Fire Protection Equipment

Hose reel and portable extinguisher
Portable extinguishers in adjacent Zone 13-D
Hose reel and portable extinguishers in Zone 13-B below

Design Basis Fire

Ignition of cable insulation in one cable tray with possible involvement of all cable insulation.

Consequences of Design Basis Fire

1. The low combustible loading of all combustibles within the zone is insufficient to breach the barriers defining the zone.

2. Exposure damage to the circuits routed through the trays within the zone may cause loss of function of some of the equipment interrupting the processing of the radwaste. The holding tanks will retain the waste until repairs are made.

3. The circuits powering the main exhaust fans are not routed through the zone. The fans will remain functional and will exhaust any smoke generated by the DBF.

4. The floor drainage system will collect and dispose of any fire protection water discharge

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. Unacceptable radioactive release to the environs will be prevented, as discussed under Zone 13-A.

3. No modifications are proposed or needed.

Fire Zone 13-D

Radwaste Building - El 786'-0" - FHA-M-3 - 1,230 square feet - Control Room and HVAC Equipment Room

Description of Zone

Reinforced concrete floor, reinforced concrete and concrete block walls. Suspended acoustic tile ceiling in control room, reinforced concrete roof slab on fluted metal deck supported on top flange of exposed structural frame in HVAC equipment room. The HVAC equipment room has one 4 inch floor drain; there are no floor drains in the control room. The control room exhaust is 1,500 cfm and 700 cfm for the HVAC room. The exhaust for both rooms is recirculated. The two rooms communicate with one another through a nonrated hollow metal door. The control room communicates with the rated stairwell enclosure through a 1-1/2 hour rated door and with adjacent Zone 13-C through a nonrated hollow metal door.

Equipment in Zone

480 V MCC 1B63
Radwaste control panels 1C84, 1C96, and 1C175
HVAC fan equipment
Associated instrumentation and controls

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	2,471.1 lb	25,699,440
Office furniture, fixtures, and supplies	3,500 lb (Note 1)	28,000,000
	Total	53,699,400

Combustible loading - 43,658.08 Btu/sq ft
Equivalent severity - 0.546 hr

Note 1: Quantity based on estimate of 5 lb/sq ft

Fire Protection Equipment

Ionization detectors at control room ceilings
Portable Extinguishers
Hose reel and portable extinguisher in adjacent Zone 13-C

Design Basis Fire

Ignition of office furniture or fixtures or supplies with possible involvement of all furniture, fixtures, supplies, and cable insulation.

Consequences of Design Basis Fire

The installed ionization detectors are expected to detect products of combustion and give an early warning prompting rapid response for control and extinguishment of the DBF. The low combustible loading of all the combustibles within the zone is insufficient to breach the barriers defining the zone. The DBF may cause loss of function of one or more of the radwaste

processes in other areas of the radwaste building. Any airborne release within the radwaste building will be exhausted through Zone 13-B and ducted to the torus area, Zone 1-A. Smoke from the zone will be exhausted and combined with outside makeup air (8,000 cfm) and discharged into Zone 13-C, and exhausted through Zone 13-B as above.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The fire protection equipment within the zone will provide the capability to control and extinguish the fire.

3. No modifications are proposed or needed.

Fire Zone 14-A

Machine Shop Building - El 757'-6" - FHA-M-13 - 3,080 square feet - Machine Shop

Description of Zone

Reinforced concrete floor and walls, and built-up roofing on rigid insulation over fluted metal deck supported on top flange of exposed structural steel frame, with UL Class A roof. The zone has compartmented decontamination, sandblasting, degreasing, and toilet rooms below an equipment mezzanine. Six floor drains are in the zone, all discharging into the liquid radwaste system. Zone exhaust and 3,500 cfm is ducted into the torus area, Zone 1-A. Nonrated hollow metal doors communicate with the exterior and adjacent Zone 2-F. A roll-up metal door is provided in the exterior wall.

Equipment in Zone

Metal working machine tools
Off-gas retention building supply air fans and equipment
Welding machine
Associated instrumentation and controls

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	182.9 lb	1,902,160
Lubricants	(Note 1)	
Hydraulic fluid	(Note 1)	
Transients	500 lb (est)	4,000,000
	Total	5,902,160

Combustible loading - 1,916.286 Btu/sq ft
Equivalent severity - 0.024 hr

Note 1: Lubricants and hydraulic fluid are not addressed because they are enclosed in the equipment or stored in metal cabinets.

Fire Protection Equipment

Portable extinguisher and hose reel
Yard hydrant hose stream available

Design Basis Fire

Ignition of transient combustibles with possible involvement of all transients and cable insulation.

Consequences of Design Basis Fire

The low combustible loading, considering all combustibles within the zone, is insufficient to breach the barriers defining the zone. The DBF may cause loss of function of one or more of the metal working machine tools. The DBF may also cause loss of function of the off-gas retention building supply air fan. The normal zone ventilation system provides a means for smoke removal.

Conclusions

The DBF will not affect the capability to achieve and maintain cold shutdown. The fire protection equipment within the zone will provide the capability to control and extinguish the fire. No modifications are proposed or needed for this zone.

Fire Zone 15-A

Off-Gas Retention Building - El 739'-6" - FHA-M-13 - 1,560 square feet - Charcoal Adsorber Vault

Description of Zone

Reinforced concrete floor and walls, reinforced concrete 43 inch thick roof slab on fluted metal deck supported on bottom flange of embedded structural steel frame. The zone has four 4 inch floor drains piped to a sump in Zone 15-C from which the drainage is automatically pumped into the liquid radwaste system. The zone is maintained under negative pressure by induced flow through the standby gas treatment system. No other ventilation is provided for the zone. A nonrated hollow metal door communicates the zone with adjacent Zone 15-B.

Equipment in Zone

Charcoal adsorbers 1T-231A through 1T-231L
Monitoring instrumentation and associated cabling

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	15.33 lbs	159,432
Carbon filter media	(Note 1)	
	Total	159,432

Combustible loading - 10.2 Btu/sq ft
Equivalent severity - 0.0013 hr

Note 1: Carbon filter media not inventoried because it is encased in carbon steel pressure vessels. See Conclusion 3.

Fire Protection Equipment

None in zone
Hose reel in adjacent Zone 15-B
Portable extinguishers in adjacent Zones 15-B and 15-C

Design Basis Fire

Ignition of cable insulation in one tray with possible involvement of all cable insulation.

Consequences of Design Basis Fire

The low combustible loading, considering all combustibles within the zone, is insufficient to breach the barriers defining the zone. The DBF may cause loss of function of monitoring equipment in the zone. Smoke can be exhausted through the standby gas treatment system by the ducted connection. Any excess smoke can be exhausted by use of the proposed portable smoke ejectors through Zone 15-C for eventual exhaust through the normal ventilation system.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The fire protection equipment in the adjacent zones will enhance the capability to control and extinguish the fire.

3. The 12 charcoal bed adsorbers are pressure vessels with a design pressure of 350 psig. The adsorbers comprise two parallel trains, each train capable of being isolated and bypassed. The adsorbers are designed to limit the temperature of the charcoal to well below its ignition temperature, thus precluding overheating or fire and the consequent escape of radioactive materials. The zone is maintained at a constant temperature by an air conditioning system which removes decay heat generated in the adsorbers. The limited amount of combustible material available for the DBF precludes a fire exposure sufficient to cause ignition of the charcoal within the adsorber vessels. The DBF will not cause an unacceptable radioactive release to the environment.

Fire Zone 15-B

Off-Gas Retention Building - 757' 6"- FHA-M-3 - 2,018 square feet - Control Room,, Off-Gas Afterfilter Room and Glycol Area

Description of Zone

Reinforced concrete floor and walls, UL Class A roof on exposed structural steel frame. The zone communicates with Zone 15-C below by a stairwell opening. Zone exhaust ventilation of 4,700 cfm is down through the stairwell to Zone 15-C and ducted to Zone 1-H and then into the torus area, Zone 1-A. The zone has four 4 inch floor drains piped to a sump in Zone 15-C then automatically pumped into the liquid radwaste system. The zone communicates with adjacent railroad airlock, Zone 2-F, through a nonrated hollow metal door and to the exterior of the building through a roll-up door.

Equipment in Zone

480 V MCC 1B-56
Off-gas filters 1F-214A and 1F-214B
Glycol tank 1T-232
Glycol pumps 1P-243A and 1P-243B
Associated instrumentation and controls

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	1,094.1 lb	11,378,640
Lubricating oil	Minimal	Nil
Transient materials	Nil	Nil
	Total	11,378,640

Combustible loading - 5,638.573 Btu/sq ft
Equipment severity - 0.07 hr

Fire Protection Equipment

Hose reel
Portable extinguishers
Yard hydrant hose streams available

Design Basis Fire

Ignition of cable insulation in one tray with possible involvement of all cable insulation

Consequences of Design Basis Fire

The low combustible loading of all combustibles within the zone is insufficient to breach the barriers defining the zone. The DBF may cause loss of power to the glycal system resulting in deterioration of the dehumidification system with the gradual buildup of moisture on the charcoal and a gradual increase in plant emissions. The DBF may also cause loss of function of the domestic water pumps. The normal ventilation system will provide a means to exhaust smoke from the zone.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The fire protection equipment in the zone will enhance the capability to control and extinguish the fire.

3. The charcoal beds can be isolated from the off-gas air stream until such time temporary power is connected to the glycol system and its function is restored.

4. The off-gas system can be isolated in event the emmission approaches the acceptable limits.

Fire Zone 15-C

Off-Gas Retention Building - El 739'-6" FHA-M-13 - 2,070 square feet - Off-Gas Prefilter and Condenser Area

Description of Zone

Reinforced concrete floor and walls, reinforced concrete ceiling slab or fluted metal deck supported on partially embedded structural steel frame. The zone has reinforced concrete shielding walls separating equipment within the zone. The entire zone is below grade. The zone has five 4 inch floor drains piped to a sump and then automatically pumped into the liquid radwaste system. Zone exhaust ventilation of 4,700 cfm is ducted to Zone 1-H and then into the torus area, Zone 1-A. The zone communicates with Zone 15-B above through a stairwell opening at the ceiling and with adjacent Zone 15-A through a nonrated hollow steel door.

Equipment in Zone

Sump pumps 1P-79A, 1P-79B, 1P-80A, and 1P-80B
Off-gas prefilters 1F-213A and 1F-213B
H2 analyzers AN-4162 and AN-4162B
Cooler condensers 1E-222A and 1E-222B
Off-gas moisture separators 1F-217A and 1F-217B
Associated instrumentation and controls

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	494.4 lb	5,141,760
Lubricants	Minimal	Nil
	Total	5,141,760

Combustible loading - 2,483.942 Btu/sq ft
Equivalent severity - 0.031 hr

Fire Protection Equipment

Portable extinguishers within the zone.
Portable extinguishers and hose reel in adjacent Zone 15-B

Design Basis Fire

Ignition of cable insulation with possible involvement of all cable insulation within the zone.

Consequences of Design Basis Fire

The low combustible loading of all combustibles within the zone is insufficient to breach the barriers defining the zone. The DBF may cause loss of function of the sump pumps and the hydrogen analizers; the DBF may also cause loss of function of the off-gas prefilters and cooler condenser monitoring systems. The normal ventilation system provides a means for smoke removal.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown.

2. The fire protection equipment within the zone and adjacent Zone 15-B will enhance the capability to control and extinguish the fire.

Fire Zones 16-A and 16-B

Pumphouse - El 761'-0" - FHA-M-15 - 588 square feet (Zone 16-A - 59 square feet (Zone 16-B) Emergency and Residual Heat Removal Service Water Pump Rooms

Description of Zones

Seismic Category 1 structure with reinforced concrete floor and walls, reinforced concrete roof slab on fluted metal deck, supported on top flange of exposed structural steel frame. Safety-related equipment in one zone is separated from redundant equipment in the other by a 12 inch thick reinforced concrete barrier. Each zone has an independent supply air fan. Both zones are exhaust vented through louvered openings in Zone 16-A. Each zone has two 4 inch floor drains. Both zones communicate with Zone 16-F below through a stairwell opening in the floor. Zone 16-B communicates with adjacent Zone 16-C by a watertight door. Zone 16-A communicates with the exterior of the building through a locked and supervised exterior door. Zones 16-A and 16-B communicate with each other by a 10 foot wide walkway opening in the reinforced concrete barrier separating redundant equipment. Zones are similar except opposite hand.

Equipment in Zone

Zone 16-A, Division II equipment
Residual heat removal service water pumps 1P-22B and 1P-22D
Emergency service water pump 1P-99B
480 V MCC 1B-46
Supply fan 1V-SF-56B
Associated instrumentation and controls

Zone 16-B, Division I equipment
Residual heat removal service water pumps 1P-22A and 1P22C
Emergency service water pump 1P-99A
480 V MCC 1B-36
Supply fan 1V-SF-56A
Associated instrumentation and controls

Combustible Material	Quantity	Heat Release - Btu
Zone 16-A		
Cable insulation	314.7 lb	3,272,880
Lubricating oil	13 gal	1,885,000
	Total	5,157,880
Combustible loading - 8,771.905 Btu/sq ft		
Equivalent severity - 0.110 hr		
Zone 16-B		
Cable insulation	258.1 lb	2,684,240
Lubricating oil	13 gal	1,885,000
	Total	4,569,240
Combustible loading - 7,640.869 Btu/sq ft		
Equivalent severity - 0.0955 hr		

Fire Protection Equipment

Portable extinguisher available in the zone, and portable extinguishers located in adjacent Zone 16-C

Design Basis Fire

Ignition of oil spill from one pump with possible involvement of oil in either one or both of the other pumps, with possible involvement of cable insulation within the same zone.

Consequences of Design Basis Fire

The low combustible loading, considering all combustibles within either zone, is insufficient to cause breaching of the barriers defining either zone. The slope of the floor and location of floor drains preclude propagation of an oil spill fire from one pump to another. Cable tray separation and lack of combustible pathway preclude propagation of the DBF from Division I to Division II cable trays. The DBF may cause loss of function of divisional emergency and residual heat removal service water pumps. Redundant divisional pumps will provide adequate water for safe plant shutdown. The normal ventilation system provides a means for smoke removal.

Conclusions

The DBF will not affect the capability to achieve and maintain cold shutdown. The proposed addition of smoke detectors in each zone and a hose reel in Zone 16-A will provide early warning and enhance the capability for early control and extinguishment.

Fire Zone 16-C

Pumphouse - El 761'-0" and 757'-6" - FHA-M-13 - 3,789 square feet - Circulating Water and Service Water Pump Room

Description of Zone

Reinforced concrete floors, precast reinforced concrete walls with louvered HVAC openings. Built-up roofing over 1-1/2 inch thick insulation on 1-1/2 inch fluted metal deck supported on top flange of exposed structural steel frame, UL Class A roof. Concrete block walled, compartmented chemical storage and handling facilities. The zone exhaust ventilation is through louvered wall openings. Fourteen 4 inch floor drains are in the zone. Watertight doors intercommunicate the zone with adjacent Zones 16-B and 16-D. A 3 hour rated door intercommunicates the zone with the adjacent Zone 16-E. Nonrated roll-up and mandoors communicate the zone to the exterior of the building.

Equipment in Zone

Circulating water pumps 1P-4A and 1P-4B
Service water pumps 1P-89A, 1P-89B, and 1P-89C
Motor driven fire pump 1P-48
Fire protection jockey pump
Chlorine treatment system
480 V MCC 1B-23
480 V MCC 1B-13
Pump control panels
Associated instrumentation and controls

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	856.7 lb	8,911,760
Lubricating oil	83 gal	12,035,000
	Total	20,946,760

Combustible loading - 5,528.308 Btu/sq ft
Equivalent severity - 0.069 hr

Fire Protection Equipment

Portable extinguishers are located within the zone and are available in adjacent Zones 16A-B and 16-D.

Design Basis Fire

Ignition of lube oil spill with possible involvement of cable insulation in adjacent cable tray.

Consequences of Design Basis Fire

The low combustible loading within the zone precludes the propagation of the DBF beyond the boundaries of the zone. The DBF may cause loss of function of one or more of the pumps within the zone. Involvement of one or more pumps will result in increased bearing temperature readings which are monitored in the control room. Heat and smoke are vented through the normal ventilation system until such time that the DBF may cause possible loss of function of damper and air operators.

Conclusions

The DBF will not affect the capability to achieve and maintain cold shutdown. The proposed installation of a hose reel near or at column line C-12 will enhance the capability for control and extinguishment of a fire within the zone.

The proposed portable smoke ejectors will provide a means of purging smoke from the zone in the event of degradation of the normal exhaust system.

Fire Zone 16-D

Pumphouse - El 761'-0" - FHA-M-13 - 240 square feet - Diesel Fire Pump Room

Description of Zone

Reinforced concrete floor, concrete block and reinforced concrete walls, reinforced concrete ceiling slab on fluted metal deck supported on top flange of structural steel frame; metal surfaces are fireproofed. Watertight door communicates the zone with adjacent Zone 16-C. Zone ventilation is independent of all other ventilation systems. Ventilation is accomplished by recirculating room air with outside air makeup. Exhaust from the zone is ducted through the roof to atmosphere and each opening has a fire damper. Engine exhaust is piped to discharge to the outside atmosphere. The zone is provided with one 4 inch floor drain.

Equipment in Zone

Diesel fire pump 1P-49
Diesel fire pump controller panel 1C-116
HVAC control panel 1C-174
Associated instrumention and controls

Combustible Material	Quantity	Heat Release - Btu
Lubricating oil	8.5 gal	1,232,500
Battery cases	40 lb	400,000
Diesel fuel oil	Minimal	Nil
Cable insulation	Minimal	Nil
	Total	1,632,500

Combustible loading - 6,802 Btu/sq ft
Equivalent severity - 0.085 hr

Fire Protection Equipment

Automatic wet pipe sprinkler system
Portable extinguisher within the zone
Portable extinguishers available outside entrance in adjacent Zone 16-C

Design Basis Fire

Fuel line break, ignition of fuel spill, with possible involvement of entire contents of the day tank.

Consequences of Design Basis Fire

The installed sprinkler system is expected to actuate shortly following ignition of the DBF and promptly control the spread of the fire. Actuation of the sprinkler system is annunciated in the control room, alerting the fire brigade for final extinguishment, if required. Release of the entire contents of the day tank into the zone may alter the combustible loading to 172,468 Btu/sq ft and the equivalent severity to 2.16 hours. Assuming loss of the sprinkler system and involvement of the entire contents of the day tank, the DBF would be of short

duration because of the adequate drainage capacity of the floor drain and would tend to mitigate violation of the zone boundaries by degradation of the watertight door. Loss of function of the standby diesel fire pump would occur due to the ruptured fuel line with or without the DBF. The redundant primary motor driven fire pump would provide sufficient fire protection water. The fire dampers are expected to close and preclude smoke and heat venting of the zone.

Conclusions

1. The DBF will not affect the capability to achieve and maintain cold shutdown. The proposed installation of a hose reel in adjacent Zone 16-C will enhance the capability to control the DBF and gain access to the manual fuel line shutoff.

2. Securing the fire damper in the zone exhaust duct in the open position provides a means for smoke removal from the zone.

Fire Zone 16-E

Pumphouse - El 761'-0" - FHA-M-13 - 96 square feet - Diesel Fire Pump Day Tank Room

Description of the Zone

Reinforced concrete floor, 8 inch concrete block walls in the interior of the pumphouse, reinforced concrete wall on common exterior wall, reinforced concrete ceiling slab on fluted metal deck supported on top flange of exposed structural steel frame. A 3 hour rated door communicates the zone with Zone 16-C. The day tank is vented through the exterior wall to the atmosphere. No additional ventilation is provided for the day tank room vault. The day tank is filled through an outside filling connection. The zone has one 4 inch floor drain.

Equipment in the Zone

Diesel fire pump day tank
Associated fuel line piping

Combustible Material	Quantity	Heat Release - Btu
Diesel fuel oil	280 gal	39,760,000
	Total	39,760,000

Combustible loading - 414,166.7 Btu/sq ft
Equivalent severity - 5.18 hr

Fire Protection Equipment

Automatic wet pipe sprinkler system
Portable extinguishers in adjacent Zone 16-C

Design Basis Fire

Ignition of oil spill with possible involvement of entire contents of the day tank

Consequences of Design Basis Fire

The installed automatic sprinkler system will actuate shortly following ignition of the DBF and promptly control the spread of the fire. Actuation of the sprinkler system will be annunciated in the control room alerting the fire brigade for final extinguishment, if required. The floor drain will dispose of sprinkler water and spilled oil. Discharge of the entire contents of the day tank will result in loss of function of the diesel fire pump. The redundant motor driven fire pump will supply adequate fire protection water to the sprinkler system. In the event of total involvement of the day tank contents, the DBF would be of short duration because of the adequate drainage capacity and would tend to mitigate the violation of the zone boundaries. Any leakage under the door will be collected in a 4 inch floor drain in adjacent Zone 16-C. The floor in Zone 16-C is sloped so as to preclude involvement of any equipment within that zone.

Conclusions

The DBF will not affect the capability to achieve and maintain cold shutdown. The proposed installation of a curb across the exterior face of the door will effectively prevent any flow of oil outside the day tank room. The installation of a hose reel in adjacent Zone 16-C will enhance the capability for control and extinguishment of a fire within the zone.

Fire Zone 16-F

Pumphouse - El 747'-6" and 72'-0" - FHA-M-13 - 600 square feet - Piping Area

Description of Zone

Two levels below grade bounded by reinforced concrete floors and walls. Ceilings at each level are reinforced concrete slab on fluted metal deck supported on the top flange of exposed structural steel frame. The lower level communicates with the upper level through a stairwell opening. The zone communicates with Zones 16-A and 16-B above through a stairwell opening at the ceiling of the upper level. Two 4 inch floor drains on each level are piped to a sump on the lower level. Redundant divisional sump pumps discharge into a storm drain which is piped to an onsite drainage field. Exhaust venting is up through Zone 16-A above to the exterior through a louvered opening.

Equipment in Zone

Safety-related cable trays, Divisions I and II
River water supply piping and valves
Residual heat removal service water discharge piping
Emergency service water discharge piping

Combustible Material	Quantity	Heat Release - Btu
Cable insulation	210.2 lb	2,186,080
	Total	2,186,080

Combustible loading - 3,643 Btu/sq ft
Equivalent severity - 0.046 hr

Fire Protection Equipment

None within the zone

Design Basis Fire

Ignition of cable insulation in one cable tray resulting in total involvement of all cable within the tray, and possible involvement of adjacent or nearby trays. Because of the absence of combustible pathways between the Division I and Division II trays, total involvement of all cabling within the zone is not postulated.

Consequences of Design Basis Fire

The low combustible loading within the zone precludes the propagation of the DBF beyond the boundaries of the zone. The unlikely event of ignition of cable insulation in one or more adjacent trays may cause possible loss of function of one division of residual heat removal service water pumps and emergency service water pumps. A DBF involving one division of cable trays will not affect the redundant divisional cable trays because of the absence of combustible pathways between the Division I and Division II cable trays. The DBF may also cause loss of function of solenoid valves controlling pneumatically operated control valves on the river water makeup supply piping.

Loss of function of these solenoid valves will not affect the river water makeup supply system because the control valves on the piping supplying the radwaste dilution system fail closed, and the control valves on the supply to the stilling basin fail open, assuring a makeup water supply. The normal ventilation provides a means of smoke removal from the zone.

Conclusions

The DBF will not affect the capability to achieve and maintain cold shutdown, because the redundant divisional train will provide sufficient service water for the residual heat removal system and emergency systems. The proposed installation of a hose reel near the pumphouse entrance on elevation 761'-0" will enhance the capability for control and extinguishment of a fire within the zone.

Fire Zones 17-A and 17-B

Intake Structure - El 767'-0" - FHA-M-17 - 412 square feet each - Pump Rooms

Description of Zones

Each zone has reinforced concrete floor and walls, with reinforced concrete roof slab on fluted metal deck, supported on top flange of exposed structural steel frame. Air supply is from two fans in each zone. Exhaust venting is through louvers in the cupolas. One 4 inch floor drain is located in each zone. A 3 foot by 6 foot heating and ventilating opening in the floor of each zone communicates with Zones 17-C and 17-D below. A 3 hour rated door communicates the two zones. Each zone has a 3 hour rated door to the stair access.

Zone 17-A is typical, opposite hand of Zone 17-B.

Equipment in Zone

Zone 17-A
- Division I river water supply pumps 1P-117A and 1P-117B
- 480 V motor control center 1B-91
- 480 V laod center 1B-9
- Room air fan 1V-SF-50
- Compressor, instrument air 1K-16A
- Associated instrumentation, controls, and cabling

Zone 17-B
- Division II river water supply pumps 1P-117B and 1P-117D
- 480 V motor control center 1B-21
- 480 V load center 1B-20
- Room air fan 1V-SF-51
- Compressor, Instrument Air 1K-16B
- Associated instrumentation, controls, and cabling

Combustible Material	Quantity	Heat Release - Btu
Zone 17-A		
Cable insulation	Nil	Nil
Lubricating oil	8 gal	1,160,000
	Total	1,160,000
Combustible loading - 2,815 Btu/sq ft		
Equivalent severity - 0.035 hr		
Zone 17-B		
Cable insulation	Nil	Nil
Lubricating oil	8 gal	1,160,000
	Total	1,160,000
Combustible loading - 2,815 Btu/sq ft		
Equivalent severity - 0.035 hr		

Fire Protection Equipment

Portable extinguishers in stairway access at elevations 767'-0" and 754'-0"

Design Basis Fire

Ignition of lubricating oil spill from one of the river water supply pump motors with possible involvement of the oil in the other pump motor within the same zone.

Consequences of Design Basis Fire

The low combustible loading, considering all combustibles within either zone, is insufficient to cause breaching of the barriers defining the zone with the exception of the 3 foot by 6 foot heating and ventilating opening in the floor. The DBF may cause loss of function of one pair of divisional river water supply pumps. Redundant divisional river water supply pumps will provide adequate makeup river water for safe plant shutdown. The smoke removal from the zone is effected by the normal ventilation system.

Conclusions

The DBF will not affect the capability to achieve and maintain cold shutdown. The redundant pair of divisional river water pumps will supply 12,000 gpm to the pumphouse stilling basin wet pit. The proposed addition of ionization smoke detectors and portable extinguishers in the zone will provide early warning of a fire and enhance the capability for early control and extinguishment.

Fire Zones 17-C and 17-D

Intake Structure - El 754'-0" - FHA-M-17 - 700 square feet each - Traveling Screen Area

Description of Zone

Reinforced concrete floors and walls, reinforced concrete ceiling slab on fluted metal deck supported on top flange of exposed structural steel frame. Zones 17-C and 17-D communicate with one another through an approximate 160 square foot opening in the wall separating the zones. A 3 foot by 6 foot heating and ventilating opening in the ceiling slab communicates the zones on elevation 754'-0" with the zones on elevation 767'-0". A 2 foot by 3 foot - 6 inch heating and ventilating opening from the HVAC intake rooms on elevation 767'-0" supplies fresh air. Ventilation is accomplished through the 3 foot by 6 foot heating and ventilating openings in the ceiling, then through the louvers in the cupolas. Zone 17-C has a nonrated door to the stair access, and Zone 17-D has a nonrated door to the exterior. Drainage is accomplished by a trench 18 inches by 9 inches deep running the width of the building, into a sump outside the building, and from there by waterway to the Cedar River.

Equipment in Zone

Zone 17-C, Division I
- Screen wash pump 1P-112A
- Self-cleaning strainer 1S-85A
- Annunciator and backwash control panel 1C-154A
- Miscellaneous instrumentation and control panel 1C-227A
- Nondivisional miscellaneous recording and instrumentation panel 1C-102

Zone 17-D, Division II
- Screen wash pump 1P-112B
- Self-cleaning strainer 1S-85B
- Annunciator and backwash control panel 1C-154B
- Miscellaneous instrumentation and control panel 1C-227B

Combustible Material	Quantity	Heat Release - Btu
Zone 17-C		
Cable insulation	126.6 lb	1,316,640
Lubricants	Minimal	Nil
	Total	1,316,640

Combustible loading - 1,880 Btu/sq ft
Equivalent severity - 0.0235 hr

Zone 17-D		
Cable insulation	104.1 lb	1,082,640
Lubricants	Minimal	Nil
	Total	1,082,640

Combustible loading - 1,547 Btu/sq ft
Equivalent severity - 0.019 hr

Fire Protection Equipment

Portable extinguisher located in each zone

Design Basis Fire

Ignition of all cable insulation in one of the divisions.

Consequences of Design Basis Fire

The low combustible loading, considering all combustibles within either zone, is insufficient to cause breaching of the barriers defining the zone. The DBF may cause loss of function of one pair of divisional river water supply pumps. Redundant divisional river water supply pumps will supply adequate makeup river water for safe plant shutdown. The normal ventilation system provides a means for smoke removal from the zone.

Conclusions

The DBF will not affect the capability to achieve and maintain cold shutdown because the redundant pair of divisional river water supply pumps will provide 12,000 gpm to the pumphouse stilling basin wet pit. The proposed addition of a portable extinguisher in either zone will enhance the capability for early control and extinguishment.

APPENDIX A

This appendix contains the detailed list of divisional components located within the plant fire zones. This list is provided to be responsive to NRC Enclosure 2, "Supplementary Guidance on Information Needed for Fire Protection Program Evaluation."

Equipment Number	Division	Description
	ZONE 1A North	
SV 5718B	2	Drywell Cooling Water Intake Loop B
ZS 5718B	2	Drywell Cooling Water Intake Loop B
MO 2146	2	Suppression Pool Outlet Valve
MO 1936	1	RHR Radwaste Discharge
MO 1937	2	RHR Radwaste Discharge
MO 2010	1	RHR Loops Crosstie
LS 2319	2	Suppression Pool Level High
PS 4346	2	Containment Pressure High
SV 3729	2	Drywell Equipment Drain Sump Discharge
ZS 3729	2	Drywell Equipment Drain Sump Discharge
SV 3728	1	Drywell Equipment Drain Sump Discharge
ZS 3728	1	Drywell Equipment Drain Sump Discharge
MO 2001	1	Containment Spray Control Loop A
MO 2006	1	Suppress Pool Spray Header Loop A
MO 2005	1	Suppress Pool Spray Header Loop A
LE 3758	1	Torus Area Flood Level East
LS 3758	1	Torus Area Flood Level High
MO 2007	1	RHR Test Line Loop A
MO 1970	2	RHR Heat Exchangers Test Line Loop B
MO 1989	2	Suppression Pool Outlet
Conduits	1,2	
Trays	2	
MO 1935	2	RHR Pumps Test Loop B
SV 4334B	1	Torus Spray Header Nitrogen Isolation
ZS 4334B	1	Torus Spray Header Nitrogen Isolation
SV 4334A	1	Torus Spray Header Nitrogen Isolation
ZS 4334A	1	Torus Spray Header Nitrogen Isolation
SV 8110B	2	Isolation Valve Outboard System B
SV 8109B	2	Isolation Valve Inboard System B
MO 2124	2	Core Spray Pump 1P-211B RCIC Control
MO 2132	2	Core Spray Pump IP-211B Test Line Control
MO 4841A	2	Drywell Equipment Sump Heat Exchanger
MO 4841B	2	Drywell Equipment Sump Heat Exchanger
LE 3759	2	Torus Area Flood Level West
LS 3759	2	Torus Area Flood Level High
SV 8107A	1	Isolation Valve Inboard System A
SV 8108A	1	Isolation Valve Outboard System A
LS 2320	2	Suppression Pool Level High

Equipment Number	Division	Description
	ZONE 1A South	
MO 1903	2	Containment Spray Control Loop B
MO 1932	2	Suppression Pool Spray Header Loop B
MO 1933	2	Suppression Pool Spray Header Loop B
MO 1934	2	RHR Pumps Test Loop B
SV 5704B	2	Drywell Loop A Cooling Water Discharge
ZS 5704B	2	Drywell Loop A Cooling Water Discharge
SV 8107B	2	Isolation Valve Inboard System B
SV 8108B	2	Isolation Valve Outboard System B
MO 1943B	1,2	RHR Service Water Crosstie Loop B
SV 4333A	2	Torus Spray Header Nitrogen Isolation
ZS 4333A	2	Torus Spray Header Nitrogen Isolation
SV 4333B	2	Torus Spray Header Nitrogen Isolation
ZS 4333B	2	Torus Spray Header Nitrogen Isolation
MO 2516	1	Suppression Pool Outlet Control
SV 5718A	1	Drywell Loop A Cooling Water Intake
ZS 5718A	1	Drywell Loop A Cooling Water Intake
SV 5704A	1	Drywell Loop B Cooling Water Discharge
ZS 5704A	1	Drywell Loop B Cooling Water Discharge
MO 2009	1	RHR Pumps Test Loop A
MO 2038	1	RHR Heat Exchanger Test Line Loop A
MO 2104	1	Core Spray Pump 1P-211A RCIC Control
MO 2290A	1	HPCI and RCIC Turbine Exhaust Isolation Valve
MO 2290B	2	HPCI and RCIC Turbine Exhaust Isolation Valve
SV 1964	2	HPCI Inlet Pressure Control Loop A
MO 2112	1	Core Spray Pump 1P-211A Test Line Control
MO 2321	2	Suppression Pool Outlet
MO 2147	1	Suppression Pool Outlet
MO 2298	1	Main Steam to RHR System
SV 8109A	1	Isolation Valve Inboard System A
SV 8110A	1	Isolation Valve Outboard System A
SV 3704	1	Drywell Floor Drain Sump Discharge
ZS 3704	1	Drywell Floor Drain Sump

Equipment Number	Division	Description
		Discharge
SV 3705	2	Drywell Floor Drain Sump Discharge
ZS 3705	2	Drywell Floor Drain Sump Discharge
MO 2069	1	Suppression Pool Outlet
Conduits	1,2,4	
Trays	1,2	

ZONE 1B

MO 1941	2	RHR Heat Exchanger Outlet Control
MO 2120	2	Core Spray Pump IP-211B Suction Header
MO 1947	2	RHR Heat Exchanger 1E201B Service Water Outlet
MO 1967	2	RHR Heat Exchanger Test Line Loop B
SV 1966	2	RHR Heat Exchanger Crosstie Header
TE 1945B	2	RHR Heat Exchanger 1E201B Service Water Outlet
E/P 1966	2	RHR Heat Exchanger Crosstie Header
PDS 1971B	2	RHR Heat Exchanger A Discharge Flow Low
MO 1912	2	RHR Pump 1P229B Suction Header B
MO 1913	2	RHR Pump 1P229B Suction Control
1C129B	2	RHR Instrumentation Racks - Channel B
1M 405	2	RHR Pump
1M 406	2	RHR Pump
1M 404	2	Core Spray Pump
MO 1920	2	RHR Pump 1P229D Suction Header B
MO 1940	2	RHR Pump Discharge Control Loop B
SV 1972	1	RHR Spray Water Sample Loop B
ZS 1972	1	RHR Spray Water Sample Loop B
SV 1973	2	RHR Spray Water Sample Loop B
ZS 1973	2	RHR Spray Water Sample Loop B
1M 403	2	Core Spray Pump
MO 1933	2	Suppression Pool Spray Header Loop B
SV 1963	2	HPCI Inlet Pressure Control Loop A
E/P 1963	2	HPCI Inlet Pressure Control Loop A
MO 1949A	2	RHR Heat Exchanger 1E201B

Equipment Number	Division	Description
		Vent Control
MO 1949B	2	RHR Heat Exchanger 1E201B Vent Control
1C 124	2	Core Spray Instrument Rack - Channel B
1C 186	2	Radwaste Building HVAC Units
		ZONE 1C
PDS 4304	1	Vacuum Breaker Pressure Differential High
SV 4305	2	Suppression Pool Vacuum Breaker Isolation
ZS 4305	2	Suppression Pool Vacuum Breaker Isolation
SV 4304	1	Suppression Pool Vacuum Breaker Isolation
ZS 4304	1	Suppression Pool Vacuum Breaker Isolation
PDS 4305	2	Vacuum Breaker Pressure Differential High
SV 4300	1	Suppression Pool Purge Outlet
ZS 4300	1	Suppression Pool Purge Outlet
SV 4309	1	Suppression Pool Purge Outlet
ZS 4309	1	Suppression Pool Purge Outlet
SV 4301	2	Suppression Pool Purge Outlet
ZS 4301	2	Suppression Pool Purge Outlet
EST 301	2	Seismic Detecting Equipment
EST 300	2	Seismic Detecting Equipment
SMA 200	2	Seismic Detecting Equipment
1C 57	1,4	RCIC Pump 1P-201A Instrument Rack
Conduits	1,2,4	
Trays	1,2	
		ZONE 1D
MO 2100	1	Core Spray Pump 1P-211A Suction Header
MO 2044A	1	RHR Heat Exchanger 1E201A Vent Control
MO 2044B	1	RHR Heat Exchanger 1E201A Vent Control
SV 1942	1	RHR Service Water Crosstie Control Loop B
SV 2037	1	RHR Heat Exchangers Crosstie Header
1C123		Core Spray Instrument Rack - Channel A
1C129A		RHR Instrument Racks - Channel A
MO 1943A	1	Remote Operated Service Water

Equipment Number	Division	Description
		Crosstie Loop B
LT 2041	1	RHR Heat Exchanger 1E-201A Level Control
MO 2036	1	RHR Heat Exchanger Crosstie Header
SV 2052	2	RHR Spray Water Sample Loop A
ZS 2052	2	RHR Spray Water Sample Loop A
SV 2051	1	RHR Spray Water Sample Loop A
ZS 2051	1	RHR Spray Water Sample Loop A
SV 2033	1	HPCI Inlet Pressure Control Loop A
TE 1945F	1	RHR Heat Exchanger 1E201A Service Water Outlet Temperature
TE 1945D	1	RHR Heat Exchanger 1E201A Inlet Temperature
MO 2031	1	RHR Heat Exchanger Outlet Control Loop A
MO 2029	1	RHR Heat Exchanger Inlet Control Loop A
1C169	1	RHR and Core Spray Pump Room 1V-AC-12
MO 1942	1	RHR Service Water Crosstie Control Loop B
PDS 1971A	1	RHR Heat Exchanger B Discharge Flow Low
E/P 2037	1	RHR Heat Exchangers Crosstie Header
TE 1945E	1	RHR Heat Exchanger 1E201A Outlet Temperature
MO 2016	1	RHR Pump 1P-229C Suction Header
MO 2030	1	RHR Pump Control Loop A
MO 2011	1	RHR Pump 1P-229A Suction Header
MO 2012	1	RHR Pump 1P-229A Suction Header
1P 229A	1	RHR Pump
MO 2015	1	RHR Pump 1P-229C Suction Header
1P 229C	1	RHR Pump
1P 211A	1	Core Spray Pump
E/P 2033	1	HPCI Inlet Pressure Control Loop A
1M 3404		RHR Room Cooling Unit
Conduits	1,2,3	
Trays	1	

ZONE 1E

SV 7605A	1	Reactor Building Vent From Off Gas Filter Cell

Equipment Number	Division	Description
ZS 7605A	1	Reactor Building Vent From Off Gas Filter Cell
1C 120	2,3	HPCI Instrument Rack
PT 4320A	1	Containment Spray Header Nitrogen Supply
SV 7605B	2	Reactor Building Vent From Off Gas Filter Cell
ZS 7605B	2	Reactor Building Vent From Off Gas Filter Cell
MO 4320A	1	Containment Atmospheric Dilution Nitrogen Flow
MO 2316	2	HPCI Condensate RCIC to Storage Tank
MO 2315	2	HPCI Condensate RCIC to Storage Tank
MO 2311	2	HPCI Condensate Flow
MO 2318	2	HPCI Pump 1P-216 RCIC
MO 2300	2	Condensate Storage Tank Supply to Pump Suction
SV 2212	2	Condensate Drain Control to Main Condenser
ZS 2212	2	Condensate Drain Control to Main Condenser
MO 2322	2	Suppression Pool Pump Suction
MO 2247	2	Cooling Water to Barometric Condenser
SV 2206	2	Drain Pot Level Control
ZS 2206	2	Drain Pot Level Control
MO 1998B	2	RHR Heat Exchanger Discharge to Radwaste
PT 4320B	2	Containment Spray Header Nitrogen Supply
MO 1998A	1	RHR Heat Exchanger Discharge to Radwaste
MO 4320B	2	Containment Atmospheric Dilution Nitrogen Flow
LS 2206	2	Drain Pot Level High
SV 2219	2	Barometric Condenser Over Flow Control
1Q 2011	2	HPCI Turbine Instrumentation
LS 2219	2	Drain Pot Level High
XVS 2281	2	HPCI Turbine Bearing Vibration
XVS 2282	2	HPCI Turbine Bearing Vibration
1P 218	2	HPCI System Auxiliary Oil Pump
1Q 2012	2	HPCI Turbine Instrumentation
MO 2202	2,3	Main Steam Supply Contol Valve
SV 2211	3	Condenser Drain Contol to Main Condenser
ZS 2211	3	Condenser Drain Control to Main Condenser
1M 4404 (1V-AC-14B)	2	HPCI Room Cooling Unit B
1C 109A	1	IV-AC-14 A and B - HPCI Pump Room Coolers Cabinet
1C 109B	2	IV-AC-14 A and B - HPCI Pump Room Coolers Cabinet

Equipment Number	Division	Description
MO 2046	1	RHR Heat Exchanger 1E 201A Service Water Outlet
1P 219	2	HPCI System Vacuum Tank Condensate System
LS 2222B	2	Barometric Condenser Vacuum Tank Level Low
PS 2220	2	Barometric Condenser Vacuum Tank Pressure High
LS 2222A	2	Barometric Condenser Vacuum Tank Level High
1M 3405 (1V-AC-14A)	1	HPCI Room Cooling Unit A
1P 233	2	Gland Seal Condenser Vacuum Pump
SV 2234	3	HPCI Drain Control
ZS 2234	3	HPCI Drain Control
SV 2235	2	HPCI Drain Control
ZS 2235	2	HPCI Drain Control
Conduits	1,2,3	
Trays	2	

ZONE 1F

MO 2500	1	Condensate Storage Tank Outlet
MO 2404	1,4	RCIC Pump Turbine 1S-203 Steam Inlet
MO 2517	1	RCIC Pump 1P-226 Suction from Suppression Pool
MO 2405	1	Turbine Trip Throttle Valve Control
1M 4405 (1V-AC-15B)	2	RCIC Room Cooling Unit B
1C 128	1,4	RCIC Instrument Racks
1C 107A	1	IV-AC-15 A and B - RCIC Room Panel
1C 107B	2	IV-AC-15 A and B - RCIC Room Panel
1M 3406 (1V-AC-15A)	1	RCIC Room Cooling Unit A
LS 2417A	1	RCIC Turbine Condenser Vacuum Tank Level High
FT 2509	1	RCIC IP-226 Discharge Flow
FS 2508	1	RCIC IP-226 Discharge Flow High/Low
1Q 1011	1	HPCI Turbine Instrumentation
MO 2426	1	RCIC Cooling Water to Barometric Condenser
MO 2511	1	RCIC Pump 1P-226 Discharge Control
MO 2515	1	RCIC Pump 1P-226 RCIC to Storage Tank
MO 2510	1	RCIC Pump 1P-226 Discharge Minimum Flow
SV 2411	4	Condenser Drain Pot Drain Control to Condenser
SV 2411	4	Condenser Drain Pot Drain Control to Condenser
ZV 2410	1	Condenser Drain Pot Drain

Equipment Number	Division	Description
		Control to Condenser
ZS 2410	1	Condenser Drain Pot Drain Control to Condenser
PS 2416	1	Barometric Condenser 1E-205 Vacuum High
LS 2417B	1	RCIC Turbine Condenser Vacuum Tank Level Low
SV 2435	1	Condensate Pump 1P-228 Drain Discharge Control
ZS 2435	1	Condensate Pump 1P-228 Drain Discharge Control
SV 2436	4	Condensate Pump 1P-228 Drain Discharge Control
ZS 2436	4	Condensate Pump 1P-228 Drain Discharge Control
LS 2407	1	Steam Condensate Drain Pot Level High
SV 2409	1	Steam Condensate Drain Pot Drain Control
ZS 2409	1	Steam Condensate Drain Pot Drain Control
Conduits	1,2,4	
Trays	1	

ZONE 1G

1C 108	1,2	1V-AC-13 A and B - CRD Pump Room Coolers Cabinet
1M 410 (1P 209B)	2	CRD Feed Pump
XVS 1806A	1	CRD Pump 209A Vibration High
1C 58	1,2	RCIC Pump 1P-201B Instrument Rack
Conduits	1,2	
Trays	1,2	

ZONE 1H

SV 7639A	1	1V-AD-19A Isolation Damper
ZS 7639A	1	1V-AD-19A Isolation Damper
SV 7639B	2	1V-AD-19B Isolation Damper
ZS 7639B	2	1V-AD-19B Isolation Damper
Conduits	1,2	
Trays	1	

ZONE 2A

1B 44	2	480 V Motor Control Center
LITS 4540	2	HPCI and RCIC Turbine Trip on High Reactor Vessel Level

Equipment Number	Division	Description
1C 55A	2,3	Reactor Vessel Level and Pressure Instruments
1C 55	1,3,4	Reactor Vessel Level and Pressure Instruments
1C 208	1	Shutdown Reactor Cooling Instrument Rack
SV 8105B	2	Isolation Valve Inboard System B
SV 8106B	2	Isolation Valve Outboard System B
LS 1861D	4	Scram Discharge Header Level Rise Trip
LS 1861C	3	Scram Discharge Header Level Rise Trip
1C 121B	1,4	Jet Pump Instrument Rack
1C 121A	2	Jet Pump Instrument Rack
SV 8101B	2	Isolation Valve Inboard System B
SV 8102B	2	Isolation Valve Outboard System B
SV 8103B	2	Isolation Valve Inboard System B
SV 8104B	2	Isolation Valve Outboard System B
1C 131G	3	Scram Solenoid Fuse Panel
1C 131H	4	Scram Solenoid Fuse Panel
1C 131E	1	Scram Solenoid Fuse Panel
1C 131F	2	Scram Solenoid Fuse Panel
1B 43	2	480V Motor Control Center
1D 42	2	250 V dc Motor Control Center
1C 126A	1,2	Main Steam Instrumentation Racks
SV 2313	2	HPCI Condensate Flow Control
1C 183	1	Reactor Building Vent Stack Radiation Monitor A
1C 184	2	Reactor Building Vent Stack Radiation Monitor B
RE 7606A	1	Reactor Building Exhaust Radiation Element
RE 7606B	2	Reactor Building Exhaust Radiation Element
1M 3718	1	Low Pressure Manifold Exhaust Blower A
1M 3719	1	Low Pressure Manifold Exhaust Blower B
SV 8114B	2	Radiation Sample Select System B
SV 8115B	2	Radiation Sample Select System B
SV 8116B	2	Radiation Sample Select System B
1C 218B		Primary Containment Oxygen Analyzer
1C 219B		Primary Containment Radiation Monitoring Rack
Conduits	1,2,3, 4,5,6	
Trays	1,2	

Equipment Number	Division	Description
		ZONE 2B
SV 7636A	1	1V-AD-52A Isolation Damper
ZS 7636A	1	1V-AD-52A Isolation Damper
SV 7636B	2	1V-AD-52B Isolation Damper
ZS 7636B	2	1V-AD-52B Isolation Damper
SV 7634A	1	1V-AD-51A Isolation Damper
ZS 7634A	1	1V-AD-51A Isolation Damper
SV 7634B	2	1V-AD-51B Isolation Damper
ZS 7634B	2	1V-AD-51B Isolation Damper
SV 7630A	1	1V-AD-42A Isolation Damper
ZS 7630A	1	1V-AD-42A Isolation Damper
SV 7630B	2	1V-AD-42B Isolation Damper
ZS 7630B	2	1V-AD-42B Isolation Damper
SV 8101A	1	Isolation Valve Inboard System A
SV 8102A	1	Isolation Valve Outboard System A
SV 8103A	1	Isolation Valve Inboard System A
SV 8104A	1	Isolation Valve Outboard System A
SV 8105A	1	Isolation Valve Inboard System A
SV 8106A	1	Isolation Valve Outboard System A
SV 8114A	1	Radiation Sample Select System A
SV 8115A	1	Radiation Sample Select System A
SV 8116A	1	Radiation Sample Select System A
PS 4365A	1	Containment Pressure
1C 218A	1	Primary Containment Oxygen Analyzer
1C 219A	1	Primary Containment Radiation Monitoring Rack
1C 131A	1	Scram Solenoid Fuse Panel
1C 131B	2	Scram Solenoid Fuse Panel
1C 131C	3	Scram Solenoid Fuse Panel
1C 131D	4	Scram Solenoid Fuse Panel
E/P 2034	1	HPCI Inlet Pressure Contol Loop A
E/P 1964	2	HPCI Inlet Pressure Control Loop A
1C 122	1,2,3	Jet Pump Instrument Rack
SV 4378A	1	Nitrogen Compressor Suction Isolation Valve
SV 4378B	2	Nitrogen Compressor Suction Isolation Valve
LS 1861A	1	Scram Discharge Header Level Rise Trip
LS 1861B	2	Scram Discharge Header Level Rise Trip
1C 76B	2	SRM Preamplifier Cabinet
1C 77D	4	IRM Preamplifier Cabinet
1C 77B	2	IRM Preamplifier Cabinet

Equipment Number	Division	Description
1D 41	2	250 Volt dc Motor Control Center
1C 126B	2,3	Main Steam Instrument Racks
SV 1868	1	Emergency Air Supply Cutoff Valve
SV 1869	2	Emergency Air Supply Cutoff Valve
MO 2740	1	Cleanup Water Return Header to Reactor Vessel
SV 1840A	1	100 psig Instrument Air Inlet
SV 1840B	2	100 psig Instrument Air Inlet
1C 193A	1	Main Steam Line Leak Detection System
1C 193C	3	Main Steam Line Leak Detection System
Conduits	1,2,3 4,5,6	
Trays	2	

ZONE 2C

1C 193B	2	Main Steam Line Leak Detection System
1C 193D	4	Main Steam Line Leak Detection System
1C 145	1	MSIV - Leakage Control System Rack
Conduits	1,2,4,5	
Trays	1,2	

ZONE 2D

ZS 4308	1	Suppression Pool Purge Inlet
MO 1909	1	RHR Emergency Suction Isolation
MO 2003	1	RHR RCIC Injection Loop A
MO 2004	1	RHR RCIC Injection Loop A
ZS 4312	1	Containment Nitrogen Gas Purge Supply
ZS 4307	1	Reactor Vessel Containment Purge Inlet
ZS 4306	2	Reactor Vessel Containment Purge Inlet
SV 4306	2	Reactor Vessel Containment Purge Inlet
SV 4313	1	Suppression Pool Nitrogen Gas Purge Supply
SV 4311	2	Makeup Nitrogen Gas Inlet Isolation
SV 4308	1	Suppression Pool Purge

Equipment Number	Division	Description
		Inlet
SV 4312	1	Containment Nitrogen Gas Purge Supply
SV 4307	1	Reactor Vessel Containment Purge Inlet
MO 1905	2	RHR RCIC Injection Loop B
MO 1904	2	RHR RCIC Injection Loop B
MO 1902	2	Containment Spray Control Loop B
SV 4331B	2	Containment Spray Header Nitrogen Isolation
ZS 4331B	2	Containment Spray Header Nitrogen Isolation
SV 4331A	2	Containment Spray Header Nitrogen Isolation
ZS 4331A	2	Containment Spray Header Nitrogen Isolation
ZS 4311	2	Makeup Nitrogen Gas Inlet Isolation
ZS 4313	1	Suppression Pool Nitrogen Gas Purge Supply
Conduits	1,2,3,4	
Trays	1,2	

ZONE 2E

None

ZONE 2F

None

ZONE 2G

MO 2239	2	Main Steam to HPCI Turbine 1S-201
TE 4444D	2	Main Steam Line A Tunnel Zone 2 High Ambient Temperature
CV 4416	2	Steam Flow Control Line B
TE 4443D	1	Main Steam Line A Tunnel Zone 1 High Ambient Temperature
CV 4413	2	Steam Flow Control Line A Isolation Valve
RE 4448C	3	Maint Steam Line C Radiation Sensor
RE 4448A	1	Main Steam Line A Radiation Sensor
RE 4448B	2	Main Steam Line B Radiation Sensor
RE 4448D	4	Main Steam Line D Radiation

Equipment Number	Division	Description
		Sensor
MO 4424	2	Drain Control
CV 4421	2	Steam Flow Control Line D
TE 4446D	4	Main Steam Line A Tunnel Zone 4 High Ambient Temperature
MO 2401	1	Main Steam Supply Control
TE 4445D	3	Main Steam Line A Tunnel Zone 3 High Ambient Temperature
CV 4419	2	Steam Flow Control Line C
ZS 4419	2	Steam Flow Control Line C
TE 4445C	3	Main Steam Line A Tunnel Zone 3 High Ambient Temperature
ZS 2513	1	RCIC Pump 1P-226 Discharge Control
MO 4442	2	Feedwater Check/Stop Valve
ZS 4421	2,3,4	Steam Flow Control Line D
TE 4446C	4	Main Steam Line A Tunnel Zone 4 High Ambient Temperature
TE 4443C	1	Main Steam Line A Tunnel Zone 1 High Ambient Temperature
ZS 4413	1,2	Steam Flow Control Line A
MO 4441	1	Feedwater Check/Stop Valve
ZS 4416	1,2,4	Steam Flow Control Line B
TE 4444C	2	Main Steam Line A Tunnel Zone 2 High Ambient Temperature
TE 4444B	2	Main Steam Line A Tunnel Zone 2 High Ambient Temperature
TE 4444A	2	Main Steam Line A Tunnel Zone 2 High Ambient Temperature
MO 2312	2	HPCI Condensate Flow
TE 4443B	1	Main Steam Line A Tunnel Zone 1 High Ambient Temperature
TE 4443A	1	Main Steam Line A Tunnel Zone 1 High Ambient Temperature
TE 4446B	4	Main Steam Line A Tunnel Zone 3 High Ambient Temperature
TE 4446A	4	Main Steam Line A Tunnel Zone 3 High Ambient Temperature
MO 2512	1	RCIC Pump 1P-226 Discharge Control
TE 4445B	3	Main Steam Line A Tunnel Zone 3 High Ambient Temperature
TE 4445A	3	Main Steam Line A Tunnel Zone 3 High Ambient Temperature
ZS 2513A&C	1	RCIC Pump 1P-226 Discharge Control
ZS 2513B&D	1	RCIC Pump 1P-226 Discharge Control
ZS 2313A	2	HPCI Condensate Flow Control
ZS 2313B	2	HPCI Condensate Flow Control
Conduits	1,2,3,4	
Trays	2	

Equipment Number	Division	Description
MO 1901	2	Reactor Vessel Head Spray Isolation
1B 35	1	480 V Motor Control Center
MO 2135	2	Core Spray Pump 1P-211B Discharge Control
MO 2137	2	Reactor Vessel Core Spray Loop B Inlet
1C 56	1,2	Reactor Vessel Level and Pressure Instruments
1C 56A	1,2	Reactor Vessel Level and Pressure Instruments
SV 2513	1	RCIC Pump 1P-226 Discharge Control
LITS 4539	1	HPCI and RCIC Turbine Trip High on Reactor Vessel Level
PS 4365B	2	Containment Pressure
Conduits	1,2,3	
Trays	1	

ZONE 3B

SV 8225A	1	Radwaste Evaporator Vacuum Pump 1P-77 Discharge
ZS 8225A	1	Radwaste Evaporator Vacuum Pump 1P-77 Discharge
SV 8225B	2	Radwaste Evaporator Vacuum Pump 1P-77 Discharge
ZS 8225B	2	Radwaste Evaporator Vacuum Pump 1P-77 Discharge
SV 4332A	1	Containment Spray Header Nitrogen Isolation
ZS 4332A	1	Containment Spray Header Nitrogen Isolation
SV 4332B	1	Containment Spray Header Nitrogen Isolation
ZS 4332B	1	Containment Spray Header Nitrogen Isolation
SV 4640	2	RCIC Water Sample
ZS 4640	2	RCIC Water Sample
MO 2701	2	Reactor RCIC System Header
TE 2722	2	Heat Exchanger 1E-215B Outlet Temperature
1C 52	1,2	Reactor Water Cleanup System
1D 14	1	125 V DC Motor Control Center
MO 2115	1	Core Spray Pump 1P-211A Discharge Control
1B 34	1,3,5,6	480 V Motor Control Center
MO 2117	1	Reactor Vessel Core Spray Loop A Inlet
MO 2000	1	Containment Spray Control Loop A
Conduits	1,2,3,5,6	
Trays	1,2	

Equipment Number	Division	Description
		ZONE 3C
SV 5837A	1	Standby Gas Treatment System - Fire Deluge
SV 5837B	2	Standby Gas Treatment System - Fire Deluge
SV 5817A	1	Reactor Building Standby Gas Treatment Air Discharge Valve
ZS 5817A	1	Reactor Building Standby Gas Treatment Air Discharge Valve
SV 5817B	2	Reactor Building Standby Gas Treatment System - Air Discharge Valve
ZS 5817B	2	Reactor Building Standby Gas Treatment System - Air Discharge Valve
1K 4	2	Standby Gas Treatment System - Air Compressor
FT 5829B	2	Standby Gas Treatment System - Air Intake
FT 5829A	1	Standby Gas Treatment System - Air Intake
1K 3	1	Standby Gas Treatment System - Air Compressor
PS 7333A	1	Reactor Building 1K-3 Located on 1V-S-13
PS 7334A	1	Located on 1K-3
PS 7335A	1	1S-3 Located on IV-S-12
PS 7333B	2	Reactor Building 1K-4 Located on IV-S-12
PS 7334B	2	Located on 1K-4
PS 7335B	2	1K-4 Located on 1V-S-13
DPS 5808A	1	Standby Gas Treatment System - HEPA Absolute Filter
DPS 5808B	2	Standby Gas Treatment System - HEPA Absolute Filter
1C 170	1	Standby Gas Treatment System - A
1C 158	1	Standby Gas Treatment - A System Panel
1C 159	2	Standby Gas Treatment - B System Panel
1C 171	2	Standby Gas Treatment System - B
SV 5825A	1	Standby Gas Treatment System - Air Intake
ZS 5825A	1	Standby Gas Treatment System - Air Intake
SV 5801A	1	Standby Gas Treatment System - Cooldown Air Valve
ZS 5801A	1	Standby Gas Treatment System - Cooldown Air Valve
DPT 5806A	1	Standby Gas Treatment System - A Train Differential Pressure
DPT 5806B	2	Standby Gas Treatment System - B Train Differential Pressure
SV 5801B	2	Standby Gas Treatment System - Cooldown Air Valve
ZS 5801B	2	Standby Gas Treatment System -

Equipment Number	Division	Description
		Cooldown Air Valve
SV 5825B	2	Standby Gas Treatment System - Air Intake
ZS 5825B	2	Standby Gas Treatment System - Air Intake
1N 3455	1	Standby Gas Treatment System - Heaters
1N 4446	2	Standby Gas Treatment System - Heaters Control
TE 5805U	1	Standby Gas Treatment System - Roughing Filter
TE 5805W	2	Standby Gas Treatment System - Roughing Filter
TS 5808A	1	Reactor Building Standby Gas Treatment System - Electrical Heater High
TS 5808B	2	Reactor Building Standby Gas Treatment System - Electrical Heater High
TE 5833A	1	Standby Gas Treatment System - Carbon Bed Inlet
TE 5833B	2	Standby Gas Treatment System - Carbon Bed Inlet
TE 5805V	1	Standby Gas Treatment System - Carbon Bed Filter
TE 5805X	2	Standby Gas Treatment System - Carbon Bed Filter
SV 5815A	1	Standby Gas Treatment System - Air Intake
ZS 5815A	1	Standby Gas Treatment System - Air Intake
SV 5815B	2	Standby Gas Treatment System - Air Intake Valve
ZS 5815B	2	Standby Gas Treatment System - Air Intake Valve
SV 7602A	1	Standby Gas Treatment System - Inlet
ZS 7602A	1	Standby Gas Treatment System - Inlet
SV 7602B	2	Standby Gas Treatment System - Inlet
ZS 7602B	2	Standby Gas Treatment System - Inlet
1M 3454	1	Standby Gas Treatment System - Exhaust Fan
IM 4445	2	Standby Gas Treatment System - Exhaust Fan
Conduits	1,2,3	
Trays	1,2	

ZONE 3D

Conduits	1,5	
Trays	1	

Equipment Number	Division	Description
		ZONE 4A
SV 7631B	2	1V-AD-17B3 Isolation Damper
ZS 7631B	2	1V-AD-17B3 Isolation Damper
SV 7631A	1	1V-AD-17A3 Isolation Damper
ZS 7631A	1	1V-AD-17A3 Isolation Damper
SV 7632B	2	1V-AD-17B2 Isolation Damper
ZS 7632B	2	1V-AD-17B2 Isolation Damper
SV 7632A	1	1V-AD-17A2 Isolation Damper
ZS 7632A	1	1V-AD-17A2 Isolation Damper
SV 7633B	2	1V-AD-17B1 Isolation Damper
ZS 7633B	2	1V-AD-17B1 Isolation Damper
SV 7633A	1	1V-AD-17A1 Isolation Damper
ZS 7633A	1	1V-AD-17A1 Isolation Damper
1MB 305 (1V-CH-1A)	1	Control Building Chiller System Loop A
1N 305A	1	Control Building Chiller System Loop A
1N 305	1	Control Building Chiller System Loop A
FS 6924A	1	Control Building Chiller System Loop A
FS 6925A	1	Control Building Chiller System Loop A
1M 3225	1	Control Building Chiller System Loop A
SV 6920B	2	1V-HX-31B H&V
ZS 6920B	2	1V-HX-31B H&V
SV 6920A	1	1V-HX-31A H&V
ZS 6920A	1	1V-HX-31A H&V
ZS 6919B	2	1V-HX-31B H&V
ZS 6919A	1	1V-HX-31A H&V
MO 2039B	2	Well Water Inlet to Cooler
SV 1956B	2	Control Building Cooler Discharge to Cooling Water
MO 2078	2	Well Water Return
MO 2077	1	Well Water Return
SV 1956A	1	Control Building Cooler Discharge to Cooling Water
MO 2039A	1	Well Water Inlet to Cooler
1MB 405 (1V-CH-1B)	2	Control Building Chiller System Loop B
1N 405A	2	Control Building Chiller System Loop B
FS 6924B	2	Control Building Chiller System Loop B
FS 6925B	2	Control Building Chiller System Loop B
1M 4214	2	Control Building Chiller System Loop B
1N 405	2	Control Building Chiller System Loop B
SV 4303	2	Reactor Vessel Containment Purge Outlet
ZS 4303	2	Reactor Vessel Containment Purge Outlet
SV&ZS 4302	1	Reactor Vessel Containment

Equipment Number	Division	Description
		Purge Outlet
SV&ZS 4310	1	Reactor Vessel Containment Purge Outlet
Conduits	1,2	
Trays	2	

ZONE 4B

None

ZONE 4C

SV 7612B	2	1V-AD-13B
ZS 7612B	2	1V-AD-8B
SV 7612A	1	1V-AD-13A
ZS 7612A	1	1V-AD-8A
SV 7610A	1	1V-AD-14A
ZS 7610A	1	1V-AD-14A
SV 7610B	2	1V-AD-14B
ZS 7610B	2	1V-AD-14B
SV 7637A	1	1V-AD-52A Isolation Damper
ZS 7637A	1	1V-AD-15A Isolation Damper
DPS 7637A	1	1V-AD-15A Isolation Damper
DPS 7637B	2	1V-AD-15B Isolation Damper
Conduits	1,2	

ZONE 4D

None

ZONE 4E

None

ZONE 5A

1M 4439	2	Standby Liquid Control Pump
1M 3445	1	Standby Liquid Control Pump
XS 2618A	1	Explosive Valve
XS 2618B	2	Explosive Valve
1N 3445	1	Standby Liquid Control Pump 1M 3445 Control
1N 4439	2	Standby Liquid Control Pump

Equipment Number	Division	Description
		1M 4439 Control
Conduits	1,2	
Trays	1,2	
		ZONE 6A
None		
		ZONE 7A
Conduits	1,2	
Trays	1,2	
		ZONE 7B
Conduits	1	
Trays	1	
		ZONE 7C
Conduits	1,2	
Trays	2	
		ZONE 7D
Conduits	1,2	
		ZONE 7E
Conduits	1,2	
		ZONE 7F
TE 4479A	3	Main Steam Line C Zone 11
TE 4480A	4	Main Steam Line D Zone 11
TE 4477A	1	Main Steam Line A Zone 11
TE 4478A	2	Main Steam Line B Zone 11

Equipment Number	Division	Description
TE 4479B	3	Main Steam Line C Zone 22
TE 4480B	4	Main Steam Line D Zone 22
TE 4477B	1	Main Steam Line A Zone 22
TE 4478B	2	Main Steam Line B Zone 22
ZS 1076A	2	Main Steam Stop Valve-1 Reactor Scram
PS 1026A	1	Control Valve EHC Pressure Low
ZS 1076B	4	Main Steam Stop Valve-2 Reactor Scram
PS 1026C	3	CV-3 EHC Pressure Low
ZS 1076C	2	Main Steam Stop Valve-3 Reactor Scram
PS 1026B	2	CV-2 EHC Pressure Low
PS 1026D	4	CV-4 EHC Pressure Low
ZS 1076D	4	Main Steam Stop Valve-4 Reactor Scram
PS 1017	4	Stop Valve-2 Main Steam Inlet Pressure Low
1C 194D	4	Main Steam Line Leak Detector
PS 1016	3	Stop Valve-1 Main Steam Inlet Pressure Low
1C 194C	3	Main Steam Line Leak Detector
PS 1015	2	Stop Valve-4 Main Steam Inlet Pressure Low
1C 194B	2	Main Steam Line Leak Detector
PS 1014	1	Stop Valve-3 Main Steam Inlet Pressure Low
1C 194A	1	Main Steam Line Leak Detector
PS 1005D	4	Turbine First Stage Pressure Low - Scram
PS 1005C	3	Turbine First Stage Pressure Low - Scram
PS 1005B	2	Turbine First Stage Pressure Low - Scram
PS 1005A	1	Turbine First Stage Pressure Low - Scram
Conduits	1,2,3,4	

ZONE 8A, B, C, E

None

ZONE 8D

Conduits	2,4	

ZONE 8F

1G 211	2	Diesel Generator Grounding Panel

Equipment Number	Division	Description
1M1K10B, 1N1K10B	2	1G21 Air Compressor
LS 3221B	2	Air Receiver 1T-115B Moisture High
LS 3222B	2	Air Receiver 1T-115B Moisture High
PS 3224B	2	Start Air Compressor 1K-10B
1ND 2116	2	1G21 Backup Fuel Control
1C 118	2	Emergency Diesel Generator Control Panel
1G 21	2	Standby Diesel Generator
1G 213	2	Stator RTD Terminal Box For 1G21
1G 212	2	1G21 Circuit Breaker Panel
1C 94	2	Emergency Diesel Generator Control Cabinet 1G21
PDS 3234B	2	Remote Inlet Filter 1F-31B DP High
LS 3223B	2	Air RCVR 1T-115B Moisture High
1M 4206 (1V-SF-21)	2	Supply Fan
TS 3277B	2	1G-21 Combustion Air Temperature High
SV 2081	2	Emergency Service Water to Diesel Generator 1E-53B
1MD 2116 (1P-41B)	2	1G-21 Backup Fuel Pump
1C 152	2	Emergency Generator Ventilation System B
ZS 7002B1	2	Supply Fan Damper ZS
LS 3218B	2	Jacket Water Expansion Tank 1T-113 Level Low
ZS 7002 B3	2	Supply Fan Damper ZS
Conduits	2	

ZONE 8G

TS 3227	2	Day Tank 1T-37B Room Temperature High
LS 3209	2	Emergency Diesel Generator Day Tank 1T-37B
LS 3216B	2	Emergency Diesel Generator Day Tank 1T-37B Low
LS 3210A	2	Emergency Diesel Generator Day Tank 1T-37B
LS 3210B	2	Emergency Diesel Generator Day Tank 1T-37B
LS 3216A	2	Emergency Generator Day Tank 1T-37B High
LS 3220A	2	Lube Oil Makeup Tank 1T-114A Level Low
LS 3220B	2	Lube Oil Makeup Tank 1T-114A Level Low-Low

ZONE 8H

1G 311	1	Diesel Generator Grounding Panel

Equipment Number	Division	Description
1C 151	1	Emergency Diesel Generator Ventilation System A
1M1K10A, 1N1K10A	1	1G-31 Air Compressor
PS 3224A	1	Start Air Compressor 1K-10A
LS 3221A	1	Air Receiver 1T-115A Moisture High
LS 3222A	1	Air Receiver 1T-115A Moisture High
1C 93	1	Emergency Generator Control Cabinet 1G31
PDS 3234A	1	Remote Intake Filter 1F-31A DP High
1G 31	1	Standby Diesel Generator
1G 312	1	1G31 Circuit Breaker Panel
1G 313	1	Stator RTD Terminal Box for 1G31
1C 117	1	Emergency Diesel Generator Control Cabinet
1ND 1116	1	1G-31 Backup Fuel Pump Control
1M 3213 (1V-SF-20)	1	Supply Fan
LS 3223A	1	Air Receiver 1T-115A Moisture High
TS 3277A	1	1G-31 Combustion Air Temperature High
SV 2080	1	Emergency Service Water to Diesel Generator 1E-53A
ZS 7002A1	1	Supply Fan Damper ZS
LS 3218A	1	Jacket Water Expansion Tank 1T-113 Level Low
1MD 1116 (1P-41A)	1	1G31 Backup Fuel Pump
ZS 7002A3	1	Supply Fan Damper ZS

ZONE 8J

TS 3226	1	Day Tank 1T-37A Room Temperature High
LS 3207	1	Emergency Diesel Generator Day Tank 1T-37A
LS 3215B	1	Emergency Generator Day Tank 1T-37A Low
LS 3208A	1	Emergency Diesel Generator Day Tank 1T-37A
LS 3208B	1	Emergency Diesel Generator Day Tank 1T-37A
LS 3215A	1	Emergency Generator Day Tank 1T-37A High
LS 3219A	1	Lube Oil Makeup Tank 1T-114A Level Low
LS 3219B	1	Lube Oil Makeup Tank 1T-114A Level Low-Low

ZONE 9A

Equipment Number	Division	Description
None		
		ZONE 10A
None		
		ZONE 10B
1D2	2	125 Volt dc Batteries
1D6	2	24 Volt dc Batteries
Conduits	2	
		ZONE 10C
1D4	2	250 Volt dc Batteries
Conduits	2	
		ZONE 10D
1D1	1	125 Volt dc Batteries
1D5	1	24 Volt dc Batteries
Conduits	2	
		ZONE 10E
1A 401	2	Switchgear-Incoming from Standby Transformer
1A 402	2	Switchgear-Incoming from Startup Transformer
1A 403	2	Switchgear-Load Center Transformer 1X41
1A 404	2	Switchgear-Core Spray Pump 1P-211B
1A 405	2	Switchgear-RHR Pump 1P-229B
1A 406	2	Switchgear-RHR Pump 1P-229A
1A 407	2	Switchgear-RHR Service Water Pump 1P-22B
1A 408	2	Switchgear-RHR Service Water Pump 1P-22D
1A 409		Switchgear-Service Water Pump 1P-89B

Equipment Number	Division	Description
1A 410		Switchgear-CRD Feed Pump 1P-209B
1A 411	2	Switchgear-Standby Diesel Generator 1G21
1A 412	2	Switchgear-Load Center Transformer 1X20
1B 4	1,2	Load Center (Essential)
1B 42	2	Motor Control Center
1N 4218	2	AC Cooling Unit Control
1N 4220 (1V-HP-30B)	2	Hot Water Secondary Loop Pump Control
1N 4232	2	HPCI Turbine Exhaust Vacuum Breaker Valve
1D 44	2	250 Volt dc Charger #2
1D 40	2	250 Volt dc Load Center
1Y 2	2	Instrument ac Transformer #2
1Y 21	2	Instrument ac Distribution Panel #2
1Y 20	1,2	Main and Tie Breaker for 1Y21
1D 22	2	125 Volt dc Charger #2
1D 20	2	125 Volt dc Load Center #2
1D 21	2	125 Volt dc Distribution Panel B
1D 23	2	125 Volt dc Distribution Panel D
1D 61	2	+24 Volt dc Charger #2
1D 62	2	-24 Volt dc Charger #2
1D 60	2	+24 Volt dc Distribution Panel #2
Conduits	2,4,5	
Trays	2	

ZONE 10F

1A 301	1	Switchgear-Incoming from Standby Transformer
1A 302	1	Switchgear-Incoming from Startup Transformer
1A 303	1	Switchgear-Load Center Transformer 1X31
1A 304	1	Switchgear-Core Spray Pump 1P-211A
1A 305	1	Switchgear-RHR Pump 1P-229A
1A 306	1	Switchgear-RHR Pump 1P-229C
1A 307	1	Switchgear-RHR Service Water Pump 1P-22A
1A 308	1	Switchgear-RHR Service Water Pump 1P-22C
1A 309		Switchgear-Service Water Pump 1P-89A
1A 310		Switchgear-CRD Feed Pump 1P-209A
1A 311	1	Switchgear-Standby Diesel Generator 1G-31
1A 312	1	Switchgear-Load Center

Equipment Number	Division	Description
		Transformer 1X91
1B 3	1,2	Load Center (Essential)
1B 34	1	Motor Control Center
1N 3207	1	AC Cooling Unit Control
1N 3209 (1V-HP-30A)	1	Hot Water Secondary Loop Pump Control
1N 3233	1	HPCI Turbine Exhaust Vacuum Breaker Valve
1D 120	1,2	125 Volt dc Charger #3
1D 12	1	125 Volt dc Charger #1
1D 10	1	125 Volt dc Load Center #1
1D 11	1	125 Volt dc Distribution Panel A
1D 13	1	125 Volt dc Distribution Panel C
1D 51	1	+24 Volt dc Charger #1
1D 52	1	-24 Volt dc Charger #2
1D 50	1	-24 Volt dc Distribution Panel #1
1Y 23	1	Uninterrupted ac Distribution Panel
1Y 11	1	Instrument ac Distribution Panel #1
1Y 10	1	Main and Tie Breaker for 1Y11
1Y 1	1	Instrument ac Transformer #1
1Y 30	1,2	RPS Distribution Panel C71-P001
RV 303	1	Recording Voltmeter for 1A3
1A 400	2	Switchgear Test and Inspection Box
3J 505	3	Condensate Pump Discharge Isolation Valve
Conduits	1,2,3	
Trays	1	

ZONE 11A

Conduits	1,3	
Trays	2	

ZONE 12A

1C 26	1,2	HVAC - Turbine Building and Control Building
1C 16	1,2,3,4	Reactor Protection System Test
1C 14	1	MSIV - Leakage Control Panel
1C 35	1,2	CAD Containment Atmospheric Dilution Panel
1C 03	1,2,3,4	Reactor and Containment Cooling
1C 04	1,2,3,4	Reactor Water Cleanup and RCIC
1C 05	1,2,3	Reactor Control

Equipment Number	Division	Description
1C 06	1,2	Feedwater and Condensate
1C 08	1,2	Generator and Auxiliary Power
1C 43	1,2,3	Division I - Core Spray Relay
1C 32	1,2,3	Division I - RHR Core Spray, ADS Panel
1C 41	1,2	Inboard Primary Containment Isolation Valve Relay
1C 30	1,4	RCIC Relays
1C 19	1	Process Instrumentation Equipment
1C 36	1,2,3,4	Startup Range Neutron Monitoring
1C 37	1,2,3,4	Power Range Neutron Monitoring Cabinet
1C 44	1,2	Division II - Core Spray Relay
1C 33	1,2,4	Division II - RHR Core Spray, and ADS Relay
1C 42	1,2	Outboard Primary Containment Isolation Valve Relay
1C 39	2,3	HPCI Computer Relay Equipment
1C 17	1,2,3,4	Channel B Primary Isolation and Reactor Protection System
1C 15	1,2,3,4	Channel A Primary Isolation and Reactor Protection System
1C 18	2	Feedwater and RCIC Equipment Panels
1C 10	1,2	Process Radiation Monitor Panels
1C 21	1,2,3,4	NSSS Temperature Recorders
1C 24	1,2	Standby Gas Treatment
1C 25	1,2	Drywell Ventilation
1C 31	1,2	Turbine and Generator Relay Panels
1C 23	1,2	HVAC Reactor Building and Main Plant System Panel
1C 34	1,2	Off Gas System
1C 29	1,2	Instrument Isolation Valves
1C 45	1,2,3,4	Automatic Blowdown Relay
1C 22	1	Meterology Instrument Panel
Conduits	1,2,3	
Trays	1	

ZONE 12B

DPS 7304A	1	Train A Intake Baffle
FT 7320A	1	Supply Fan Instrumentation
DPT 7305A	1	Supply Fan Differential Pressure
EC 7304A	1	Voltage Controller
OT 7304A	1	Torque Transmitter
TS 7304A	1	Temperature Switch
TE 7311A	1	Supply Fan Temperature Element
SV 7328A	1	Supply Fan
CU 7329A	1	Supply Fan Controller
1N 3206	1	Standby Filter Unit Heater Control
LC 7328A	1	Sump Level Controller
1M 3234	1	Sump Pump Motor

Equipment Number	Division	Description
1N 3234	1	Sump Pump Motor Control
SV 7322A	1	Exhaust Fan Solenoid
1V-SF-30A (1M3223)	1	Supply Fan
ZS 7318A	1	Supply Fan Control Valve
SV 7318A	1	Supply Fan Control Valve
FT 7320B	2	Supply Fan Flow Instrument
DPT 7305B	2	Supply Fan Delta P
DPS 7304B	2	Train B Intake Baffle
1C 163	2	HVAC Standby Filter Unit SFU-30B (Elevation 800')
ZS 7301B	2	Supply Fan Control Valve
SV 7301B	2	Supply Fan Control Valve
EC 7304B	2	Electric Heater Controller
OT 7304B	2	Torque Transmitter
TS 7304B	2	Temperature Switch
TS 6124B	2	Temperature Switch Outside Air
SV 6110A	1	Air Filter Control Valve
ZS 6123A	1	Air Filter Control Valve
TS 6124A	2	Temperature Switch Outside Air
SV 7328B	2	Supply Fan Solenoid
TE 7311B	2	Supply Fan Temperature Element
CU 7329B	2	Control Unit for Supply Fan
SV 7322B	2	Filter Exhaust
ZS 7318B	2	Supply Fan Control Valve
SV 7318B	2	Supply Fan Control Valve
1M 4211 (1V-SF-30B)	2	Supply Fan Emergency Intake
LC 7328B	2	Sump Level Control
1M 4220 (1V-HP-30B)	2	Hot Water Secondary Loop Pump
1M 3209 (1V-HP-30A)	1	Hot Water Secondary Loop Pump
ZS 6123B	2	Control Building Intake
SV 6110B	2	Air Filter
1N 4233, 1M4233	2	Sump Pump Motor and Control
TS 6124A	1	Outside Air Temperature
FS 6113	1	Air Condenser Flow Switch
1M 3210 (1V-CF-33)	1	Exhaust Fan
CS 6132B	2	Battery Room Exhaust
CS 6132A	1	Battery Room Exhaust
1M 3212 (1V-EF-30A)	1	Exhaust Fan
1M 4205 (1V-EF-30B)	2	Exhaust Fan
1M 3205 (1V-AC-32)	1	Air Condenser
1M 3217 (1V-EF-30C)	1	Exhaust Fan
SV 7333B	2	Control Building Class 1 "B" Air Located Near 1C133B
SV 7334B	2	B Class 1 Air Supply
PER 7334B	2	Control Building Class 1 "B" Air Located Near 1C133B
PER 7333B	2	B Class 1 Air Supply
SV 7333A	1	Control Building Class 1 "A" Air Location Near 1C133A
SV 7334A	1	A Class 1 Air Supply
PER 7334A	1	Control Building 1 "A" Air Located Near 1C33A
PER 7333A	1	A Class 1 Air Supply
SV 6107A	1	Control Building Exhaust Control Valve
ZS 6107A	1	Control Building Exhaust Control Valve

Equipment Number	Division	Description
ZS 6107B	2	Control Building Exhaust Control Valve
SV 6107B	2	Control Building Exhaust Control Valve
1M 3207 (1V-AC-30A)	1	Essential Switchgear and Battery Room AC Unit
PC 6126V	2	Humidity Steam Generator
1M 3208 (1V-RF-30A)	1	Essential Switchgear and Battery Room Exhaust Fan
SV 6108A	1	Central Building Supply
SV 6108B	2	Central Building Supply
1M 4218 (1V-AC-30B)	2	Essential Switchgear and Battery Room AC Unit
1M 4219 (1V-RF-30B)	2	Essential Switchgear and Battery Room Exhaust Fan
ZS 7301A	1	Supply Fan Control Valve
SV 7301A	1	Supply Fan Control Valve
SV 7333A	1	Control Building Class 1 "A" Air Located Near 1C133A
SV 7334A	1	A Class 1 Air Supply
PER 7333A	1	B Class 1 Air Supply
1C 133A	1	Mechanical Equipment Room Instrument Panel
1C 133B	2	Mechanical Equipment Room Instrument Panel
SV 7333B	2	Control Building Class 1 "B" Air Located Near 1C 133B
SV 7334B	2	B Class 1 Air Supply
PER 7333B	2	B Class 1 Air Supply
PER 7334B	2	Control Building Class 1 "B" Air Located Near 1C133B

ZONE 13A, B, C

None

ZONE 13D

SV 7641A	1	Radwaste 1V-AD-44A Isolation Damper
ZS 7641A	1	Radwaste 1V-AD-44A Isolation Damper
SV 7641B	2	Radwaste 1V-AD-44B Isolation Damper
ZS 7641B	2	Radwaste 1V-AD-44B Isolation Damper
Conduits	1,2	

ZONE 14A

Equipment Number	Division	Description

None

ZONE 15A, B, C

None

ZONE 16A

1M 4601 (1V-SF-56B)	2	Supply Fan
1C 161	2	RHR Fan 56B HVAC Control Panel
SV 7539B	2	PH 1V-SF-56B Discharge Damper
SV 7538B	2	PH 1V-SF-56B Discharge Damper
SV 7536	1	PH 1V-SF-56A Exhaust Louvers
SV 7537	2	PH 1V-SF-56B Exhaust Louvers
1M 4207 (1P99B)	2	Emergency Service Water Pump
1P 22D (1M408)	2	RHR Service Water Pump
1P 22B (1M407)	2	RHR Service Water Pump
LIS 4935B	2	Stilling Basin Level
LT 4935B	2	Stilling Basin Level
Conduits	1,2	
Trays	1	

ZONE 16B

1B 36	1	480 Volt Motor Control Center
1P 22A (1M307)	1	RHR Service Water Pump
1P 22C (1M308)	1	RHR Service Water Pump
LIS 4935A	1	Stilling Basin Level
LT 4935A	1	Stilling Basin Level
1P 99A (1M3214)	1	Emergency Service Water Pumps
SV 7539A	1	PH 1V-SF-56A Discharge Damper
1M 3601 (1V-SF-56A)	1	Supply Fan
SV 7538A	1	PH 1V-SF-56A Discharge Damper
1C 160	1	RHR Fan 56A HVAC Control Panel
Conduits	1	
Trays	1	

ZONE 16 C, D, E

None

ZONE 16F

Equipment Number	Division	Description
LS 4936B	2	Floor Drain Sump
1N 4602	2	Floor Drain Sump Control
LE 4936B	2	Floor Drain Sump
LE 4936A	1	Floor Drain Sump
LS 4936A	1	Floor Drain Sump
1N 3602	1	Pump House Drain Sump Control
1P 132B (1M4602)	2	Pump House Drain Sump Pump
1P 132A (1M3602)	1	Pump House Drain Sump Pump
1N 4602	2	Pump House Drain Sump Control
Conduits	1,2	
Trays	1,2	

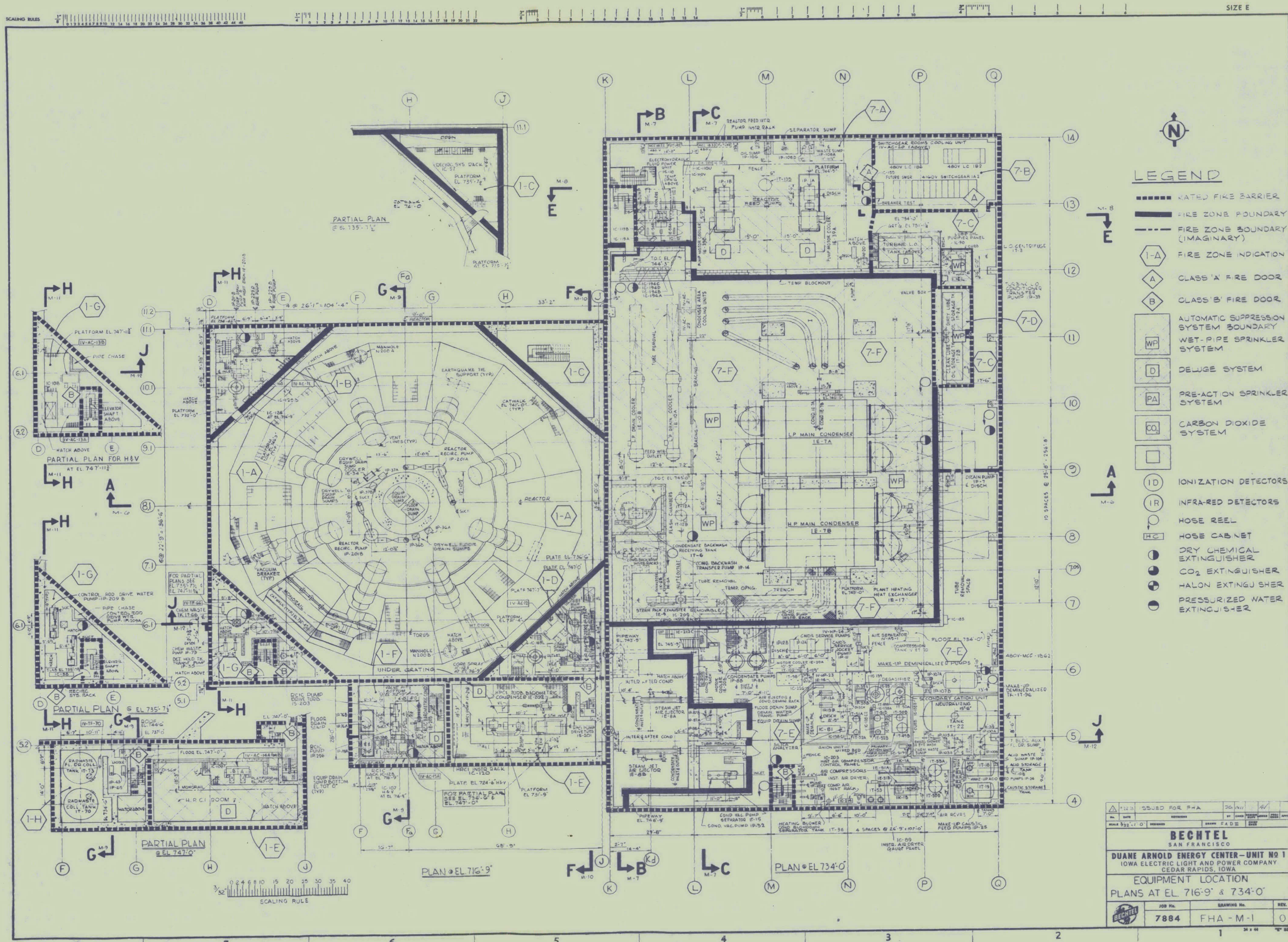
ZONE 17A

1V-UH-52B	1	Unit Heater
1P 117C (1M902)	1	Water Supply Pump
1B 9	1	Load Center
1B 91	1	Motor Control Center
1V-UH-52D	1	Unit Heater
TIC 7718A	1	Intake Structure Pump Room A High Temperature Alarm
TIC 7717A	1	Intake Structure Pump Room A Low Temperature Alarm
1V-SF-50 (1M9101)	1	Supply Fan
1P 117A (1M901)	1	Water Supply Pump
1C 156	1	HVAC 1V-SF-50 Control Panel
Conduits	1	
Trays	1	

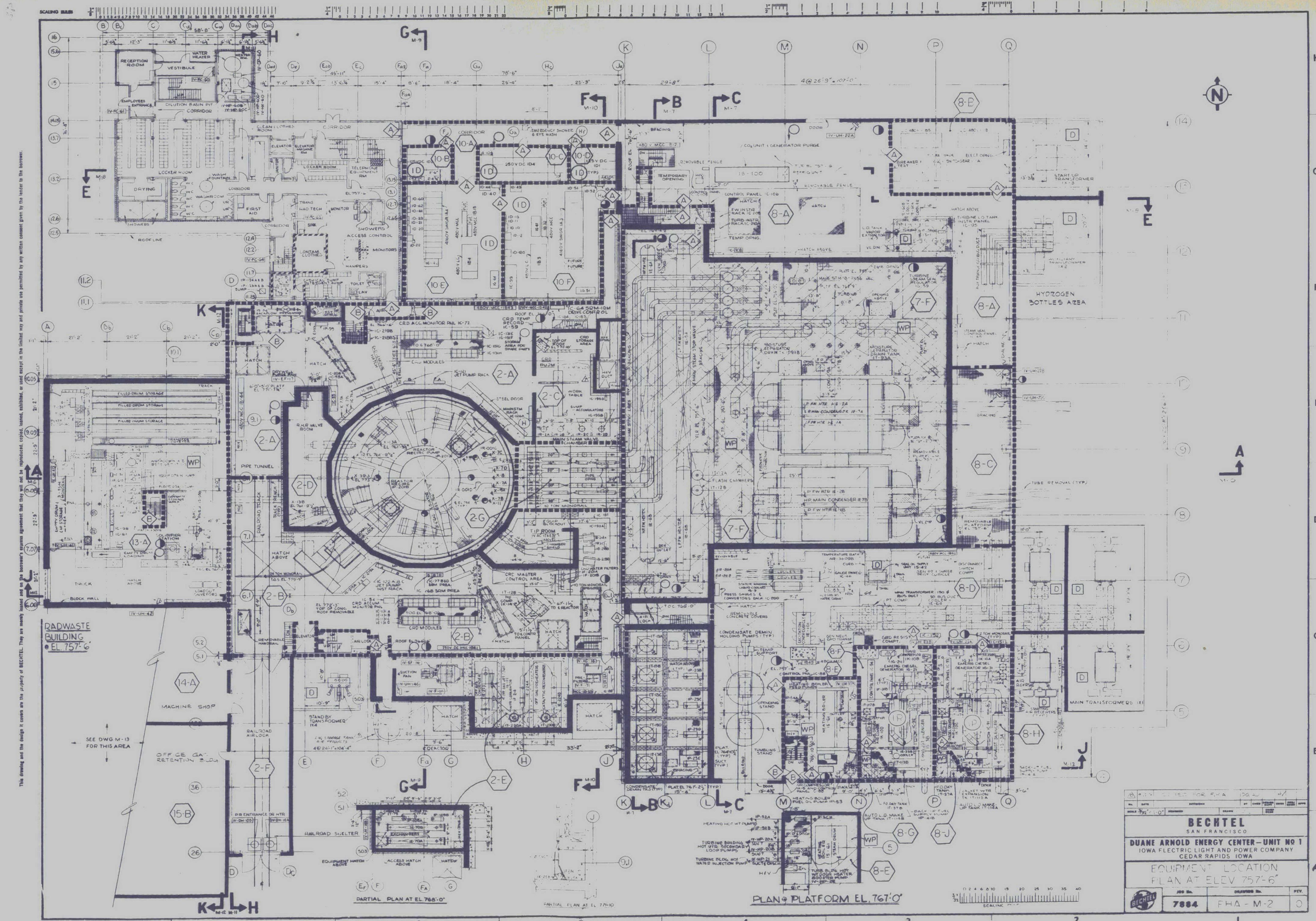
ZONE 17B

1P 117B (1M2001)	2	Water Supply Pump
1B 20	2	Motor Control Center
1B 21	2	Motor Control Center
1V-UH-52C	2	Unit Heater
1P 117D (1M2002)	2	Water Supply Pump
1C 157	2	HVAC 1V-SF-51 Control Panel
1V-SF-51 (1M2101)	2	Supply Fan
TIC 7717B	2	Intake Structure Pump Room B Low Temperature Alarm
TIC 7718B	2	Intake Structure Pump Room B High Temperature Alarm
1V-UH-52A	2	Unit Heater
Conduits	2	
Trays	2	

Equipment Number	Division	Description
		ZONE 17C
1M 9109	1	Gate Hoist
TE 2900	1	River Temperature
1N 9109	1	Gate Hoist Control
1V-UH-52F	1	Unit Heater
1M 9107	1	Traveling Screen Motor
PS 2902	1	Traveling Screen 1F-36A
MO 2902	1	Screen Wash Water 1P-122A
1N 9107	1	Traveling Screen Control
1P 112A (1M9106)	1	Screen Wash Pump
PDS 2910A	1	River Water Strainer 1S-85A Differential Pressure
MO 2910A	1	River Water Strainer 1S-85A
TE 2916	1	Water Supply Pumps 117A/C Discharge
1C 154A	1	Screen A Wash Water Strain Control Pump
1C 227A	1	River Water Analysis and Levels
1C 102	1	Intake Structure Instrument Panel
1V-UH-52H	1	Unit Heater
Conduits	1,2	
Trays	1	
		ZONE 17D
1N 2111	2	Gate Hoist Control
1M 2111	2	Gate Hoist
1V-UH-52E	2	Unit Heater
1M 2107	2	Traveling Screen Motor
PS 2903	2	Traveling Screen 1F-36B
MO 2903	2	Screen Wash Water 1P-112B
1N 2107	2	Traveling Screen Control
PDS 2910B	2	River Water Strainer 1S-85B
MO 2910B	2	River Water Strainer 1S-85B
1P 112B (1M2106)	2	Screen Wash Pump
TE 2917	2	Water Supply Pumps 117B/D Discharge
1C 154B	2	Screen B Wash Water Strainer Control Pump
1C 227B	2	River Water Analysis and Levels
1V-UH-52G	2	Unit Heater
Conduits	2	
Trays	2	



LEGEND
RATED FIRE BARRIER
FIRE ZONE BOUNDARY
FIRE ZONE BOUNDARY (IMAGINARY)
FIRE ZONE INDICATION
CLASS 'A' FIRE DOOR
CLASS 'B' FIRE DOOR
AUTOMATIC SUPPRESSION SYSTEM BOUNDARY
WET-PIPE SPRINKLER SYSTEM
DELUGE SYSTEM
PRE-ACTION SPRINKLER SYSTEM
CARBON DIOXIDE SYSTEM
IONIZATION DETECTORS
INFRA-RED DETECTORS
HOSE REEL
HOSE CABINET
DRY CHEMICAL EXTINGUISHER
CO2 EXTINGUISHER
HALON EXTINGUISHER
PRESSURIZED WATER EXTINGUISHER
PARTIAL PLAN FOR H&V AT EL. 747'-11½"
PARTIAL PLAN @ EL 735'-7½"
PARTIAL PLAN @ EL 747'-0"
PLAN @ EL 716'-9"
PLAN @ EL 734'-0"
LP MAIN CONDENSER 1E-7A
HP MAIN CONDENSER 1E-7B
REACTOR
TORUS
SCALING RULE
BECHTEL
SAN FRANCISCO
DUANE ARNOLD ENERGY CENTER-UNIT NO 1
IOWA ELECTRIC LIGHT AND POWER COMPANY
CEDAR RAPIDS, IOWA
EQUIPMENT LOCATION
PLANS AT EL. 716'-9" & 734'-0"
7884
FHA-M-1
0
SIZE E



0		ISSUED FOR FHA		DG				
No.	DATE	REVISIONS	BY	CHKD	DESIGN SUPV	ENGR	PROJ ENGR	APPR

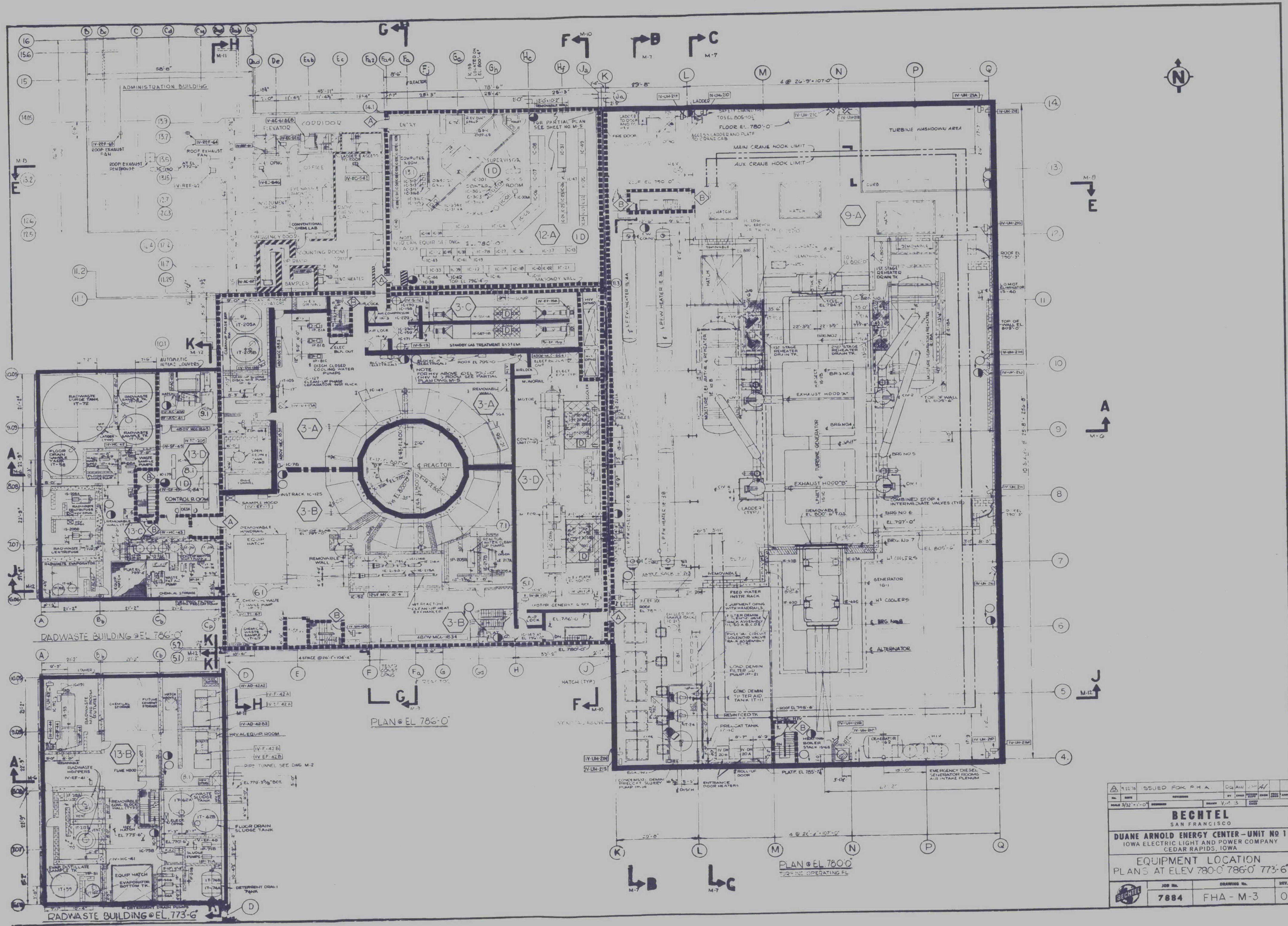
SCALE 3/32" = 1'-0" | DESIGNED | DRAWN | CHIEF ENGR

BECHTEL
SAN FRANCISCO

DUANE ARNOLD ENERGY CENTER—UNIT NO 1
IOWA ELECTRIC LIGHT AND POWER COMPANY
CEDAR RAPIDS IOWA

EQUIPMENT LOCATION
PLAN AT ELEV 757'-6"

JOB No.	DRAWING No.	REV.
7884	FHA - M-2	0



No.	Date	Revisions	By	Chkd	Design Supv	Engr	Proj Engr	Appr
0	9.22.78	ISSUED FOR F.H.A.	DG	AW	JSN	A/		

Scale 3/32" = 1'-0" | Designed | Drawn V.M.B. | Chief Engr

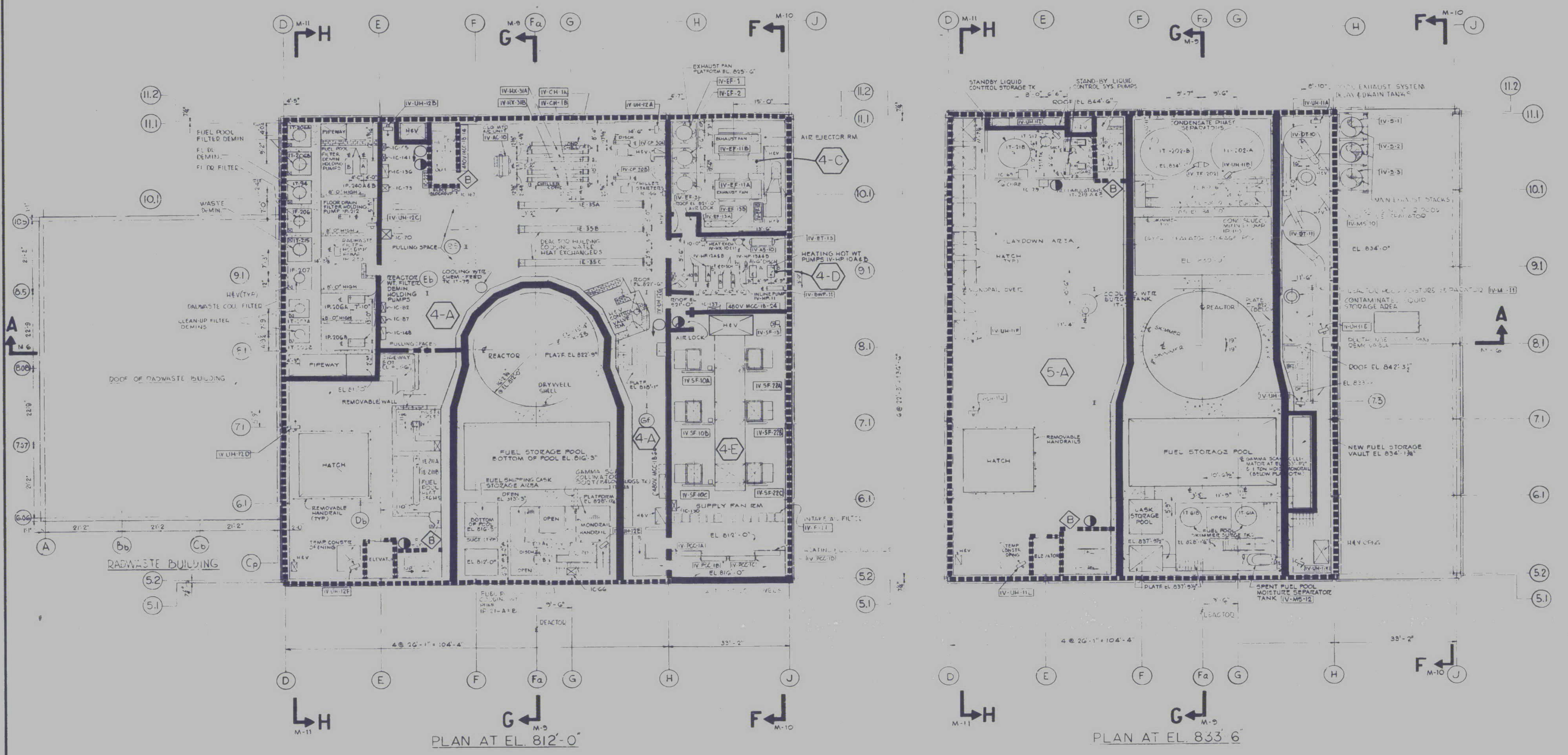
BECHTEL
SAN FRANCISCO

DUANE ARNOLD ENERGY CENTER – UNIT No 1
IOWA ELECTRIC LIGHT AND POWER COMPANY
CEDAR RAPIDS, IOWA

EQUIPMENT LOCATION
PLANS AT ELEV 780'-0" 786'-0" 773'-6"

Job No.	Drawing No.	Rev.
7884	FHA-M-3	0

SIZE E



0	9/26/78	ISSUED FOR F.H.A.	DG	A.M.	JSH	AV	
No.	DATE	REVISIONS	BY	CHKD	DESIGN SUPV	ENGR	PROJ ENGR / APP'R

SCALE 3/32" = 1'-0" DESIGNED DRAWN F.A.D. 3/70 CHIEF ENGR

BECHTEL
SAN FRANCISCO

DUANE ARNOLD ENERGY CENTER—UNIT NO 1
IOWA ELECTRIC LIGHT AND POWER COMPANY
CEDAR RAPIDS, IOWA

EQUIPMENT LOCATION
PLANS AT ELEVS 812'-0" & 833'-6"

JOB No.	DRAWING No.	REV.
7884	FHA - M-4	0

PLAN PLENUM
EL. 783'-6"

PLAN PLATFORM
EL. 778'-0"

PLAN AT EL 855'-0"

PARTIAL PLAN "JJ" • EL. 796'-0" H&V

PARTIAL PLAN @ EL 807'-8½"

PARTIAL PLAN • EL. 796'-0" H&V

PARTIAL PLAN EL 772'-6"
ADMINISTRATION AND CONTROL BUILDING

PARTIAL PLAN EL 800'-4"
CONTROL RM. BUILDING-HVAC ROOM

PARTIAL ROOF PLAN EL 817'-0"
CONTROL RM BUILDING-HVAC RM.

NO.	DATE	REVISIONS	BY	CHKD	PROJ ENGR	CONST ENGR	APPD
1	4/12/76	ISSUED FOR F.H.A.	DG	AW			

SCALE 3/32" = 1'-0" DESIGNED DRAWN V.M.B. CHECKED

BECHTEL
SAN FRANCISCO

DUANE ARNOLD ENERGY CENTER—UNIT No 1
IOWA ELECTRIC LIGHT AND POWER COMPANY
CEDAR RAPIDS, IOWA

EQUIPMENT LOCATION
PLAN • EL 855'-0" PARTIAL PLAN • EL 796'-0"
PARTIAL PLANS: EL 800'-4" EL 807'-8" EL 772'-6"

JOB No.	DRAWING No.	REV.
7884	FHA - M-5	0

34 x 44 E SIZE

SECTION A-A
LOOKING NORTH

SCALING RULE

4/24/74	ISSUED FOR F.H.A.	DN	AW	KF			
No.	DATE	REVISIONS	BY	CHKD	PROJECT ENGR	GROUP	APPD

SCALE 3/32" = 1'-0" DESIGNED — DRAWN W. WALSH CHECKED

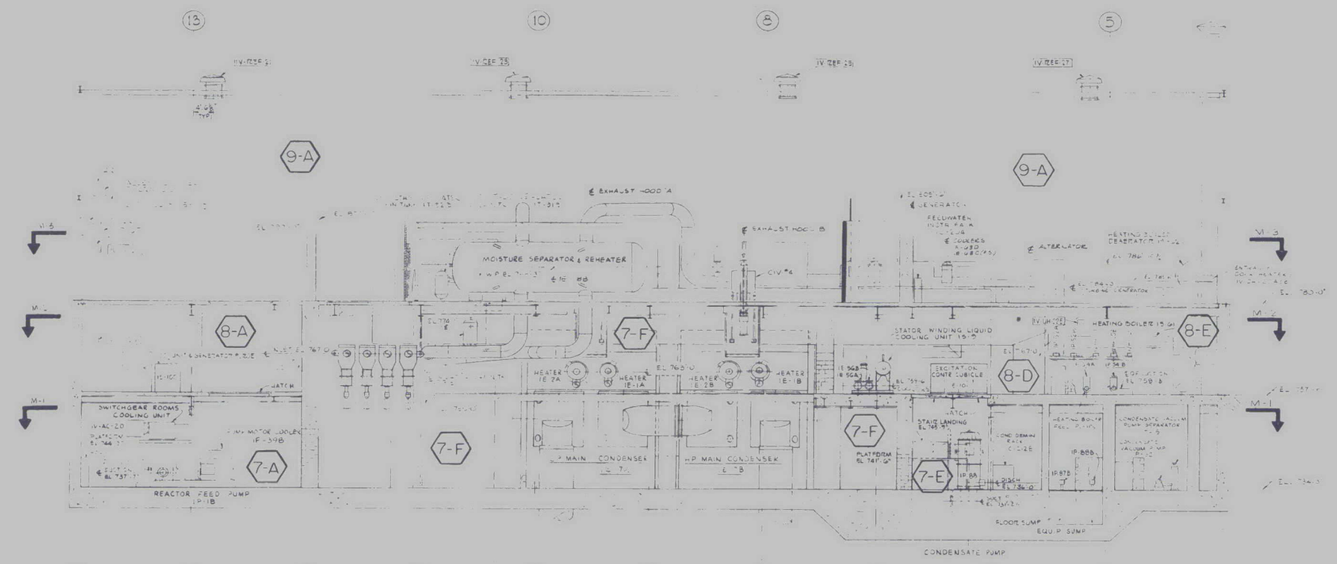
BECHTEL
SAN FRANCISCO

DUANE ARNOLD ENERGY CENTER—UNIT NO 1
IOWA ELECTRIC LIGHT AND POWER COMPANY
CEDAR RAPIDS IOWA

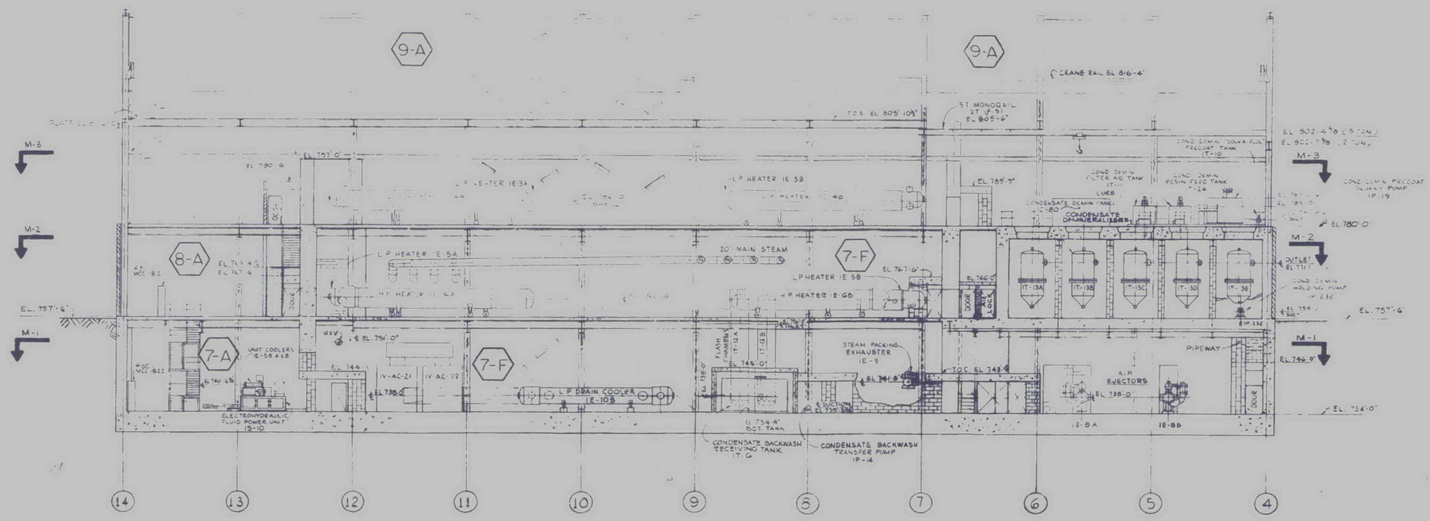
EQUIPMENT LOCATION
SECTION A-A

JOB No.	DRAWING No.	REV.
7884	FHA-M-6	0

SCALING RULES



SECTION C-C



SECTION B-B

SCALING RULE

NO.	DATE	REVISIONS	BY	COND	PROJECT ENGR	DESIGN ENGR	CHIEF CHECK	APPR
0	9/22/78	ISSUED FOR P.H.A.	DG	AW	JOH			

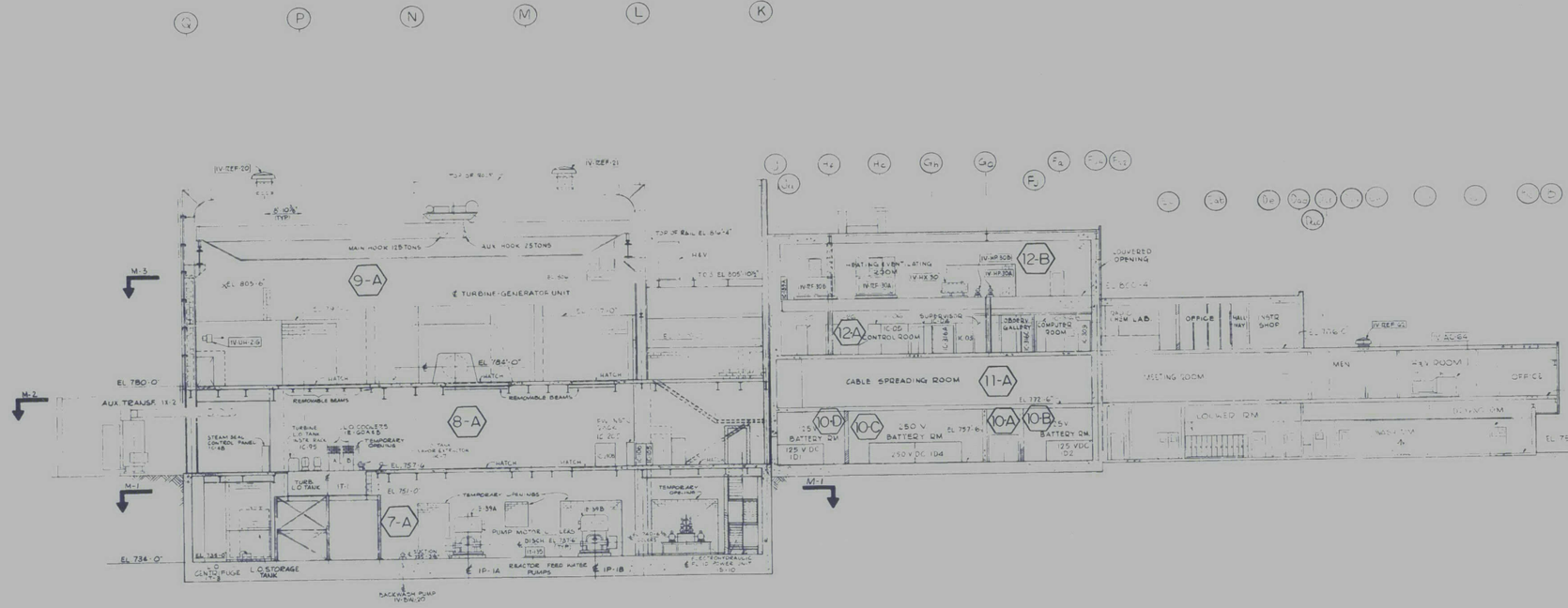
SCALE 3/32"=1'-0" DESIGNED DRAWN PJA

BECHTEL
SAN FRANCISCO

DUANE ARNOLD ENERGY CENTER—UNIT No 1
IOWA ELECTRIC LIGHT AND POWER COMPANY
CEDAR RAPIDS, IOWA

EQUIPMENT LOCATION
SECTIONS B-B & C-C

JOB No.	DRAWING No.	REV.
7884	FHA-M-7	0



SECTION E-E

3/32" 0 2 4 6 8 10 15 20 25 30 35 40
SCALING RULE

No.	DATE	REVISIONS	BY	CHKD	PROJ ENGR	DESIGN ENGR	CONST ENGR
3	4-21-78	ISSUED FOR F.H.A.	DG	AW	JSM	MV	

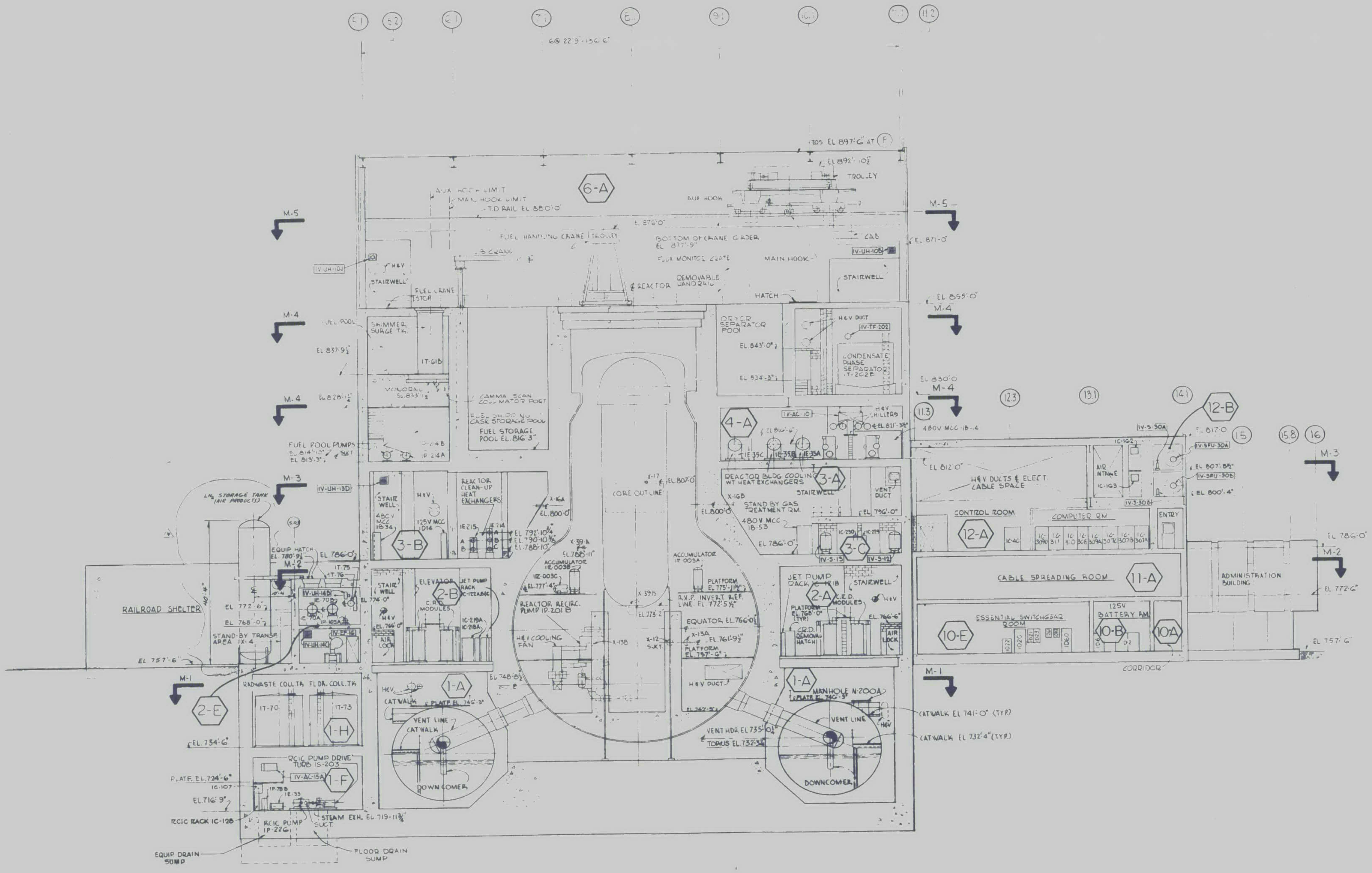
SCALE 3/32"=1'-0" DESIGNED DRAWN W.O.

BECHTEL
SAN FRANCISCO

DUANE ARNOLD ENERGY CENTER — UNIT No 1
IOWA ELECTRIC LIGHT AND POWER COMPANY
CEDAR RAPIDS, IOWA

EQUIPMENT LOCATION
SECTION E-E
LOOKING SOUTH

JOB No.	DRAWING No.	REV.
7884	FHA - M-8	0



SECTION G-G

No.	DATE	REVISIONS	BY	CHKD	DESIGN SUPV	ENGR	PROJ ENGR	APPR
0	9/22/76	ISSUED FOR F.H.A.	DG	AW	JSH	AV		

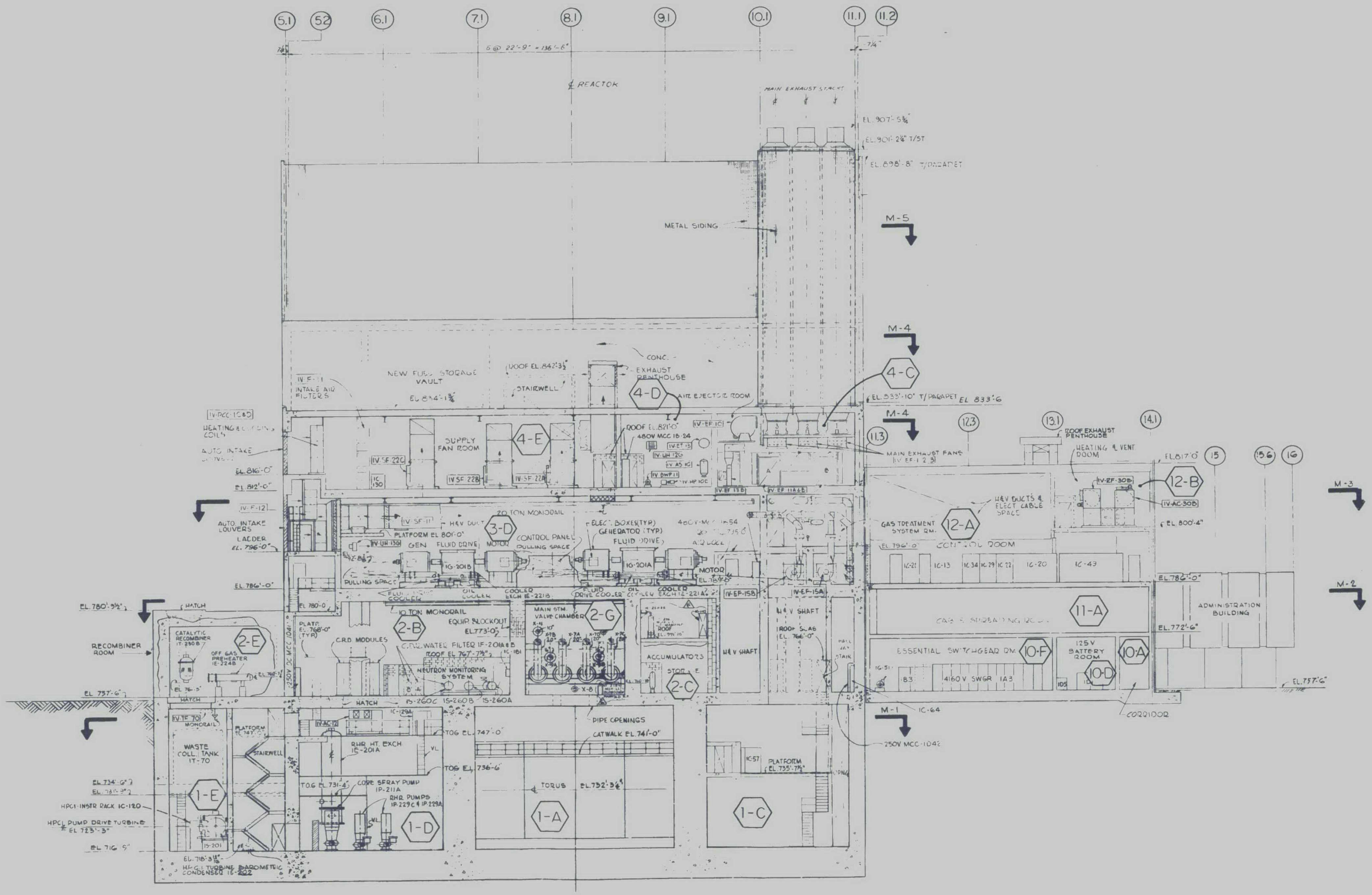
SCALE 3/32" = 1'-0" DESIGNED DRAWN V.M.B CHIEF ENGR

BECHTEL
SAN FRANCISCO

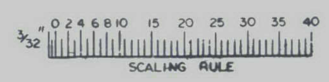
DUANE ARNOLD ENERGY CENTER—UNIT No 1
IOWA ELECTRIC LIGHT AND POWER COMPANY
CEDAR RAPIDS, IOWA

EQUIPMENT LOCATION
REACTOR BUILDING SECTION-GG

JOB No.	DRAWING No.	REV
7884	FHA-M-9	0



SECTION F-F



No.	DATE	REVISIONS	BY	CHKD	DESIGN SUPV	ENGR	PROJ ENGR	APPR
0	9/22/78	ISSUED FOR F.H.A.	DG	AW	JSH			

SCALE 3/32" = 1'-0" DESIGNED DRAWN J.G.F. CHIEF ENGR

BECHTEL
SAN FRANCISCO

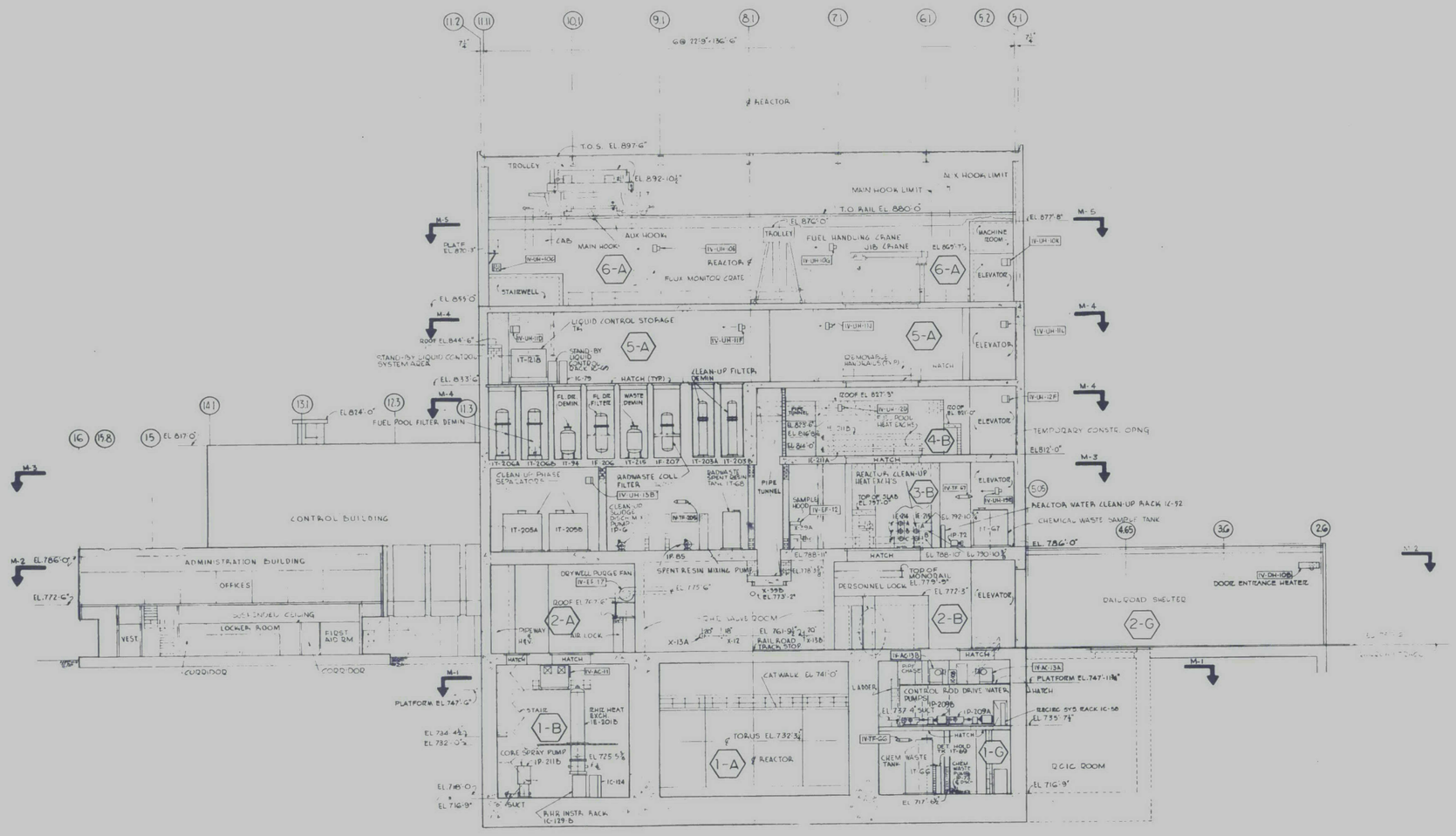
DUANE ARNOLD ENERGY CENTER—UNIT No 1
IOWA ELECTRIC LIGHT AND POWER COMPANY
CEDAR RAPIDS, IOWA

EQUIPMENT LOCATION
REACTOR BLDG. SECT. F-F

JOB No.	DRAWING No.	REV.
7884	FHA-M-10	0

SCALING RULES

SIZE E



SECTION H-H

No.	DATE	REVISIONS	BY	CHKD	DESIGN ENGR	FIELD ENGR	APVD
A	9/22/76	ISSUED FOR F.H.A.	DG	AW	JTW	AH	

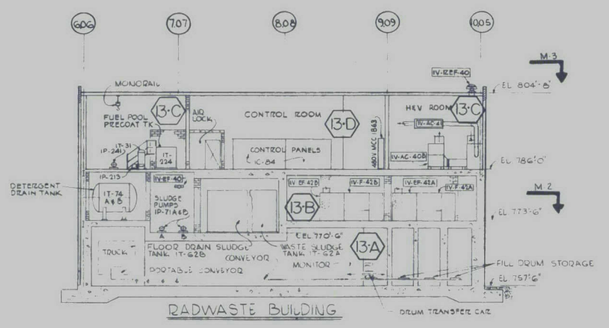
SCALE 3/32" = 1'-0" DESIGNED DRAWN V.N.B. CHKD

BECHTEL
SAN FRANCISCO

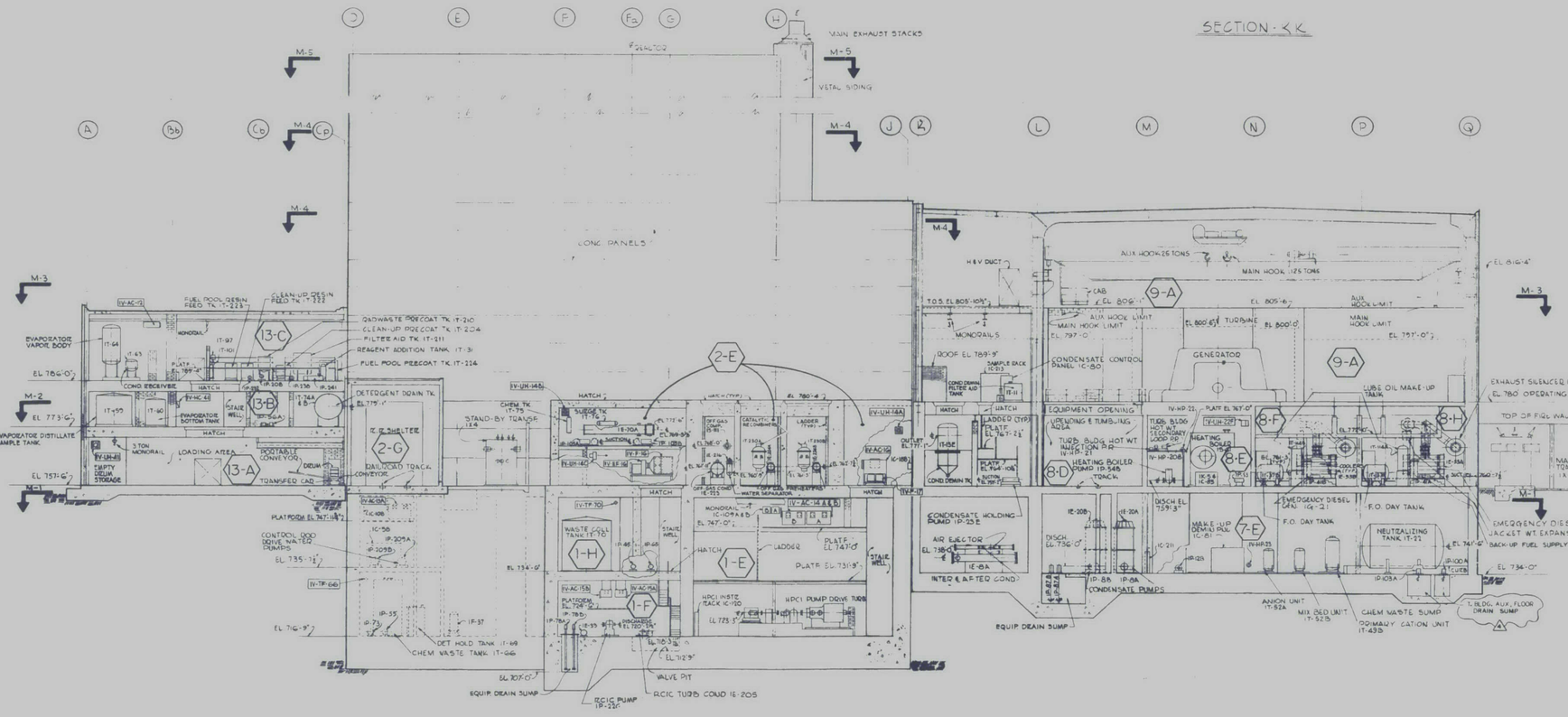
DUANE ARNOLD ENERGY CENTER — UNIT NO 1
IOWA ELECTRIC LIGHT AND POWER COMPANY
CEDAR RAPIDS, IOWA

EQUIPMENT LOCATION
REACTOR BUILDING SECTION ~~H-H~~

JOB No.	DRAWING No.	
7884	FHA - M - 11	0



SECTION - KK



SECTION JJ

No.	DATE	REVISIONS	BY	CHKD	PROJECT ENGR	ENGR	PROJ ENGR	APPD
1	9/12/78	ISSUED FOR F.H.A.	DG	AW	LJM	AV		

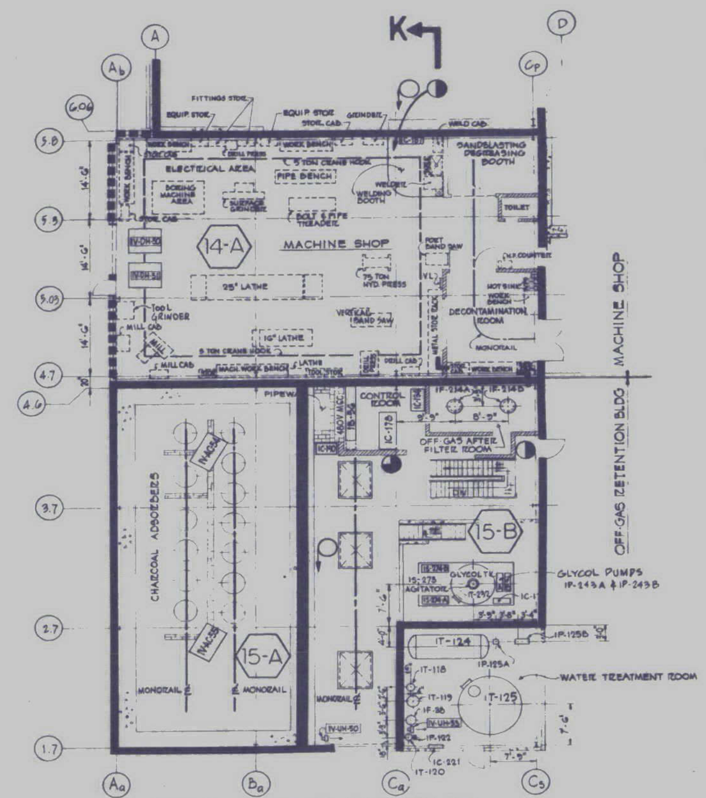
SCALE 3/32"=1'-0" DESIGNED DRAWN V.M.B. CHKD

BECHTEL
SAN FRANCISCO

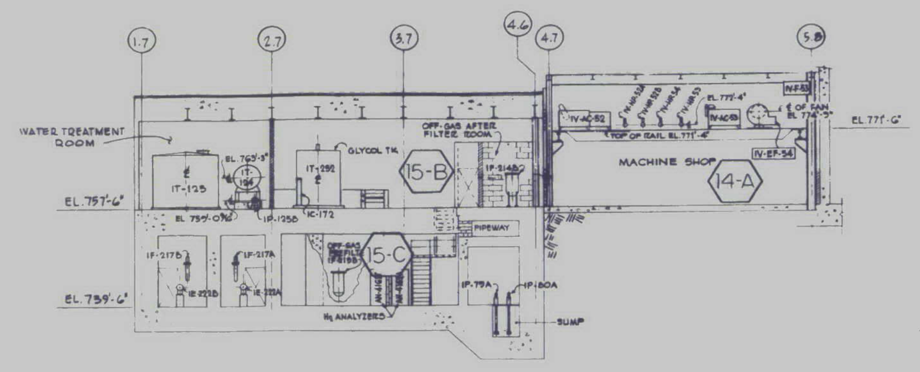
DUANE ARNOLD ENERGY CENTER — UNIT NO 1
IOWA ELECTRIC LIGHT AND POWER COMPANY
CEDAR RAPIDS, IOWA

EQUIPMENT LOCATION
SECTIONS J-J & K-K

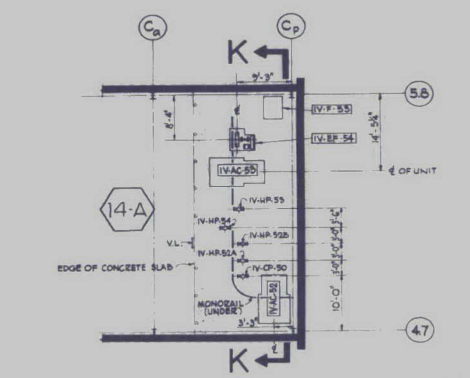
JOB No.	DRAWING No.	REV.
7884	FHA - M-12	0



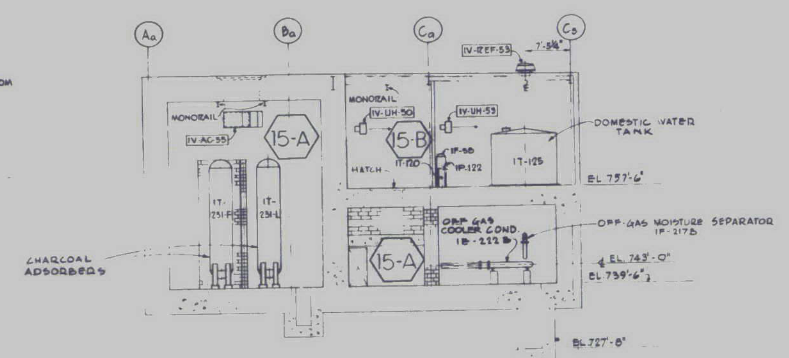
OFF-GAS RETENTION BLDG.
& MACHINE SHOP
PLAN AT EL. 757'-6"



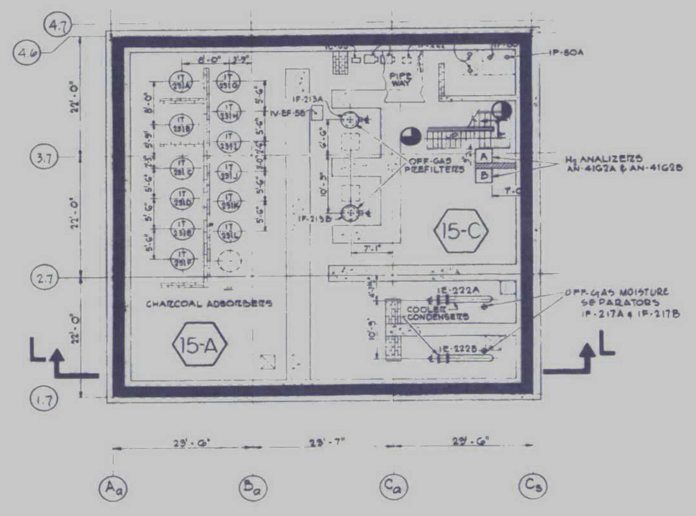
SECTION K-K



PARTIAL PLAN OF MACHINE SHOP
AT EL. 771'-6"



SECTION L-L



OFF-GAS RETENTION BLDG.
PLAN AT EL. 739'-6"

0	9/22/78	ISSUED FOR F.H.A.	DG	AWJ	JSH			
NO.	DATE	REVISIONS	BY	CHKD				APPD

SCALE 3/32" = 1'-0" | DESIGNED | DRAWN G.M.S.

BECHTEL
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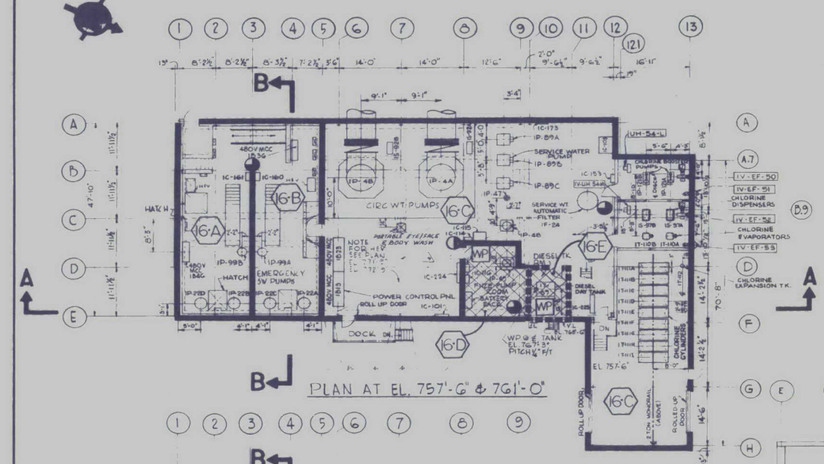
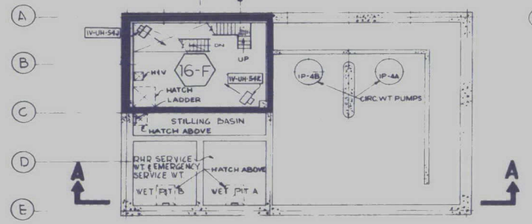
DUANE ARNOLD ENERGY CENTER—UNIT NO 1
IOWA ELECTRIC LIGHT AND POWER COMPANY
CEDAR RAPIDS, IOWA

OFF-GAS RETENTION BLDG. & MACHINE SHOP
PLANS & SECTIONS

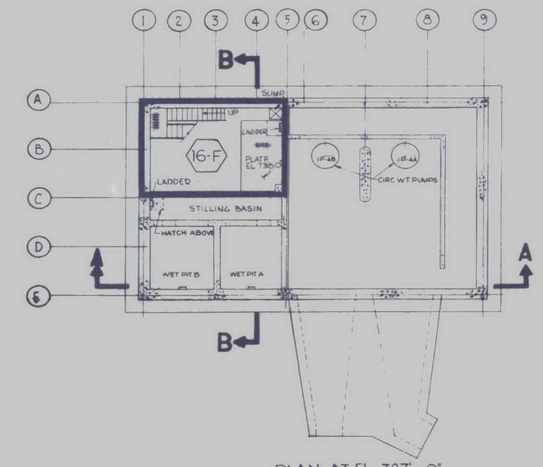
JOB No.	DRAWING No.	REV.
7884	FHA-M-13	0



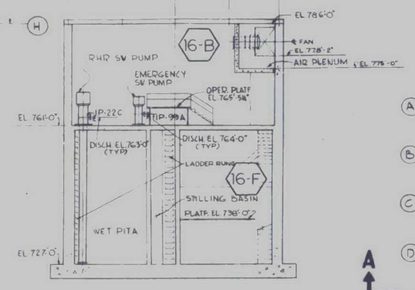
PLAN AT EL. 757'-6" & 761'-0"



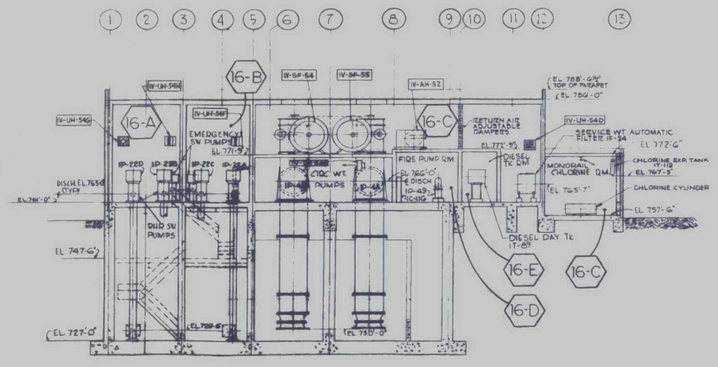
PLAN AT EL. 747'-6"



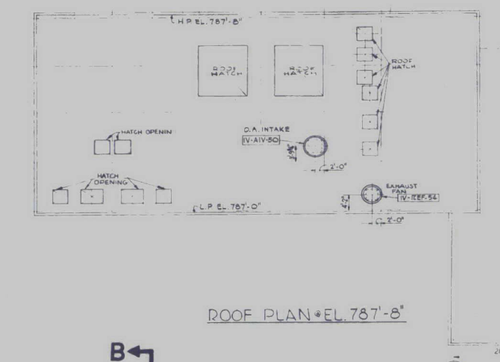
PLAN AT EL. 727'-0"



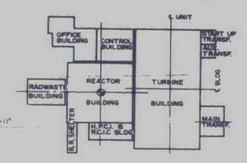
SECTION BB



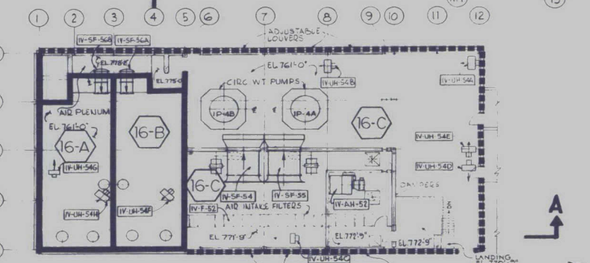
SECTION AA



ROOF PLAN @ EL. 787'-8"



KEY PLAN



PLAN AT EL. 761'-0" - EL. 771'-9" - EL. 772'-9"
FOR HEATING AND VENTILATING ONLY

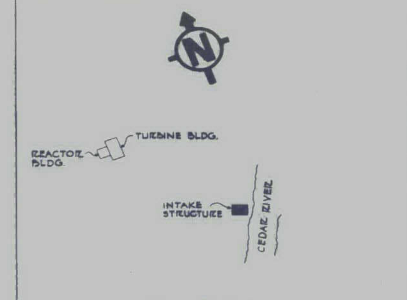
A	9/15/76	ISSUED FOR F.H.A.	DG	AW	
NO.	DATE	REVISIONS	BY	CHKD	APPD

BECHTEL
SAN FRANCISCO

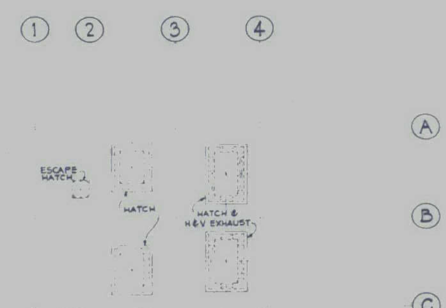
DUANE ARNOLD ENERGY CENTER — UNIT No 1
IOWA ELECTRIC LIGHT AND POWER COMPANY
CEDAR RAPIDS, IOWA

EQUIPMENT LOCATION
PUMP HOUSE PLANS & ELEVATIONS

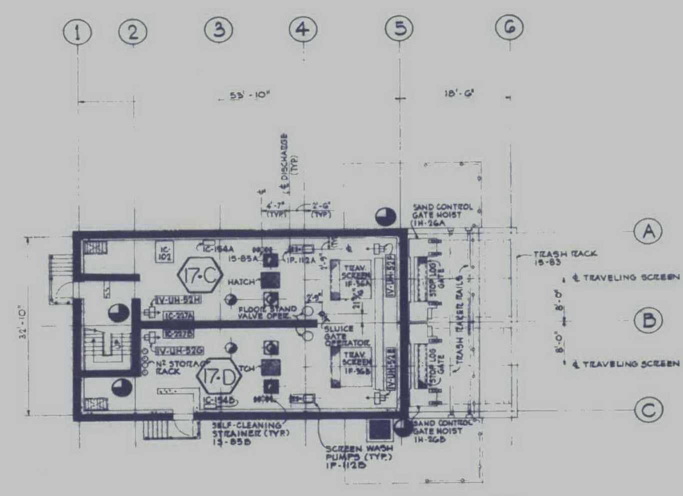
JOB No.	DRAWING No.	REV.
7884	FHA - M - 15	0



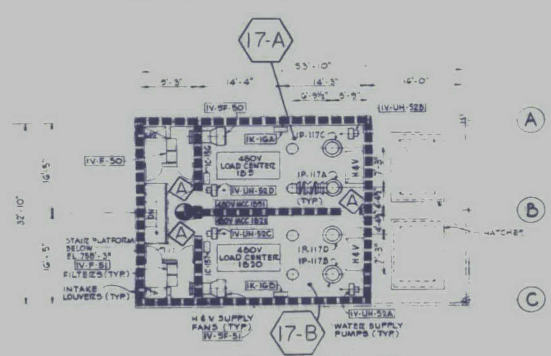
KEY PLAN



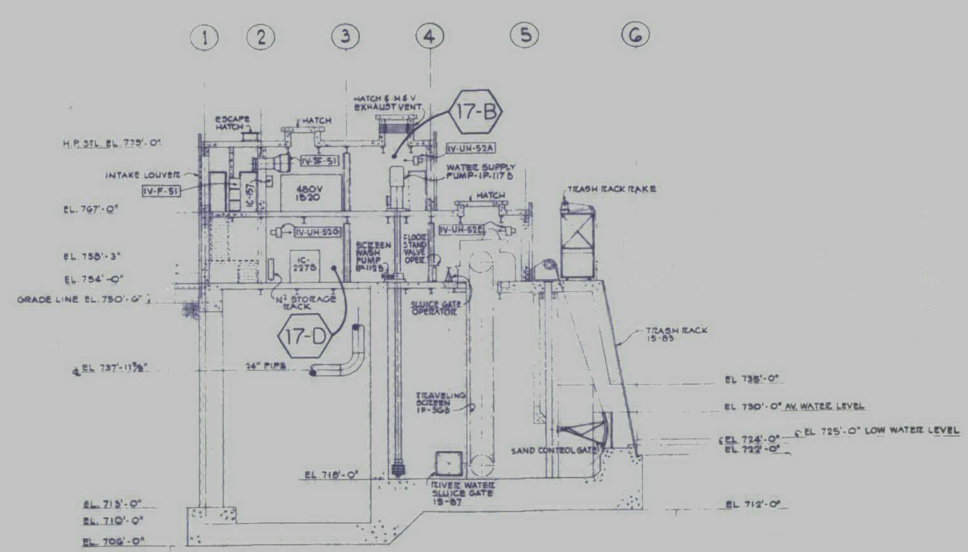
ROOF PLAN



PLAN AT EL. 754'-0"



PLAN AT 767'-0"



SECTION A-A

No.	DATE	REVISIONS	BY	CHKD	DESIGN SUPV	ENGR	PROJ ENGR	APPR
0	9/22/76	ISSUED FOR F.H.A.	DG	AW	JSH	[illegible]		

SCALE 3/32" = 1'-0" DESIGNED DRAWN FL CHIEF ENGR

BECHTEL
SAN FRANCISCO

DUANE ARNOLD ENERGY CENTER UNIT NO 1
IOWA ELECTRIC LIGHT AND POWER COMPANY
CEDAR RAPIDS, IOWA

EQUIPMENT LOCATION
INTAKE STRUCTURE PLANS AT ELEVATIONS

JOB No.	DRAWING No.	REV.
7884	FHA - M-17	0